

NPTEL : Introduction to Aerospace Propulsion (Aerospace Engineering)

Co-ordinators : Prof. Bhaskar Roy, Prof. A M Pradeep

Lecture 1 - Course Intro & Historical development of flights

Lecture 2 - Early development of aircraft propulsive devices

Lecture 3 - Development of Jet propulsion for aircraft

Lecture 4 - Introduction to thermodynamics, Scope and method, Basic concepts: system, surroundings, property, intensive and extensive, state, equilibrium and state postulate, process, path and cycle

Lecture 5 - Quasi-static processes, zeroth law of thermodynamics and temperature, concept of energy and its various forms, internal energy, enthalpy

Lecture 6 - Specific heats at constant pressure and volume Work and heat transfers

Lecture 7 - Tutorial

Lecture 8 - First law of thermodynamics for closed systems

Lecture 9 - First law of thermodynamics for open systems/flow processes

Lecture 10 - Second law of thermodynamics, heat engines, refrigerators and heat pumps, Kelvin-Planck and Clausius statement of second law of thermodynamics

Lecture 11 - Reversible and irreversible processes, concept of entropy

Lecture 12 - Increase of entropy principle, third law of thermodynamics, absolute entropy, perpetual motion machines

Lecture 13 - Tutorial

Lecture 14 - Carnot cycle, Carnot principle, thermodynamic temperature scale

Lecture 15 - Exergy, availability and second law efficiency

Lecture 16 - Tutorial

Lecture 17 - Gas and vapour power cycles, Otto cycle, Diesel cycle, Dual cycle

Lecture 18 - Rankine cycle, Brayton cycle, Stirling and Ericsson cycles

Lecture 19 - Thermodynamic property relations, Jacobean and Legendre transformations, Maxwell's equations

Lecture 20 - Tutorial

Lecture 21 - Properties of gas and vapour mixtures

Lecture 22 - One-dimensional compressible flows, isentropic flows

Lecture 23 - Flows with friction and heat transfer, normal and oblique shocks

Lecture 24 - Piston-prop engines: Otto cycles; Ideal and Real cycles

Lecture 25 - IC Engines for aircraft application

Lecture 26 - Performance parameters of IC engines

Lecture 27 - Supercharging of aircraft IC engines

Lecture 28 - Tutorial: IC Engines

Lecture 29 - Propeller fundamentals

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[Lecture 30 - Propeller aerodynamic theories - I](#)

[Lecture 31 - Propeller aerodynamic theories - II](#)

[Lecture 32 - Tutorial: Propellers](#)

[Lecture 33 - Ideal cycles for Jet engines](#)

[Lecture 34 - Ideal cycles for variants of jet engines](#)

[Lecture 35 - Tutorial](#)

[Lecture 36 - Fundamentals of Ramjets and Pulsejets](#)

[Lecture 37 - Fundamentals of Rocket engines](#)

[Lecture 38 - Fundamentals of Missile engines](#)

[Lecture 39 - Various space vehicles and their engines](#)

[Lecture 40 - Closure of the lecture series : recap](#)

NPTEL : Jet Aircraft Propulsion (Aerospace Engineering)

Co-ordinators : Prof. A M Pradeep, Prof. Bhaskar Roy

- Lecture 1 - Introduction & Development of Jet Aircraft Propulsion
- Lecture 2 - How the Aircraft Jet Engines make Thrust
- Lecture 3 - Jet Engine Basic Performance Parameters
- Lecture 4 - Turbojet, Reheat Turbojet and Multi-spool Engines
- Lecture 5 - Turbofan, Turbo-prop and Turboshift engines
- Lecture 6 - Ideal and Real Brayton cycles
- Lecture 7 - Jet Engine Cycles for Aircraft propulsion
- Lecture 8 - Cycle components and component performances
- Lecture 9 - Tute-1
- Lecture 10 - Analysis of engine real cycles
- Lecture 11 - Tute-2
- Lecture 12 - Thermodynamics of Compressors
- Lecture 13 - Thermodynamics of Turbines
- Lecture 14 - Axial Compressors : two dimensional analytical model
- Lecture 15 - Cascade analysis; Loss and Blade performance estimation
- Lecture 16 - Free Vortex theory; Single-Multi-stage characteristics
- Lecture 17 - Tutes-3
- Lecture 18 - Elements of centrifugal compressor
- Lecture 19 - Centrifugal Compressor characteristics: Surging, Choking
- Lecture 20 - Axial flow turbines; Turbine Blade 2-D (cascade) analysis
- Lecture 21 - Multi-staging: Axial Turbine; Turbine Cooling Technology
- Lecture 22 - Radial Turbine Aerodynamics & Thermodynamics; Losses
- Lecture 23 - Tutes-4
- Lecture 24 - Types of combustion chambers: mechanism & parameters
- Lecture 25 - Pr. Loss, Combustion efficiency; Combustion intensity
- Lecture 26 - Practical combustion system ; Stability, Fuel injection
- Lecture 27 - Intakes for Powerplant: Transport / Military Aircraft
- Lecture 28 - Subsonic, Transonic, Supersonic Intake Designs
- Lecture 29 - Nozzle : fixed and variable geometry nozzles
- Lecture 30 - C-D nozzle and their uses
- Lecture 31 - Tute-5

[Lecture 32 - Engine Off Design Operations](#)

[Lecture 33 - Aircraft Engine component matching: Dimensional analysis](#)

[Lecture 34 - Engine component matching and Sizing](#)

[Lecture 35 - Installed Performance of Engine](#)

[Lecture 36 - Tute-6](#)

[Lecture 37 - Use of Ramjets and Pulsejets in Aircraft propulsion](#)

[Lecture 38 - Thermodynamic Cycle & Performance Parameters](#)

[Lecture 39 - Flow in Diffusers, Combustors and Nozzles](#)

[Lecture 40 - Performance and Design of Ramjet & Scramjet Engines](#)

[Lecture 41 - Tute-7](#)

[Lecture 42 - Future of Aircraft Propulsion](#)

- Lecture 1 - Introduction to Turbo machines Syllabus, References and Schedules
- Lecture 2 - Axial Flow Compressors and Fans : Introduction to Compressor Aerothermodynamics
- Lecture 3 - A two dimensional analytical model :Cascade
- Lecture 4 - 2D losses in Axial flow Compressor Stage : Primary losses
- Lecture 5 - Tutorial 1 : Two Dimensional Axial Flow Compressors
- Lecture 6 - 3D Flows in Blade Passages, Secondary Flows, Tip leakage Flow, Scrubbling
- Lecture 7 - Three Dimensional Flow Analysis : Radial Equilibrium Concept
- Lecture 8 - Classical Blade Design Laws : Free Vortex and other Laws
- Lecture 9 - Three Dimensional Flow Analysis in Axial Flow Compressor
- Lecture 10 - Tutorial 2 : Three Dimensional Axial Flow Compressors
- Lecture 11 - Axial Compressor Characteristics: Single stage, Multi stage and Multi spool Characteristics
- Lecture 12 - Instability in Axial Compressors
- Lecture 13 - Inlet Distortion and Rotating Stall, Control of Instability
- Lecture 14 - Transonic Compressors and Shock Structure Models, Transonic Compressor Characteristics
- Lecture 15 - Axial Flow Compressor Design, Inter Spool Duct
- Lecture 16 - Design of Compressor Blades, Aerofoil Design (Subsonic, Transonic, Supersonic Profiles)
- Lecture 17 - Design of Compressor Blade: 3D Blade Shapes of Rotors and Stators
- Lecture 18 - Noise Problem in Axial Compressors and Fans
- Lecture 19 - Axial Flow Turbines: Introduction to Turbines Aerothermodynamics
- Lecture 20 - Axial Flow Turbines: Turbine Blade 2D (Cascade) Analysis
- Lecture 21 - Axial Flow Turbines: Work done, Degree of Reaction, Losses and Efficiency
- Lecture 22 - Axial Flow Turbines: Blade and Axial Flow Passages, Exit Flow Matching with Nozzle
- Lecture 23 - Tutorial 3 : Axial Flow Turbines
- Lecture 24 - Multi staging and Multi spooling of Turbine
- Lecture 25 - 3D Flow in Turbine: 3D Flow Theories, Free Vortex Theories etc.
- Lecture 26 - Tutorial 4 : 3D Flows in Axial Flow Turbines
- Lecture 27 - Turbine Blade Cooling – Fundamentals of Heat Transfer, Blade Cooling Requirements
- Lecture 28 - Turbine Blade Cooling Technologies
- Lecture 29 - Turbine Blade Design: Turbine Profiles, Aerofoil Data and Profile Construction
- Lecture 30 - Turbine Blade Design: 3D Blade Shapes
- Lecture 31 - Centrifugal Compressors: Thermodynamics and Aerodynamics

[Lecture 32 - Centrifugal Compressors: Characteristics, Stall, Surge Problems](#)

[Lecture 33 - Tutorial 5 : Centrifugal Compressors](#)

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[Lecture 40 - CFD for Turbomachinery: 2D and 3D Blade Generation and Analysis Using CFD](#)

Lecture 1 - Course Layout and Brief Introduction of Course Instructor

Lecture 2 - Introduction to International Standard Atmosphere (ISA)

Lecture 3 - Pressure, Temperature, Density and Viscosity Variation with Altitude in ISA

Lecture 4 - Other Standard Atmospheres

Lecture 5 - Aircraft Component Nomenclature - Wing and its Components

Lecture 6 - Aircraft Component Nomenclature - Fuselage and its Components

Lecture 7 - Aircraft Component Nomenclature - Tail Plane and its Components

Lecture 8 - Tutorial 1 - Aircraft Component Nomenclature

Lecture 9 - Essentials of Incompressible Flow - Part I

Lecture 10 - Essentials of Incompressible Flow - Part II

Lecture 11 - Bernoulli's Equation and Coanda Effect

Lecture 12 - Mach Number

Lecture 13 - Tutorial 2 - Incompressible Flow and Flow Visualization

Lecture 14 - Viscous Flow and Reynolds Number

Lecture 15 - Introduction to Boundary Layer

Lecture 16 - Pressure Measurement

Lecture 17 - Air Speed Measurement - Pitot Static Tube

Lecture 18 - Air Speed Corrections

Lecture 19 - Altitude and ROC/ROD Measurement

Lecture 20 - Measurements in Compressible Flows

Lecture 21 - Non Pneumatic Instruments

Lecture 22 - Introduction to Aerofoils and Aerofoil Nomenclature

Lecture 23 - Aerofoils - A Visit to the Past

Lecture 24 - Thick Aerofoils

Lecture 25 - Low Reynolds Number Aerofoils

Lecture 26 - Lift Generation by Wings - Part I

Lecture 27 - Lift Generation by Wings - Part II

Lecture 28 - Coefficient of Lift and Coefficient of Pressure

Lecture 29 - Tutorial on Aerofoils

Lecture 30 - Critical Mach Number

Lecture 31 - Wave Drag

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[Lecture 33 - Introduction to Drag and Types of Drag](#)

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[Lecture 60 - Endurance](#)

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[Lecture 63 - Landing Performance of Flight](#)

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[Lecture 65 - Tutorial on Range and Endurance](#)

[Lecture 66 - Flapping Wing Aerodynamics - Part I](#)

[Lecture 67 - Flapping Wing Aerodynamics - Part II](#)

Lecture 1 - What is Aircraft Design

Lecture 2 - Aircraft Design Process

Lecture 3 - Design Stages

Lecture 4 - Phases in Aircraft Design

Lecture 5 - The Design Spiral

Lecture 6 - Importance of Cost in Aircraft Design

Lecture 7 - Basic Laws of Aircraft Design

Lecture 8 - Requirements Capture

Lecture 9 - Quality Function Deployment

Lecture 10 - House of Quality Chart

Lecture 11 - Example of HoQ for HALE UAV

Lecture 12 - Illustration of HOQ-GA aircraft

Lecture 13 - Airliners

Lecture 14 - Key Issues in Design of Airliners

Lecture 15 - Design Considerations - Future Airliners

Lecture 16 - Supersonic Transport Aircraft

Lecture 17 - Airliner and Supersonic Aircraft, some additional concepts

Lecture 18 - Design Considerations - Cargo Aircraft

Lecture 19 - Design Considerations - GA Aircraft

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Lecture 21 - Cargo, GA and Military Aircraft, Some additional concepts

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Lecture 24 - Wing Sweep

Lecture 25 - Canards and Flying Wing

Lecture 26 - Three Surface Aircraft

Lecture 27 - Winglets

Lecture 28 - Thrust Vectoring

Lecture 29 - Few Novel Concepts_01

Lecture 30 - Aircraft Configuration Design - Closing Remarks

Lecture 31 - Choices in Aircraft Layout

- Lecture 32 - Wing Geometry Definitions
- Lecture 33 - Options for Wing layout
- Lecture 34 - Propulsion System Layout
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- Lecture 36 - Landing Gear Layout - Part 1
- Lecture 37 - Landing Gear Layout - Part 2
- Lecture 38 - Landing Gear of some Famous Aircraft
- Lecture 39 - Tutorial on OpenVSP
- Lecture 40 - Initial Sizing in Aircraft Design
- Lecture 41 - Estimation of Empty Weight Fraction
- Lecture 42 - Estimation of Mission Segment Weights
- Lecture 43 - Estimation of Fuel Weight Fractions
- Lecture 44 - Estimation of maximum L/D
- Lecture 45 - Estimation of engine parameters
- Lecture 46 - Estimation of Design gross weight
- Lecture 47 - Take-off weight build up
- Lecture 48 - Tutorial on Initial Sizing of Transport Aircraft
- Lecture 49 - Tutorial on Initial Sizing of Military Aircraft
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- Lecture 51 - Component Buildup Method
- Lecture 52 - Drag Estimation of Military Aircraft
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- Lecture 56 - Flaps as High Lift Devices
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- Lecture 60 - Constraint Analysis- Transport Aircraft - Part 1
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Lecture 8 - Impact of Gravity

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Lecture 13 - Constant (T/m) Solution

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Lecture 15 - Multi-stage Rocket Basics

Lecture 16 - Multi-stage Configuration Basics

Lecture 17 - Multi-stage Solution Basics

Lecture 18 - Multi-stage Problem Definition

Lecture 19 - Optimal Staging Strategy

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- Lecture 34 - Net Static Lift for other LTA systems
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NPTEL : Aero elasticity (Aerospace Engineering)

Co-ordinators : Prof. C. Venkatesan

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NPTEL : Introduction to Propulsion (Aerospace Engineering)

Co-ordinators : Dr. D.P. Mishra

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- Lecture 29 - Perpetual motion machines, reversible and irreversible processes, Carnot cycle
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[Lecture 45 - Climate Change and Drought: a global perspective](#)

[Lecture 46 - GIS and Drought Management: a global perspective](#)

Lecture 1 - Introduction

Lecture 2 - Insect, abundance and diversity

Lecture 3 - Insect classification based on economic importance

Lecture 4 - Pest, causes for outbreaks and categories

Lecture 5 - Pest, causes for outbreaks and categories (Continued...)

Lecture 6 - Pest surveillance and methods of sampling

Lecture 7 - Principles of Pest Management and History

Lecture 8 - IPM, Definition and Concepts

Lecture 9 - Ecological Methods of Pest Management - Legal and Cultural

Lecture 10 - Ecological Methods of Pest Management - Cultural (Continued...)

Lecture 11 - Ecological Methods of Pest Management - Cultural (Continued...)

Lecture 12 - Ecological Methods of Pest Management - Physical

Lecture 13 - Ecological Methods of Pest Management - Mechanical

Lecture 14 - Host Plant Resistance

Lecture 15 - Host Plant Resistance (Continued...)

Lecture 16 - Biological Control - Predators

Lecture 17 - Biological Control - Parasitoids

Lecture 18 - Biological Control - Microbes: Fungi, Bacteria and Viruses

Lecture 19 - Biological Control - Microbes: Entomopathogenic Nematodes

Lecture 20 - Pest management by modifying insect behaviour

Lecture 21 - Use of sex pheromones in pest management

Lecture 22 - Use of attractants and repellants in pest management

Lecture 23 - Pest management through radiation technology - Principles

Lecture 24 - Sterile Insect Technique - case studies

Lecture 25 - Pest management through botanicals

Lecture 26 - Pest management through botanicals (Continued...)

Lecture 27 - Chemical Control - History and classification

Lecture 28 - Mode of Action of different insecticide groups

Lecture 29 - Chemical Control - Considerations for Chemicals Integration

Lecture 30 - Insecticide Resistance and Management

Lecture 31 - Insecticide as component of IPM

[Lecture 32 - Biotechnological Approaches in IPM](#)

[Lecture 33 - Agro-ecosystem Analysis](#)

[Lecture 34 - IPM in Paddy](#)

[Lecture 35 - IPM in Paddy \(Continued...\)](#)

[Lecture 36 - IPM in Pigeon pea](#)

[Lecture 37 - IPM in Pigeon pea \(Continued...\)](#)

[Lecture 38 - IPM in Groundnut](#)

[Lecture 39 - IPM in Mustard and Soyabean](#)

[Lecture 40 - IPM in Cotton](#)

[Lecture 41 - IPM in Cotton \(Continued...\)](#)

[Lecture 42 - IPM in Sugarcane](#)

[Lecture 43 - IPM in Sugarcane \(Continued...\)](#)

[Lecture 44 - IPM in Tomato](#)

[Lecture 45 - IPM in Cabbage](#)

[Lecture 46 - IPM in Mango](#)

[Lecture 47 - IPM in Grapes](#)

Lecture 1 - Introduction

Lecture 2 - Relationship between Food, Nutrition and Health 1

Lecture 3 - Relationship between Food, Nutrition and Health 2

Lecture 4 - Digestion, absorption and utilization of Nutrients 1

Lecture 5 - Digestion, absorption and utilization of Nutrients 2

Lecture 6 - Recommended dietary allowances

Lecture 7 - Carbohydrate

Lecture 8 - Fiber

Lecture 9 - Protein

Lecture 10 - Protein - health significance

Lecture 11 - Fat

Lecture 12 - Energy 1

Lecture 13 - Energy 2

Lecture 14 - Energy 3

Lecture 15 - Fat Soluble Vitamins 1

Lecture 16 - Fat Soluble Vitamins 2

Lecture 17 - Fat Soluble Vitamins 3

Lecture 18 - Water Soluble Vitamins 1

Lecture 19 - Water Soluble Vitamins 2

Lecture 20 - Water soluble Vitamins 3

Lecture 21 - Water soluble Vitamins 4

Lecture 22 - Major minerals 1

Lecture 23 - Major minerals 2

Lecture 24 - Trace minerals 1

Lecture 25 - Trace minerals 2

Lecture 26 - Water

Lecture 27 - Nutritional Disorders

Lecture 28 - Balanced diet and food groups

Lecture 29 - Food guide for selecting adequate diet, practical aspects of food selection

Lecture 30 - Meal planning

Lecture 31 - Other aspects affecting food selection

[Lecture 32 - Food sanitation and hygiene](#)

[Lecture 33 - Water Purification](#)

[Lecture 34 - Therapeutic adaptation of normal diet](#)

[Lecture 35 - Principles of therapeutic diet](#)

[Lecture 36 - Diet during fevers](#)

[Lecture 37 - Diet in lung disease](#)

[Lecture 38 - Diet in GI disorders - constipation](#)

[Lecture 39 - Diet during diarrhoea](#)

[Lecture 40 - Diet in disorders of liver](#)

[Lecture 41 - Diseases of gall bladder](#)

[Lecture 42 - Diet in Diabetes](#)

[Lecture 43 - Diseases of Heart and blood vessels](#)

[Lecture 44 - Diet for myocardial infarction](#)

[Lecture 45 - Diet in kidney disorders](#)

[Lecture 46 - Diet in renal failure](#)

[Lecture 47 - Diet in cancer](#)

[Lecture 48 - Diet in metabolic disorders](#)

[Lecture 49 - Diet in stress, burns and surgery](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Weather Forecast in Agriculture and Agro-advisory (WF) (Agriculture)

Co-ordinators : Dr. R. Nagarajan, Co Faculty, Dr.T.N.Balasubramanian (Rtd.), Instructor Incharge

Lecture 1 - Introduction

Lecture 2 - Basic aspects of Atmosphere, Climate, Weather

Lecture 3 - Basic aspects of Rainfall and their application in crop production

Lecture 4 - Basic aspects of Temperature and their application in crop production

Lecture 5 - Basic aspects of Relative humidity, Cloud cover and their application in crop production

Lecture 6 - Basic aspects of wind, wind direction and their application in crop production

Lecture 7 - Three weather codes and crop production

Lecture 8 - Crop production risks and their management

Lecture 9 - Weather sensitive crops, stages and farm operations

Lecture 10 - Crop-weather interactions and definition

Lecture 11 - Crop-Weather Interactions: Wheat, Rice and Maize

Lecture 12 - Crop-Weather Interactions: Sorghum, Groundnut and Pigeon pea

Lecture 13 - Crop-Weather Interactions: Cotton and Sugarcane

Lecture 14 - Crop-Weather Interactions: Sugarbeet and Chickpea

Lecture 15 - Crop-Weather Interactions: Sunflower and Mustard

Lecture 16 - Genesis of weather forecast in India and Abroad

Lecture 17 - Types of weather forecast and details

Lecture 18 - Types of weather forecast and details (Continued...)

Lecture 19 - Simple methods of verification of weather forecast with real event

Lecture 20 - Traditional knowledges on weather forecast and their validity

Lecture 21 - Weather thumb rules and their validity

Lecture 22 - Development and component of agro advisory for weather forecast

Lecture 23 - Development and component of agro advisory for weather forecast (Continued...)

Lecture 24 - Model agro advisories for selected five days weather forecast

Lecture 25 - Mass communication mode of agro advisories and their effectiveness

Lecture 26 - Discussion on weather forecast and agro advisory from different website

Lecture 27 - Role of climate manager on farm management decision based on weather forecast at village level and assignment

Lecture 28 - Development of selected weather window for issuing agro advisory - case study from Tamil Nadu

Lecture 29 - Model of agro advisory for 54 selected weather window of Tamil Nadu for rice

Lecture 30 - Response farming- a type of farm planning being practiced in Australia considering seasonal climate forecast

Lecture 31 - Case study in India on the adoption of weather based crop production - Crop management

[Lecture 32 - Case study in India on the adoption of weather based crop production - Pest and disease management](#)

[Lecture 33 - Case study in India on the adoption of weather based animal production](#)

[Lecture 34 - Cost benefit analysis for the case study done on crop management](#)

[Lecture 35 - Cost benefit analysis for the case study done on animal management](#)

[Lecture 36 - Summary](#)

Lecture 1 - Introduction

Lecture 2 - Highlights Week 0 and 1

Lecture 3 - What is ICT?

Lecture 4 - Architecture of a Computer

Lecture 5 - Architecture of a Phone

Lecture 6 - What is the Internet?

Lecture 7 - What is WWW?

Lecture 8 - Highlights Week 2

Lecture 9 - Phones, Smart Phones, Phablets, Tablets

Lecture 10 - Introduction to Android

Lecture 11 - Network Architectures - Part-1 (Introduction to Computer Networks)

Lecture 12 - Network Architectures - Part-2 (Overview of Network Architecture)

Lecture 13 - Network Architectures - Part-3 (Architecture of Internet)

Lecture 14 - Mobile Wireless Communications - Introduction (Module-1)

Lecture 15 - Mobile Wireless Communication (Module-2)

Lecture 16 - Highlights Week 3

Lecture 17 - Adaptive and Responsive Websites

Lecture 18 - Data management

Lecture 19 - Knowledge Representation

Lecture 20 - Knowledge Representation Techniques

Lecture 21 - Expert Systems

Lecture 22 - Highlights Week - 4

Lecture 23 - Speech Recognition

Lecture 24 - Speech Synthesis

Lecture 25 - Identity Management - Part 1

Lecture 26 - Identity Management - Part 2

Lecture 27 - Location Recognition - Part 1

Lecture 28 - Location Recognition - Part 2

Lecture 29 - Parameter Sensing

Lecture 30 - Highlights Week-5

Lecture 31 - Social Networking - Part 1

[Lecture 32 - Social Networking - Part 2](#)

[Lecture 33 - Blogs](#)

[Lecture 34 - Facebook](#)

[Lecture 35 - Twitter](#)

[Lecture 36 - 3G WCDMA \(Module- 3\)](#)

[Lecture 37 - 4G Mobile Wireless WiMAX \(Module-4\)](#)

[Lecture 38 - Advanced Wireless Technologies \(Module-5\)](#)

[Lecture 39 - LTE, WLAN, Bluetooth and Future](#)

[Lecture 40 - Highlights Week-6](#)

[Lecture 41 - Introduction to Cloud Computing](#)

[Lecture 42 - Introduction to Cloud Services](#)

[Lecture 43 - Cloud Service Providers](#)

[Lecture 44 - GIS Application in Agriculture - Part 1](#)

[Lecture 45 - GIS Application in Agriculture - Part 2](#)

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11 - Application of Navier Stoke's equation for finding out viscosity - Part 2

Lecture 12 - Application of Navier Stoke's equation for finding out viscosity - Part 3

Lecture 13 - Flow through pipes

Lecture 14 - Hagen-poiseuille equation from Navier stokes equation

Lecture 15 - Fanning friction factor

Lecture 16 - Moody's chart

Lecture 17 - Laminar and turbulent flow in a pipe

Lecture 18 - Flow through flat and parallel plates

Lecture 19 - Flow of film or film flow

Lecture 20 - Problems and solution of falling film

Lecture 21 - Flow through annulus - Part 1

Lecture 22 - Flow through annulus - Part 2

Lecture 23 - Stoke's law

Lecture 24 - Flow through flat plates or slits

Lecture 25 - Problems and solution for flow through flat plates or slits

Lecture 26 - Compressible fluid flow

Lecture 27 - Flow through nozzle - I

Lecture 28 - Flow through nozzle - II

Lecture 29 - Flow through nozzle - problems and solutions

Lecture 30 - Nozzle flow- problems and solutions

Lecture 31 - Sonic velocity

- Lecture 32 - Sonic velocity - Mach number
- Lecture 33 - Variable fluid flow
- Lecture 34 - Variable fluid flow - problems and solutions
- Lecture 35 - Variable fluid flow - problems and solutions (Continued...)
- Lecture 36 - Pneumatic conveying
- Lecture 37 - Problem on Pneumatic conveying - Part 1
- Lecture 38 - Problem on Pneumatic conveying - Part 2
- Lecture 39 - Non Newtonian fluid flow - Part 1
- Lecture 40 - Non Newtonian fluid flow - Part 2
- Lecture 41 - Velocity profile for Non Newtonian fluid
- Lecture 42 - Average velocity for Non Newtonian fluid
- Lecture 43 - Problems and solution of Non Newtonian fluid - Part 1
- Lecture 44 - Problems and solution of Non Newtonian fluid - Part 2
- Lecture 45 - Flow of Non Newtonian fluid through slit
- Lecture 46 - Generalized coefficient of Reynolds number
- Lecture 47 - Flow through packed beds
- Lecture 48 - Ergun's equation- derivation - Part 1
- Lecture 49 - Ergun's equation- derivation - Part 2
- Lecture 50 - Solving problems on Ergun's equation
- Lecture 51 - Solving problems on Ergun's equation
- Lecture 52 - Fluidization
- Lecture 53 - Fluidized bed flow
- Lecture 54 - Problem of Fluidized bed condition - Part 1
- Lecture 55 - Problem of Fluidized bed condition - Part 2
- Lecture 56 - Problem and solution
- Lecture 57 - Problem and solution
- Lecture 58 - Problem and solution
- Lecture 59 - Problem and solution
- Lecture 60 - Problem and solution with comprehension of course

Lecture 1 - Importance of Farm Machines in the Contest of Enhance Production, Multiple Cropping, Labour Scarcity etc.

Lecture 2 - Ploughing and first opening of the soil, the design and component details

Lecture 3 - Tractor, implement and soil force consideration for tillage implement design

Lecture 4 - Tractor, implement and soil force consideration for tillage implement design

Lecture 5 - Mechanics of rotavator or rotary tillers

Lecture 6 - Design of a tractor PTO operated rotavator

Lecture 7 - Tractor implement hitching systems

Lecture 8 - Mechanics of tractor implement hitch system and traction prediction models

Lecture 9 - Laboratory class on traction and tire testing

Lecture 10 - Combination tillage implements for efficient land preparation

Lecture 11 - LASER guided land leveller

Lecture 12 - Introduction of seeding operation

Lecture 13 - Types of seed metering devices and their operation

Lecture 14 - Types of fertilizer metering, furrow opening and soil covering devices

Lecture 15 - Equipment for seeding and planting

Lecture 16 - Equipment for precision planting

Lecture 17 - Equipment for Paddy Transplanting

Lecture 18 - Microcontroller based uniform seed rate application system

Lecture 19 - GPS based automatic Variable rate fertilizer applicator

Lecture 20 - Embedded GPS integrated Variable Rate Fertilizer Applicator

Lecture 21 - Design of a seeding equipment - PART 1

Lecture 22 - Design of a seeding equipment - PART 2

Lecture 23 - Design of a seeding equipment - PART 3

Lecture 24 - Design a tractor drawn seed drill for a 40 hp tractor - I

Lecture 25 - Design a tractor drawn seed drill for a 40 hp tractor - II

Lecture 26 - Testing of tractor operated seeding equipment

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32 - Farm machines for interculture operation

Lecture 33 - Performance of weeding blades of a push-pull weeder

Lecture 34 - Advanced level machinery for inter and intra row weeding

Lecture 35 - Tractor mounted contact type microcontroller based improved variable rate herbicide applicator

Lecture 36 - Design of manually operated weeding equipment

Lecture 37 - Plant protection equipment/machinery

Lecture 38 - Selection and design of plant protection equipment/machinery

Lecture 39 - Manually operated knapsack-cum-boom sprayer

Lecture 40 - Performance evaluation of sprayer

Lecture 41 - Testing and certification of spraying equipment

Lecture 42 - Problems based on the design and selection of spraying equipment - I

Lecture 43 - Problems based on the design and selection of spraying equipment - II

Lecture 44 - Advanced level spraying equipment: Ultrasonic sensor based sprayer

Lecture 45 - Advanced level spraying equipment: Drone assisted variable rate chemical application system and electrostatic sprayer

Lecture 46 - Harvesting equipment

Lecture 47 - Machines for harvesting cereal crops, root and fruit crops

Lecture 48 - Combine Harvester

Lecture 49 - Advanced technology approach for cotton harvesting

Lecture 50 - Threshing operation and equipment

Lecture 51 - Design of threshing equipment

Lecture 52 - Performance evaluation and testing of thresher

Lecture 53 - Conservation Agriculture

Lecture 54 - Materials for construction of farm machinery

Lecture 55 - Machinery for Land Drainage, Land Reclamation and Estate Maintenance Part - I

Lecture 56 - Machinery for Land Drainage, Land Reclamation and Estate Maintenance Part - II

Lecture 57 - Machinery for Land Drainage, Land Reclamation and Estate Maintenance Part - III

Lecture 58 - Machinery Selection and Management - Part 1

Lecture 59 - Machinery Selection and Management - Part 2

Lecture 60 - Epilogue

Lecture 1 - Introduction

Lecture 2 - Soil Properties - I

Lecture 3 - Soil Properties - II

Lecture 4 - Soil Water

Lecture 5 - Tutorial - I

Lecture 6 - Field water balance

Lecture 7 - Evapotranspiration

Lecture 8 - Crop water requirement

Lecture 9 - Irrigation Scheduling

Lecture 10 - Tutorial

Lecture 11 - Irrigation Water Conveyance System

Lecture 12 - Irrigation Water Conveyance

Lecture 13 - Channel Design Structures

Lecture 14 - Measurement of Irrigation Water: Pipe

Lecture 15 - Tutorial

Lecture 16 - Water Application Methods

Lecture 17 - Surface Irrigation Hydraulics

Lecture 18 - Furrow Irrigation Hydraulics

Lecture 19 - Border Irrigation Design

Lecture 20 - Tutorial

Lecture 21 - Sprinkler Irrigation Design

Lecture 22 - Sprinkler Irrigation : Hydraulic Design

Lecture 23 - Drip Irrigation - I

Lecture 24 - Drip Irrigation Design

Lecture 25 - Tutorial (Week 5)

Lecture 26 - Irrigation Wells

Lecture 27 - Aquifer Properties

Lecture 28 - Well Hydraulics - 1

Lecture 29 - Well Hydraulics - 2

Lecture 30 - Tutorial

Lecture 31 - Introduction

[Lecture 32 - Centrifugal Pump: Basics](#)

[Lecture 33 - Centrifugal Pumps: Power Requirement](#)

[Lecture 34 - Pump Characteristic Curves](#)

[Lecture 35 - Tutorial](#)

[Lecture 36 - Management of salt affected soils: Saline and alkali soils - 1](#)

[Lecture 37 - Management of salt affected soils: Saline and alkali soils - 1](#)

[Lecture 38 - Agricultural Drainage: Related Concepts](#)

[Lecture 39 - Agricultural Drainage: Introduction](#)

[Lecture 40 - Tutorial](#)

[Lecture 41 - Drainage System Components](#)

[Lecture 42 - Drainage System : Drain Pipe](#)

[Lecture 43 - Drainage System : Structures](#)

[Lecture 44 - Drainage System Design](#)

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[Lecture 50 - Tutorial](#)

[Lecture 51 - Surface drainage system design - 1](#)

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[Lecture 53 - Non-conventional drainage](#)

[Lecture 54 - Economics of drainage project](#)

[Lecture 55 - Tutorial](#)

[Lecture 56 - Case study of drainage system](#)

[Lecture 57 - Drainage Model](#)

[Lecture 58 - Irrigation Efficiency](#)

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Lecture 1 - Importance Of Rheology In Food

Lecture 2 - Food Rheology

Lecture 3 - Food Rheology

Lecture 4 - Food Rheology

Lecture 5 - Food Rheology

Lecture 6 - Measurements of Rheological Properties

Lecture 7 - Measurements of Rheological Properties

Lecture 8 - Rheological Properties of Viscoelastic Food

Lecture 9 - Rheological Properties of Viscoelastic Food

Lecture 10 - Rheological Properties of Viscoelastic Food

Lecture 11 - Thermal Processing And Microbial Death Kinetics

Lecture 12 - Thermal processing and microbial death kinetics

Lecture 13 - Thermal processing and microbial death kinetics (Continued...)

Lecture 14 - Thermal processing and microbial death kinetics (Continued...)

Lecture 15 - Thermal processing and microbial death kinetics (Continued...)

Lecture 16 - Evaporation and concentration

Lecture 17 - Evaporation and concentration

Lecture 18 - Evaporation and concentration

Lecture 19 - Evaporation and concentration

Lecture 20 - Evaporation and concentration

Lecture 21 - Heat Exchangers

Lecture 22 - Heat Exchangers

Lecture 23 - Heat Exchangers

Lecture 24 - Heat Exchangers

Lecture 25 - Heat Exchangers

Lecture 26 - Drying Technology

Lecture 27 - Drying Technology

Lecture 28 - Drying Technology

Lecture 29 - Drying Technology

Lecture 30 - Drying Technology

Lecture 31 - Freezing and Freeze Drying

[Lecture 32 - Freezing and Freeze Drying](#)

[Lecture 33 - Freezing and Freeze Drying](#)

[Lecture 34 - Freezing and Freeze Drying](#)

[Lecture 35 - Freezing and Freeze Drying](#)

[Lecture 36 - Size Reduction](#)

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[Lecture 38 - Size Reduction \(Continued...\)](#)

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[Lecture 47 - Mixing and agitation \(Continued...\)](#)

[Lecture 48 - Mixing and agitation \(Continued...\)](#)

[Lecture 49 - Mixing and agitation \(Continued...\)](#)

[Lecture 50 - Mixing and agitation \(Continued...\)](#)

[Lecture 51 - Leaching and Extraction](#)

[Lecture 52 - Leaching and Extraction \(Continued...\)](#)

[Lecture 53 - Leaching and Extraction \(Continued...\)](#)

[Lecture 54 - Leaching and Extraction \(Continued...\)](#)

[Lecture 55 - Leaching and Extraction \(Continued...\)](#)

[Lecture 56 - Non Thermal Processing](#)

[Lecture 57 - Non Thermal Processing \(Continued...\)](#)

[Lecture 58 - Non Thermal Processing \(Continued...\)](#)

[Lecture 59 - Non Thermal Processing \(Continued...\)](#)

[Lecture 60 - Non Thermal Processing \(Continued...\)](#)

Lecture 1 - Introduction

Lecture 2 - Soilerosion causes and types

Lecture 3 - Factors affecting soil erosion and effects of soil erosion

Lecture 4 - Soil erosion - Mechanics

Lecture 5 - Water erosion control measures

Lecture 6 - Soil loss estimation

Lecture 7 - Erosivity and Erodibility

Lecture 8 - Modification in Universal soil loss equation - Part I

Lecture 9 - Modification in Universal soil loss equation - Part II

Lecture 10 - Soil loss measurement

Lecture 11 - Bunds - Introduction

Lecture 12 - Contour Bunds

Lecture 13 - Problems on Contour Bunds

Lecture 14 - Graded Bunds

Lecture 15 - Problems on Graded Bunds

Lecture 16 - Terrace - Introduction

Lecture 17 - Bench Terraces

Lecture 18 - Problems on Bench Terraces

Lecture 19 - Broad-base Terraces

Lecture 20 - Problems on Broad-base Terraces

Lecture 21 - Grassed Waterways

Lecture 22 - Problems on Grassed Waterways

Lecture 23 - Parabolic Grassed Waterways

Lecture 24 - GATE Questions on Various Topics Covered

Lecture 25 - Introduction-Gully Control Measures

Lecture 26 - Gully Control Measures (Permanent Structures)

Lecture 27 - Design Considerations- Permanent Gully Control Structures

Lecture 28 - Basics of Open Channel Hydraulics - 1

Lecture 29 - Basics of Open Channel Hydraulics - 2

Lecture 30 - Hydraulic Design of Drop Spillway

Lecture 31 - Hydraulic Design of drop Spillway in different Flow Conditions

[Lecture 32 - Hydraulic Design Components](#)

[Lecture 33 - Structural Design of Drop Spillway - 1](#)

[Lecture 34 - Structural Design of Drop Spillway - 2](#)

[Lecture 35 - Structural Design of Drop Spillway - 3](#)

[Lecture 36 - Structural Design of Drop Spillway - 4](#)

[Lecture 37 - GATE Question](#)

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[Lecture 45 - Chute Spillway Design - I](#)

[Lecture 46 - Chute Spillway Design - II](#)

[Lecture 47 - Energy Dissipation](#)

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[Lecture 51 - Formation of Sand Dunes](#)

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[Lecture 53 - Land Capability Classes](#)

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Lecture 1 - Preamble of the Subject

Lecture 2 - What is Food and Nutrients

Lecture 3 - Nutritional Value of the Nutrients

Lecture 4 - Best Way of Storage of Food Materials

Lecture 5 - Preservation Techniques

Lecture 6 - Temperature Quotient and Its Impact

Lecture 7 - Food Additives

Lecture 8 - Quality of Food

Lecture 9 - Quality of Food (Continued...)

Lecture 10 - Emerging Technology

Lecture 11 - Emerging Technology (Continued...)

Lecture 12 - Food Laws - Why?

Lecture 13 - Food Laws of India

Lecture 14 - Standards in India

Lecture 15 - Hygiene and Other Controls in India

Lecture 16 - Physico-Chemical Properties of Milk

Lecture 17 - Milk - What is it

Lecture 18 - Milk - How it looks?

Lecture 19 - Milk - Constituents

Lecture 20 - Constituents of Milk

Lecture 21 - Milk Fat

Lecture 22 - Milk Fat (Continued...)

Lecture 23 - Milk Fat (Continued...)

Lecture 24 - Milk Fat (Continued...)

Lecture 25 - Protein

Lecture 26 - Protein (Continued...)

Lecture 27 - Amino Acids

Lecture 28 - Amino Acids (Continued...)

Lecture 29 - Milk Protein

Lecture 30 - Casein Micelle

Lecture 31 - Whey Protein

- Lecture 32 - Whey Protein (Continued...)
- Lecture 33 - Lactoferrin
- Lecture 34 - Carbohydrates in Milk
- Lecture 35 - Small Constituents of Milk
- Lecture 36 - Enzymes in Milk
- Lecture 37 - Chemical and Microbial Spoilage of Milk and Milk Products
- Lecture 38 - Extrinsic Factors for Microbial Growth
- Lecture 39 - Natural or Other Type of Spoilage
- Lecture 40 - Packaging
- Lecture 41 - Milk Pasteurization
- Lecture 42 - Thermal Death Time
- Lecture 43 - Pasteurization Effectiveness
- Lecture 44 - Milk Pasteurization and Homogenization
- Lecture 45 - Milk Pasteurization and Homogenization (Continued...)
- Lecture 46 - Milk Homogenization
- Lecture 47 - Milk Centrifugation
- Lecture 48 - Types of Available Milk
- Lecture 49 - Types of Available Milk in the Market
- Lecture 50 - New Technologies in Dairy Industries
- Lecture 51 - Cheese
- Lecture 52 - Cheddar Cheese
- Lecture 53 - Ice Cream
- Lecture 54 - Process of Ice Cream Preparation
- Lecture 55 - Ice Cream Lolies
- Lecture 56 - Over Run and Calculation for Preparing Ice Cream Mix
- Lecture 57 - Transportation of Ice Cream vis a vis Frozen Foods
- Lecture 58 - Packaging of Food Materials
- Lecture 59 - Modified Atmosphere Packaging
- Lecture 60 - Flow Chart for Manufacturing Some Dairy and Food Products

- Lecture 1 - Organic Farming: Introduction and Status
- Lecture 2 - Organic Farming: Introduction and Status (Continued...)
- Lecture 3 - Organic Farming and its Components
- Lecture 4 - Organic Farming Concepts and Principles
- Lecture 5 - Organic Farming Concepts and Principles (Continued...)
- Lecture 6 - SWOT Analysis of Organic Farming
- Lecture 7 - Sustainable Agriculture
- Lecture 8 - Key Indicators of Sustainable Agriculture
- Lecture 9 - Organic Farming and Climate Change
- Lecture 10 - Organic Farming and Climate Change (Continued...)
- Lecture 11 - Principles of Compost Production
- Lecture 12 - Vermicompost Production Technology
- Lecture 13 - Vermicompost Production Technology (Continued...)
- Lecture 14 - Vermicompost Production Technology (Continued...)
- Lecture 15 - Enriched Vermicompost Production Technology
- Lecture 16 - Vermicompost Quality and Marketing
- Lecture 17 - Introduction to Pest and Disease Management
- Lecture 18 - Pest and Disease Management in Organic Farming
- Lecture 19 - Level C Pest and Disease Management
- Lecture 20 - Level C Pest and Disease Management (Continued...)
- Lecture 21 - Introduction to Organic Crop Management
- Lecture 22 - Introduction to Organic Crop Management (Continued...)
- Lecture 23 - Organic Vegetable Crop Management
- Lecture 24 - Organic Vegetable Crop Management (Cereals)
- Lecture 25 - Organic Vegetable Crop Management (Cereals) (Continued...)
- Lecture 26 - Organic Field Crop Management (Pulse and Oilseed Crop)
- Lecture 27 - Organic Plantation Crop Management
- Lecture 28 - Organic Meat Production
- Lecture 29 - Introduction on transition to organic crop production
- Lecture 30 - Crop planning and rotation design in organic system
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**NPTEL : NOC:Post Harvest Operations and Processing of Fruits, Vegetables, Spices and Plantation Crop Products
(Agriculture)**

Co-ordinators : Prof. Hari Niwas Mishra

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Lecture 28 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 29 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 30 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 31 - Soil Health and Quality, Problem Soil, Land Capability Classification

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- [Lecture 33 - Soil Health and Quality, Problem Soil, Land Capability Classification \(Continued...\)](#)
- [Lecture 34 - Soil Health and Quality, Problem Soil, Land Capability Classification \(Continued...\)](#)
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- [Lecture 45 - Fertilizer Quality Control, Fertilizer Adulteration and Fertilizer Testing \(Continued...\)](#)
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- [Lecture 52 - Fertilizer Recommendation Approaches and Integrated Plant Nutrient Management \(Continued...\)](#)
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- [Lecture 54 - Fertilizer Recommendation Approaches and Integrated Plant Nutrient Management \(Continued...\)](#)
- [Lecture 55 - Fertilizer Recommendation Approaches and Integrated Plant Nutrient Management \(Continued...\)](#)
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- [Lecture 57 - Agricultural Productivity and Environmental Quality \(Continued...\)](#)
- [Lecture 58 - Agricultural Productivity and Environmental Quality \(Continued...\)](#)
- [Lecture 59 - Agricultural Productivity and Environmental Quality \(Continued...\)](#)
- [Lecture 60 - Agricultural Productivity and Environmental Quality \(Continued...\)](#)

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- Lecture 2 - Why Cooling is required ?
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- Lecture 5 - How to produce Safe Foods ? (Continued...)
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- Lecture 7 - Cooling Load Calculation (Continued...)
- Lecture 8 - Cooling Load Calculation (Continued...)
- Lecture 9 - Cooling Load Calculation (Continued...)
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- Lecture 11 - Basics of Thermodynamics (Continued...)
- Lecture 12 - Basics of Thermodynamics (Continued...)
- Lecture 13 - Basics of Thermodynamics (Continued...)
- Lecture 14 - Basics of Thermodynamics (Continued...)
- Lecture 15 - Basics of Thermodynamics (Continued...)
- Lecture 16 - Basics of Thermodynamics (Continued...)
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- Lecture 45 - Reciprocating Compressor (Continued...)
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- Lecture 52 - Crystallization in Freezing
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- Lecture 54 - Freezers
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- Lecture 59 - Ice Cream
- Lecture 60 - Ice Cream (Continued...)

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Lecture 2 - Classification of wheels, Forces and moments acting on wheel

Lecture 3 - Tyre constructions and its specification

Lecture 4 - Tractive performance parameters

Lecture 5 - Tutorial 1

Lecture 6 - Mechanics of wheel and its tractive performance

Lecture 7 - Measurement of soil strength, cohesion and angle of internal friction

Lecture 8 - Measurement and characterization of terrain response

Lecture 9 - Characterization of shear stress and shear strength in different soil conditions

Lecture 10 - Tutorial 2 - Measurement of shear strength, modulus of sinkage and cone index

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Lecture 21 - Effect of tyre parameters on tractive performance of tyre

Lecture 22 - Selection of tyre

Lecture 23 - Comparison of single tyre with dual tyres

Lecture 24 - Performance evaluation of a walking tractor fitted with track

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Lecture 26 - Measurement of Cone Index

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Lecture 28 - Measurement of Theoretical Velocity, Actual Velocity and Slip for a Pneumatic Wheel

Lecture 29 - Measurement of Contact Area of a Pneumatic Tyre on a Hard Surface

Lecture 30 - Measurement of Tractive Efficiency

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Lecture 2 - Plant Sources of Edible Oils and Fats

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Lecture 8 - Glycerides - Type, Structure and Function

Lecture 9 - Triglycerides - Function in Nutrition and Food Processing

Lecture 10 - Phospholipids and Sterols

Lecture 11 - Engineering Properties of Edible Oils

Lecture 12 - Chemical Properties of Edible Oils

Lecture 13 - Rancidity and Reversion

Lecture 14 - Oxidative Rancidity

Lecture 15 - Antioxidants in Edible Oil

Lecture 16 - Pre-Treatment Techniques

Lecture 17 - Physical Methods for Oil Extraction - Concept and Mechanism

Lecture 18 - Expression - Pressing

Lecture 19 - Screw Expelling

Lecture 20 - Recent Developments in Oil Expression Technology

Lecture 21 - Extraction principles and mechanisms

Lecture 22 - Factors affecting extraction process

Lecture 23 - Solvent Extraction Technology and Equipment

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- Lecture 54 - Lecithin Production
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- Lecture 56 - Edible Oil Blending and Fortification
- Lecture 57 - Packaging materials and methods
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Lecture 12 - Streamflow Measurement - 1

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Lecture 3 - Emerging Concerns in Wastewater Treatment in Global Scenario

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Lecture 6 - Collection and Preservation of Samples and the Measurement of pH, Acidity, Alkalinity

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Lecture 8 - Determination of BOD, COD and TOC

Lecture 9 - Modelling of BOD and its relation with COD and TOC

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Lecture 11 - Wastewater Treatment Classification and Plant Analysis

Lecture 12 - Order of Reaction and Types of Reactors Used in Wastewater Treatment

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Lecture 17 - Grit Chamber and its Classification - I

Lecture 18 - Grit Chamber and its Classification - II and Skimming Tank

Lecture 19 - Theory of Sedimentation and Introduction to Primary Sedimentation Tank and its Types

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Lecture 21 - Equalization

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Lecture 29 - Important nomenclature on aerobic treatment units

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[Lecture 34 - Phases of Post Modern Architecture - Critical Regionalism](#)

[Lecture 35 - Phases of Post Modern Architecture - Memphis Milano](#)

[Lecture 36 - Phases of Post Modern Architecture - Deconstructivism - Part I](#)

[Lecture 37 - Phases of Post Modern Architecture - Deconstructivism - Part II](#)

[Lecture 38 - Phases of Post Modern Architecture - Pop Art](#)

[Lecture 39 - Evolution of Typography in Contemporary Era](#)

[Lecture 40 - Phases of Post Modern Architecture - Industrial Design](#)

Lecture 1 - Interior-Architecture: Definition and Understanding

Lecture 2 - Craft: Definition and Understanding (Varied Perspectives on Art and Craft)

Lecture 3 - Interior-Architecture and Craft and Technology: Establishing Inter-Relationships

Lecture 4 - Interior-Architecture and Craft and Technology: Exploring Applications

Lecture 5 - Summary and Discourse - I

Lecture 6 - Interior-Architecture: Documenting Knowledge and Skills

Lecture 7 - Traditional Knowledge Systems and the Ingenious skills of the communities

Lecture 8 - Interior-Architecture: Documenting Materials; Tools and Techniques

Lecture 9 - Traditional Knowledge Systems and the Indigenous materials; tools and techniques

Lecture 10 - Summary and Discourse - II

Lecture 11 - Creative and Cultural Industries: Understanding Definition; Significance and Scope

Lecture 12 - Building Crafts: Definitions; Perspectives and Frameworks

Lecture 13 - Building Crafts: Craft and Technology and its Role in Creating/Enhancing Interior-Architecture

Lecture 14 - Building Crafts; Craft and Technology and its Role in Creating/Enhancing Interior-Architecture

Lecture 15 - Summary and Discourse - III

Lecture 16 - Best Studies related to the Craft Sector

Lecture 17 - Case Studies from Gujarat

Lecture 18 - Case Studies from Rajasthan

Lecture 19 - Case Studies from Uttarakhand

Lecture 20 - Summary and Discourse - IV

Lecture 21 - Craft and Technology in Interior Architecture: Decoding Systems

Lecture 22 - Craft and Technology in Interior Architecture; Decoding Systems

Lecture 23 - Craft and Technology in Interior Architecture: Transformation through Time

Lecture 24 - Craft and Technology in Interior Architecture; Transformation through Time

Lecture 25 - Summary and Discourse - V

Lecture 26 - Overview of the Craft Sector Today

Lecture 27 - Craft Sector: Issues and Challenges

Lecture 28 - Craft Sector: Policies and Reforms

Lecture 29 - Craft Sector: Gaps

Lecture 30 - Summary and Discourse - VI

Lecture 31 - Continuity and Revival: Research and Documentation Perspective

[Lecture 32 - Continuity and Revival: Education and Training Perspective](#)

[Lecture 33 - Continuity and Revival: Innovation and Development Perspective](#)

[Lecture 34 - Continuity and Revival: Resource Building and Dissemination Perspective](#)

[Lecture 35 - Summary and Discourse - VII](#)

[Lecture 36 - Interventions: Process Based](#)

[Lecture 37 - Interventions: Product / Design Based](#)

[Lecture 38 - Interventions: Technology Based](#)

[Lecture 39 - Interventions: Marketing / Management Based](#)

[Lecture 40 - Summary and Discourse - VIII](#)

Lecture 1 - Introduction to Urbanisation

Lecture 2 - Introduction to Urban Governance

Lecture 3 - Constitutional Provision for Urban Local Governance

Lecture 4 - Legislative Provisions

Lecture 5 - Interfaces

Lecture 6 - People & Community - 1

Lecture 7 - People & Community - 2

Lecture 8 - Land as Basic Resource

Lecture 9 - Urban Environment and Ecology

Lecture 10 - Distinctive Features of Non-Municipal Urban (NMU) and Nagar Panchayats

Lecture 11 - Organisation Development

Lecture 12 - Transparency and Accountability

Lecture 13 - Capacity Building - 1

Lecture 14 - Capacity Building - 2

Lecture 15 - Improving Systems and Processes for Urban Governance

Lecture 16 - Urban Reform and Managing Change - 1

Lecture 17 - Urban Reform and Managing Change - 2

Lecture 18 - Visioning for Cities

Lecture 19 - Resolving Conflicts for Managing Change

Lecture 20 - Leadership and Team Building

Lecture 21 - Basic Concepts of Planning and Development

Lecture 22 - Regional and Metropolitan Planning

Lecture 23 - Urban Planning

Lecture 24 - Urban Infrastructure and Services - 1

Lecture 25 - Urban Infrastructure and Services - 2

Lecture 26 - Overview of Municipal Finance

Lecture 27 - Alternate Sources of Municipal Finance

Lecture 28 - Municipal Accounts

Lecture 29 - Value Capture Financing

Lecture 30 - Public Private Partnership (PPP) in Urban Governance

Lecture 31 - Housing Strategy for Cities

- Lecture 32 - Housing & Urban Poverty
- Lecture 33 - Real Estate Regulation and Development
- Lecture 34 - Urban Land Management
- Lecture 35 - Urban Risk and Disaster Management
- Lecture 36 - Managing Urban Environment - 1
- Lecture 37 - Managing Urban Environment - 2 (Mandates for Blue and Green Infrastructures)
- Lecture 38 - Traffic and Transportation Management - 1
- Lecture 39 - Traffic and Transportation Management - 2
- Lecture 40 - Designing Urban Public Spaces
- Lecture 41 - Centrally Sponsored Programmes and Schemes
- Lecture 42 - AMRUT
- Lecture 43 - Smart City: Concept and Mission
- Lecture 44 - Swachh Bharat Mission and HRIDAY
- Lecture 45 - PMAY and NULM
- Lecture 46 - Fundamentals of Project Planning
- Lecture 47 - Formulation of Projects
- Lecture 48 - Project Monitoring and Management
- Lecture 49 - Essentials of Infrastructure and Engineering Design
- Lecture 50 - Managing Trans-municipal and Large Projects
- Lecture 51 - Enhancing City Image
- Lecture 52 - Essential Competencies of City Managers
- Lecture 53 - Problem Solving and Decision Making
- Lecture 54 - Effective Negotiation
- Lecture 55 - Communication Skills
- Lecture 56 - Time Management
- Lecture 57 - Stress Management
- Lecture 58 - Best Practices in Urban Management
- Lecture 59 - Reflective Learning and Excellence
- Lecture 60 - Course Summary, Doubt Clearing and Further Reading

Lecture 1 - Introduction

Lecture 2 - User Interface Designer

Lecture 3 - Design methods - I

Lecture 4 - Design Methods - II

Lecture 5 - Human Factor in Interaction Design

Lecture 6 - User Research - I

Lecture 7 - User Research - II

Lecture 8 - Low Fidelity Design - I

Lecture 9 - Low Fidelity Design - II

Lecture 10 - High Fidelity Design

Lecture 11 - Visual Cognition

Lecture 12 - Contemporary Visual Language in Design - I

Lecture 13 - Contemporary Visual Language in Design - II

Lecture 14 - Usage of Typography in User Interface Design - I

Lecture 15 - Usage of Typography in User Interface Design - II

Lecture 16 - Design Semiotics and Visual Perception

Lecture 17 - Visual Communication Design

Lecture 18 - User Testing - I

Lecture 19 - User Testing - II

Lecture 20 - Contemporary Interface Design Technology

Lecture 1 - Disaster risk: Hazards X Exposure X Vulnerability

Lecture 2 - Disaster Recovery and Build Back Better: Risk Perception and Disaster Risk Preparedness - Part 1

Lecture 3 - Risk Perception and Disaster Risk Preparedness - Part 2

Lecture 4 - Build Back Better - People's Perspectives

Lecture 5 - Architecture at Risk

Lecture 6 - Culture, climate change adaptation and disaster risk reduction

Lecture 7 - Ayutthaya at Risk

Lecture 8 - Disaster vulnerability

Lecture 9 - Cultural Heritage: Reassembled

Lecture 10 - Rock shelters at risk

Lecture 11 - The Built Environment Professions in Disaster Risk Reduction and Response

Lecture 12 - Gadri discussions: social dimension of risk, health and DRM

Lecture 13 - Community Participation in Disaster Risk Governance : Voices from Mumbai and Ghana

Lecture 14 - Community Participation in Disaster Risk Governance : Insights From Mumbai

Lecture 15 - Frameworks

Lecture 16 - Disaster Preparedness from Cognitive and Heuristic Perspectives

Lecture 17 - Information for Disaster Preparedness

Lecture 18 - The Role of Social Networks in Disaster Preparedness

Lecture 19 - Diffusion of Disaster Preparedness Technology : What Pioneers Contribute ?

Lecture 20 - Cities and Climate Change: Adaptation and Mitigation

Lecture 21 - Temporary Shelter Construction in India

Lecture 22 - Temporary shelter construction in Kenya

Lecture 23 - Build back better in Nepal recovery

Lecture 24 - Lessons from Peru

Lecture 25 - Progressive Housing in El Salvador

Lecture 26 - Decentralizing (re)construction in Colombia

Lecture 27 - Tsunami reconstruction in Tamilnadu - Part 1 (Approach)

Lecture 28 - Tsunami reconstruction in Tamilnadu - Part 2 (Findings)

Lecture 29 - Culture and (disaster)risk

Lecture 30 - Cultural theory of risk

Lecture 31 - Guidance to DRR

[Lecture 32 - Self-help housing in Turkey](#)

[Lecture 33 - The Production of refugee place in time: Case of Tibetan refugees](#)

[Lecture 34 - Assessments](#)

[Lecture 35 - Designing culturally responsive built environment in disaster context](#)

[Lecture 36 - Disaster Risk Communication](#)

[Lecture 37 - CAM and CBDRM](#)

[Lecture 38 - How to teach disaster recovery and built back better in-built environment education](#)

[Lecture 39 - Source, Message and Receiver in Disaster Risk Communication](#)

[Lecture 40 - Summary and Conclusion](#)

- Lecture 1 - Introduction to Sustainability
- Lecture 2 - Buildings, Needs and 'Sustainability'
- Lecture 3 - Sustainability and Sustainable Development
- Lecture 4 - Historic Origins of Sustainability
- Lecture 5 - Pioneers of Sustainable Development
- Lecture 6 - Environmental Impacts of Development: Impacts on Water
- Lecture 7 - Environmental Impacts of Development: Impacts on Land and Air
- Lecture 8 - Social and Economic Impacts of Development
- Lecture 9 - Agenda 21 and UN Goals
- Lecture 10 - Established needs for Sustainability in Building Sector
- Lecture 11 - Definition and Characteristics of Sustainability
- Lecture 12 - Flavors of Sustainable Architecture
- Lecture 13 - Indicators and Terminologies in Sustainable Architecture
- Lecture 14 - Process of Designing Green Buildings
- Lecture 15 - Green Building Ratings and Components
- Lecture 16 - Fundamentals of Thermal Comfort
- Lecture 17 - Climatic Considerations, Physiological Objectives of Design
- Lecture 18 - Fundamentals of Climate Responsive Buildings - I
- Lecture 19 - Fundamentals of Climate Responsive Buildings - II
- Lecture 20 - Visual and Acoustic Comfort
- Lecture 21 - Sustainable Sites - I
- Lecture 22 - Sustainable Sites - II
- Lecture 23 - Sustainable Sites - III
- Lecture 24 - Sustainable Sites - IV
- Lecture 25 - Sustainable Sites - V
- Lecture 26 - Water Conservation - I
- Lecture 27 - Water Conservation - II
- Lecture 28 - Water Conservation - III
- Lecture 29 - Water Conservation - IV
- Lecture 30 - Water Conservation - V
- Lecture 31 - Materials and Resources - I

[Lecture 32 - Materials and Resources - II](#)

[Lecture 33 - Materials and Resources - III](#)

[Lecture 34 - Materials and Resources - IV](#)

[Lecture 35 - Materials and Resources - V](#)

[Lecture 36 - Energy Efficiency - I](#)

[Lecture 37 - Energy Efficiency - II](#)

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[Lecture 41 - Indoor Environmental Quality - I](#)

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[Lecture 46 - Vernacular Architecture - I](#)

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[Lecture 48 - Codes and Standards](#)

[Lecture 49 - Introduction to Whole Building Simulation - I](#)

[Lecture 50 - Introduction to Whole Building Simulation - II](#)

[Lecture 51 - Whole Building Performance - I](#)

[Lecture 52 - Whole Building Performance - II](#)

[Lecture 53 - Whole Building Performance - III](#)

[Lecture 54 - Whole Building Performance - IV](#)

[Lecture 55 - Whole Building Performance - V](#)

[Lecture 56 - Whole Building Performance - VI](#)

[Lecture 57 - Whole Building Performance - VII](#)

[Lecture 58 - Whole Building Performance - VIII](#)

[Lecture 59 - Whole Building Performance - IX](#)

[Lecture 60 - Whole Building Performance - X](#)

Lecture 1 - Introduction to Structure, Form and Architecture

Lecture 2 - Relationship of Structure to Architectural Buildings - Part I

Lecture 3 - Relationship of Structure to Architectural Buildings - Part II

Lecture 4 - Loads on Structures

Lecture 5 - Synthesis of Architectural and Structural Form

Lecture 6 - Connecting Structure and Architecture - Part I

Lecture 7 - Connecting Structure and Architecture - Part II

Lecture 8 - Structural Transformation in Architectural History

Lecture 9 - Factors affecting the Structural Forms

Lecture 10 - Learning from Animal's Architecture

Lecture 11 - Basic Structural Properties

Lecture 12 - Structural Requirements

Lecture 13 - Structural Arrangement

Lecture 14 - Structural Forms and Shapes

Lecture 15 - Structural Materials

Lecture 16 - Structural Typology

Lecture 17 - Compressive Structures

Lecture 18 - Tensile Structures

Lecture 19 - Load Bearing Structures

Lecture 20 - Temporary Structures

Lecture 21 - Framed Structure

Lecture 22 - Arch Structures

Lecture 23 - Vault Structures

Lecture 24 - Dome Structures

Lecture 25 - Grid Structures

Lecture 26 - Shell Structures

Lecture 27 - Trusses and Space Frames

Lecture 28 - Folded Plate Structures

Lecture 29 - Membrane Structures

Lecture 30 - Pneumatic Structures

Lecture 31 - Structure and Architectural Forms in Windy Areas

[Lecture 32 - Structure and Architectural Forms in Seismic Prone Areas](#)

[Lecture 33 - Structure and Architectural Forms in Flood Prone Areas](#)

[Lecture 34 - Cost Effective Structure and Architecture](#)

[Lecture 35 - Structure and Light in Architecture](#)

[Lecture 36 - Evolution of Highrise Structural System](#)

[Lecture 37 - Highrise Structural Components - Part I](#)

[Lecture 38 - Highrise Structural Components - Part II](#)

[Lecture 39 - Mega Structure and Architecture-Case Studies](#)

[Lecture 40 - Architecture and Structure - Past, Present and Future](#)

Lecture 1 - Introduction to Engineering Graphics

Lecture 2 - Drawing Instruments

Lecture 3 - Sheet Layout and Fixing Sheet

Lecture 4 - Types of Lines and Graphic Symbols

Lecture 5 - Lettering

Lecture 6 - Dimensioning

Lecture 7 - Basic Geometrical Construction

Lecture 8 - Scales

Lecture 9 - Curves used in Engineering Practice: Conic Sections

Lecture 10 - Curves used in Engineering Practice: Cycloids, Trochoids and Involutives

Lecture 11 - Introduction to Orthographic Projection

Lecture 12 - Orthographic Projections - 1st Quadrant Vs 3rd Quadrant

Lecture 13 - Orthographic Projections - Projection of Points

Lecture 14 - Orthographic Projections - Introduction to Projection of Lines

Lecture 15 - Locus of Points

Lecture 16 - Projection of lines parallel to both the reference planes

Lecture 17 - Projection of line parallel to one and perpendicular to another plane

Lecture 18 - Projection of lines inclined to one plane

Lecture 19 - Projection of lines inclined to both the planes

Lecture 20 - Projection of a point and line on auxiliary plane

Lecture 21 - Projection of a plane perpendicular to both the reference planes

Lecture 22 - Projection of a plane perpendicular to one and parallel to another plane

Lecture 23 - Projection of a plane inclined to one and perpendicular to the other plane

Lecture 24 - Projection of a plane inclined to both the reference planes - I

Lecture 25 - Projection of a plane inclined to both the reference planes - II

Lecture 26 - Introduction to types of solids

Lecture 27 - Projection of solids in simple positions

Lecture 28 - Projection of solids with axis inclined to one of the reference planes and parallel to another

Lecture 29 - Projection of solids with axis inclined to both the reference planes

Lecture 30 - Projection of spheres

Lecture 31 - Orthographic Projections Introduction to Sections of Solids

[Lecture 32 - Orthographic Projections Sections of Prisms](#)

[Lecture 33 - Orthographic Projections Sections of Pyramids](#)

[Lecture 34 - Orthographic Projections Sections of Cylinders](#)

[Lecture 35 - Orthographic Projections Sections of Cones](#)

[Lecture 36 - Orthographic Projections Sections of Spheres](#)

[Lecture 37 - Development of Surfaces - I](#)

[Lecture 38 - Development of Surfaces - II](#)

[Lecture 39 - Intersection of Surfaces - I](#)

[Lecture 40 - Intersection of Surfaces - II](#)

- Lecture 1 - Conceptual Understanding of the Urban Areas
- Lecture 2 - Urbanization and Sustainable Development
- Lecture 3 - Urban Planning and 73-74 Constitution Amendment Acts
- Lecture 4 - Types and Level of Plans
- Lecture 5 - Regional Plan - I
- Lecture 6 - Regional Plan - II
- Lecture 7 - Development Plan - I
- Lecture 8 - Development Plan - II (Case Study- Draft Bhopal Development Plan 2031)
- Lecture 9 - Zonal Plan
- Lecture 10 - Town Planning Scheme
- Lecture 11 - Local Area Plan (Urban Redevelopment Plan)
- Lecture 12 - Special Purpose Plan (AMRUT)
- Lecture 13 - Special Purpose Plan (HRIDAY)
- Lecture 14 - Special Purpose Plan (Smart City)
- Lecture 15 - Perspective Plan (Agenda 2030 SDGs)
- Lecture 16 - Contextualizing Cities (Egyptian, Mesopotamian, and Indus Valley Civilization)
- Lecture 17 - Contextualizing Cities (Vedic Period)
- Lecture 18 - Contextualizing Cities (Greek and Roman)
- Lecture 19 - Contextualizing Cities (Industrial Revolution)
- Lecture 20 - Contextualizing Cities (1900-1939)
- Lecture 21 - Contextualizing Cities (1940-1979)
- Lecture 22 - Contextualizing Cities (1980-2021)
- Lecture 23 - Public Health and Urban Planning - I
- Lecture 24 - Public Health and Urban Planning - II
- Lecture 25 - Public Health and Urban Planning - III
- Lecture 26 - Public Health and Urban Planning - IV
- Lecture 27 - Housing Issues in India
- Lecture 28 - Culture and Planning of Cities
- Lecture 29 - Urbanization and Environmental Problems
- Lecture 30 - Urbanization and Slums
- Lecture 31 - Introduction to Planning Legislation

[Lecture 32 - Evolution and Growth of Planning Legislation - I](#)

[Lecture 33 - Evolution and Growth of Planning Legislation - II \(USA\)](#)

[Lecture 34 - Evolution and Growth of Planning Legislation - III \(India\)](#)

[Lecture 35 - Land Acquisition Act](#)

[Lecture 36 - Legal Requirements for Industrial Development](#)

[Lecture 37 - National Environmental Legal Requirements](#)

[Lecture 38 - Section I - Cantonment Act and Section II - Legal Requirement for Heritage Conservation](#)

[Lecture 39 - Zoning Regulation](#)

[Lecture 40 - Contemplating Learning Outcomes and Future Direction in Urban Planning](#)

- Lecture 1 - Introduction to isometric projection and isometric Scale
- Lecture 2 - Isometric projection of planar figures - quadrilaterals
- Lecture 3 - Isometric projection of planar figures - circles, semi circles and curves
- Lecture 4 - Isometric projection of straight prisms
- Lecture 5 - Isometric projection of straight pyramids
- Lecture 6 - Isometric projection of Straight Cylinders
- Lecture 7 - Isometric projection of Cones
- Lecture 8 - Isometric projection of Frustums of cones and pyramids
- Lecture 9 - Isometric projection of section of solids
- Lecture 10 - Isometric projection of spheres
- Lecture 11 - Isometric projection of combination of solids
- Lecture 12 - Isometric Projection of intersecting solids
- Lecture 13 - Converting orthographic views to isometric drawing - 1
- Lecture 14 - Converting orthographic views to isometric drawing - 2
- Lecture 15 - Converting Isometric drawing to orthographic views
- Lecture 16 - Introduction to axonometric projection
- Lecture 17 - Axonometric projection of planar figures- quadrilaterals, circles and curves
- Lecture 18 - Axonometric projection of prisms and pyramids
- Lecture 19 - Axonometric projection of Cylinders, cones and spheres
- Lecture 20 - Axonometric projection of intersecting solids and combination of solids

Lecture 1 - State of Global Environment (Air)

Lecture 2 - State of Global Environment (Biodiversity)

Lecture 3 - State of Global Environment (Oceans and Coasts)

Lecture 4 - State of Global Environment (Land and Soil)

Lecture 5 - State of Global Environment (Freshwater)

Lecture 6 - Definition, Process and Purpose of EIA

Lecture 7 - EIA Impact Areas, Current and Emerging - Part 1

Lecture 8 - EIA Impact Areas, Current and Emerging - Part II

Lecture 9 - EIA Origin in USA and World-Wide Development

Lecture 10 - EIA in India

Lecture 11 - World Sustainable Development Timeline (1970-1999)

Lecture 12 - World Sustainable Development Timeline (2000-2021)

Lecture 13 - EIA Law, Policy and Institutional arrangements for EIA systems - Part I

Lecture 14 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part II - Air

Lecture 15 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part III - Air

Lecture 16 - EIA Law, Policy and Institutional arrangements for EIA Systems - Part IV - Water and Geology

Lecture 17 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part V - Ecology

Lecture 18 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part VI - Coastal Ecology and Geomorphology

Lecture 19 - EIA Law, Policy and Institutional arrangements for EIA Systems - Part VII - Noise

Lecture 20 - EIA Law, Policy and Institutional arrangements for EIA Systems - Part VIII - Ecosystem Services

Lecture 21 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part IX - Cultural Heritage and Health

Lecture 22 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part X

Lecture 23 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part XI

Lecture 24 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part XII

Lecture 25 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part XIII

Lecture 26 - EIA Process - Starting and Initial Stage

Lecture 27 - EIA Process - Impact Prediction

Lecture 28 - EIA Process - Impact Evaluation, Mitigation and Enhancement

Lecture 29 - EIA Process - Participation, Presentation and Review

Lecture 30 - EIA Process - Follow-Up (Monitoring and Auditing)

Lecture 31 - EIA Methods - Air Assessment - Part I

- Lecture 32 - EIA Methods - Air Assessment - Part II
- Lecture 33 - EIA Methods - Water Assessment
- Lecture 34 - EIA Methods - Soil, Land and Geology
- Lecture 35 - EIA Methods - Climate and Climate Change - Part I
- Lecture 36 - EIA Methods - Climate and Climate Change - Part II
- Lecture 37 - EIA Methods for Ecology (Definitions and Concepts)
- Lecture 38 - EIA Methods for Ecology (Baseline Study)
- Lecture 39 - EIA Methods for Ecology (Impact Prediction and Evaluation)
- Lecture 40 - EIA Methods - Ecosystem Services - Part I
- Lecture 41 - EIA Methods - Ecosystem Services - Part II
- Lecture 42 - EIA Methods - Coastal Ecology and Geomorphology - Part I
- Lecture 43 - EIA Methods - Coastal Ecology and Geomorphology - Part II
- Lecture 44 - EIA Methods - Noise
- Lecture 45 - EIA Methods - Transport
- Lecture 46 - EIA Methods - Landscape and Visuals
- Lecture 47 - EIA Methods - Cultural Heritage
- Lecture 48 - EIA Methods - Health
- Lecture 49 - EIA Methods - Socio-Economic Impacts (SIA) - Part I
- Lecture 50 - EIA Methods - Socio-Economic Impacts (SIA) - Part II
- Lecture 51 - EIA Methods - Land Acquisition, Resettlement and Livelihoods
- Lecture 52 - EIA Methods - Resource Efficiency
- Lecture 53 - EIA Methods - Risk and Risk Assessment
- Lecture 54 - EIA Methods - Cumulative Effects
- Lecture 55 - EIA - Environmental Management Plans
- Lecture 56 - EIA - Widening the scope: Strategic Environmental Assessment
- Lecture 57 - EIA - Reporting and Review of EIA Quality
- Lecture 58 - EIA Case Study - Mumbai Metro Line 3, Colaba - Bandra - SEEPZ
- Lecture 59 - EIA Case Study - Development of Water Aerodrome, Andaman and Nicobar - Part - I
- Lecture 60 - EIA Case Study - Development of Water Aerodrome, Andaman and Nicobar - Part - II

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Pre-Independence - Part 1: Indo-Saracenic Architecture

Lecture 4 - Pre-Independence - Part 2: Colonial Architecture and Art Deco

Lecture 5 - Pre-Independence to Independence - Part 1

Lecture 6 - Pre-Independence to Independence - Part 2

Lecture 7 - Revivalism

Lecture 8 - The First Generation (1945-1970) - Part 1

Lecture 9 - The First Generation (1945-1970) - Part 2

Lecture 10 - The First Generation (1945-1970) - Part 3

Lecture 11 - The First Generation (1945-1970) - Part 4

Lecture 12 - The First Generation (1945-1970) - Part 5

Lecture 13 - The First Generation (1945-1970) - Part 6

Lecture 14 - Impact of Western Architects: Le Corbusier - Part 1

Lecture 15 - Impact of Western Architects: Le Corbusier - Part 2

Lecture 16 - Impact of Western Architects: Le Corbusier - Part 3

Lecture 17 - Impact of Western Architects: Le Corbusier - Part 4

Lecture 18 - Impact of Western Architects: Le Corbusier - Part 5

Lecture 19 - Impact of Western Architects: Le Corbusier - Part 6

Lecture 20 - Impact of Western Architects: Walter Gropius - Part 1

Lecture 21 - Impact of Western Architects: Walter Gropius - Part 2

Lecture 22 - Impact of Western Architects: Louis I Kahn - Part 1

Lecture 23 - Impact of Western Architects: Louis I Kahn - Part 2

Lecture 24 - Impact of Western Architects: Louis I Kahn - Part 3

Lecture 25 - Impact of Western Architects: Louis I Kahn - Part 4

Lecture 26 - Introduction to Critical Regionalism - Part 1

Lecture 27 - Introduction to Critical Regionalism - Part 2

Lecture 28 - Critical Regionalism in Indian Architecture - Part 1

Lecture 29 - Critical Regionalism in Indian Architecture - Part 2

Lecture 30 - Critical Regionalism in Indian Architecture - Part 3

Lecture 31 - Critical Regionalism in Indian Architecture - Part 4

[Lecture 32 - Critical Regionalism in Indian Architecture - Part 5](#)

[Lecture 33 - Structure: The Works of Mahendra Raj](#)

[Lecture 34 - Point-Blocks and High Rises - Part 1](#)

[Lecture 35 - Point-Blocks and High Rises - Part 2](#)

[Lecture 36 - Search for a new Architecture - Part 1](#)

[Lecture 37 - Search for a new Architecture - Part 2](#)

[Lecture 38 - Search for a new Architecture - Part 3](#)

[Lecture 39 - Search for a new Architecture - Part 4](#)

[Lecture 40 - Search for a new Architecture - Part 5](#)

Lecture 1 - Culture, Identity and Built Environment

Lecture 2 - Space and Meaning in Balinese Vernacular Architecture

Lecture 3 - Adobe Construction and Religious Structures

Lecture 4 - Social System, Beliefs and its Architecture

Lecture 5 - Anthropology of Shelter-Conclusion

Lecture 6 - Stone as a Vernacular Resource Material

Lecture 7 - Earth as Vernacular Resource Material

Lecture 8 - Bamboo as Vernacular Resource Material

Lecture 9 - Timber as Vernacular Resource Material

Lecture 10 - Advanced Material Adaptations: The conclusion

Lecture 11 - Cultural Geography and Vernacular Architecture

Lecture 12 - Cultural Geography and Small-scale Features in the Landscape

Lecture 13 - Acculturation in Architecture

Lecture 14 - Tradition and Transmission

Lecture 15 - Transformation in Vernacular Context

Lecture 16 - Disasters Vulnerability and Traditions

Lecture 17 - Learning Disaster Mitigation from the Vernacular

Lecture 18 - The Second Birth: Lessons from Disaster Recovery

Lecture 19 - Climate Change and Traditions

Lecture 20 - Yonmenkaigi (Four square table system) Method for Collaborative Knowledge Development

Lecture 1 - Introduction to Interaction Design

Lecture 2 - Components of Interaction Design

Lecture 3 - Interaction Design Process

Lecture 4 - Understanding User

Lecture 5 - Conceptual Design - Part 1

Lecture 6 - Conceptual Design - Part 2

Lecture 7 - Role of Cognition

Lecture 8 - Role of Social Interaction

Lecture 9 - Designing for Emotional Interaction

Lecture 10 - Interactive Interfaces

Lecture 11 - Data Gathering

Lecture 12 - Data Analysis

Lecture 13 - Discovering Requirements

Lecture 14 - User Personas and Scenarios

Lecture 15 - Design and Prototyping - Part 1

Lecture 16 - Design and Prototyping - Part 2

Lecture 17 - Visual Interface Design

Lecture 18 - Elements of User Interface

Lecture 19 - Affordances and UI Transformations

Lecture 20 - Component-Based Design Systems

NPTEL : NOC:Understanding and Reducing Ghg Emissions - Focus on Scope 1 and 2 Emission Reduction through Building Design and Construction (Architecture)

Co-ordinators : Prof. Avlokita Agrawal

- Lecture 1 - Introduction, Sustainability, And Sustainable Development
- Lecture 2 - Sustainable Development And Sustainable Goals
- Lecture 3 - Sustainable Development Goals and Climate Change
- Lecture 4 - Climate Risk
- Lecture 5 - Impact of Development on Climate Natural Components
- Lecture 6 - UNFCCC
- Lecture 7 - Kyoto Protocol
- Lecture 8 - The Paris Agreement
- Lecture 9 - Green House Gases
- Lecture 10 - Carbon Footprint and Calculation
- Lecture 11 - The GHG Protocol
- Lecture 12 - ISO International Standards
- Lecture 13 - Identification and Determination of Scope 1,2 and 3 GHG Emissions
- Lecture 14 - Identification and Determination of Scope 1,2 and 3 GHG Emissions - Part II
- Lecture 15 - Identification and Determination of Scope 1,2 and 3 GHG Emissions - Part III
- Lecture 16 - India Specific GHG Programs - I
- Lecture 17 - India Specific GHG Programs - II
- Lecture 18 - Accounting Methods and Data Collection
- Lecture 19 - Tools for Calculation of GHG
- Lecture 20 - Understanding the Role of Buildings and Related Emissions
- Lecture 21 - Understanding Emissions of Airports
- Lecture 22 - Understanding Emissions of University Campuses
- Lecture 23 - Understanding Emissions of Fuel Supply Companies
- Lecture 24 - Understanding Emissions of IT Companies
- Lecture 25 - Understanding Emissions of Real Estate Companies
- Lecture 26 - Thermal Comfort in Building
- Lecture 27 - Passive Design Measures
- Lecture 28 - Advanced Passive Design Measures
- Lecture 29 - Natural and Mechanical Ventilation
- Lecture 30 - Daylighting and Lighting Design

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

[Lecture 31 - Factors Affecting Material Selection in Building?](#)

[Lecture 32 - Material Selection for Emission Reduction](#)

[Lecture 33 - Reducing Emission from purchased Electricity](#)

[Lecture 34 - Strategies of Renovation and Retrofitting for Emission Reduction](#)

[Lecture 35 - Case studies of Various Efficient Building Design](#)

[Lecture 36 - Calculation of Emissions Reduction from HVAC System](#)

[Lecture 37 - Calculation of Emission Reduction from Fenestration](#)

[Lecture 38 - Calculation of Emission Reduction from Building Envelope](#)

[Lecture 39 - Calculation of Emission Reduction from Source of Energy](#)

[Lecture 40 - Course Summary](#)

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Lecture 2 - Types of Research

Lecture 3 - Qualitative vs. Quantitative Research

Lecture 4 - Research Methods vs Research Methodology

Lecture 5 - Issues and Challenges in Planning and Architectural Research

Lecture 6 - Research Process - I

Lecture 7 - Research Process - II

Lecture 8 - Research Process - III

Lecture 9 - Research Writing - I

Lecture 10 - Research Writing - II

Lecture 11 - Basics of Literature Review

Lecture 12 - Bibliometric Analysis

Lecture 13 - Systematic Literature Review

Lecture 14 - Meta Analysis

Lecture 15 - Referencing

Lecture 16 - Types of Data in Research

Lecture 17 - Measurement and Scaling Techniques - I

Lecture 18 - Measurement and Scaling Techniques - II

Lecture 19 - Types of Surveys - I

Lecture 20 - Types of Surveys - II

Lecture 21 - Determining the Sample Size

Lecture 22 - Sampling Techniques - I

Lecture 23 - Sampling Techniques - II

Lecture 24 - Sources of Data

Lecture 25 - Preparation of Survey Questionnaire

Lecture 26 - Methods of Data Collection - I

Lecture 27 - Methods of Data Collection - II

Lecture 28 - Methods of Data Collection - III

Lecture 29 - Ethics in Data Management and Use

Lecture 30 - Similarity vs. Plagiarism

Lecture 31 - Processing of Data and Database Management

[Lecture 32 - Interpreting Data](#)

[Lecture 33 - Descriptive Statistics](#)

[Lecture 34 - Representation of Data and Inferences - I](#)

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[Lecture 36 - Hypothesis Testing](#)

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[Lecture 41 - Quantitative Research - Case Study - II](#)

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[Lecture 50 - Qualitative Research - Case Study - V](#)

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[Lecture 53 - Spatial Methods in Planning Research](#)

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[Lecture 59 - Programming Language and Software for Research in Planning and Architecture](#)

[Lecture 60 - Emerging Research Potential in Planning and Architecture](#)

Lecture 1 - Introduction

Lecture 2 - Atmosphere-A brief survey (Pressure, Temperature and Chemical composition)

Lecture 3 - Atmosphere-A brief survey (Continued...) (Vertical structure of the atmosphere)

Lecture 4 - Vertical structure of atmosphere (Continued...) and The Earth system - Oceans

Lecture 5 - The Earth system - Oceans (Continued...) and Marine biosphere

Lecture 6 - The Earth system - Hydrological cycle

Lecture 7 - The Earth system - Hydrological cycle (Continued...) and Carbon cycle

Lecture 8 - The Earth system - Carbon cycle (Continued...), and Carbon in the oceans Earth's crust

Lecture 9 - The Earth system - Carbon in the oceans Earth's crust

Lecture 10 - Atmospheric Thermodynamics- Introduction

Lecture 11 - The hydrostatic equation

Lecture 12 - Hypsometric equation and pressure at sea level

Lecture 13 - Basic Thermodynamics

Lecture 14 - Concept of air parcel and dry adiabatic lapse rate

Lecture 15 - Potential temperature

Lecture 16 - Skew-T In-P chart

Lecture 17 - Problems using Skew-T In-P chart

Lecture 18 - Problems using Skew-T In-P chart (Continued...)

Lecture 19 - Problems using Skew-T In-P chart (Continued...)

Lecture 20 - Lifting Condensation Level (LCL)

Lecture 21 - Lifting Condensation Level (LCL) (Continued...)

Lecture 22 - Saturated Adiabatic and Pseudo-adiabatic processes

Lecture 23 - Equivalent potential temperature and wet bulb potential temperature

Lecture 24 - Föhn's rule - Chinook winds

Lecture 25 - Problems on Chinook wind and static stability

Lecture 26 - Static stability-Brunt-Väisälä frequency

Lecture 27 - Conditional and convective instability

Lecture 28 - Static stability - Problems using radiosonde data and skew T In P chart

Lecture 29 - The second law of thermodynamics – Clausius Clapeyron relation

Lecture 30 - Clausius Clapeyron relation (Continued...)

Lecture 31 - Atmospheric radiation – Radiation laws

[Lecture 32 - Planck's distribution and Inverse square law](#)

[Lecture 33 - Physics of scattering, emission and absorption](#)

[Lecture 34 - Physics of scattering, emission and absorption \(Continued...\)](#)

[Lecture 35 - Radiative Transfer Equation " Derivation](#)

[Lecture 36 - Radiative Transfer Equation \(Continued...\)](#)

[Lecture 37 - Radiative heating profiles of the atmosphere](#)

[Lecture 38 - Climate Dynamics " Introduction](#)

[Lecture 39 - Climate sensitivity and feedback](#)

[Lecture 40 - Climate change](#)

[Lecture 41 - Atmospheric dynamics](#)

Lecture 1 - Introduction

Lecture 2 - Blackbody radiation

Lecture 3 - Properties of real surfaces

Lecture 4 - Spectral and directional variations

Lecture 5 - Shape factor

Lecture 6 - Triangular enclosure

Lecture 7 - Evaluation of shape factors

Lecture 8 - Radiation in enclosures

Lecture 9 - Electrical analogy

Lecture 10 - Applications

Lecture 11 - Non-gray enclosures

Lecture 12 - Enclosure with Specular surfaces

Lecture 13 - Integral method for enclosures

Lecture 14 - Introduction to gas radiation

Lecture 15 - Plane parallel model

Lecture 16 - Diffusion approximation

Lecture 17 - Radiative equilibrium

Lecture 18 - Optically thick limit

Lecture 19 - Radiation spectroscopy

Lecture 20 - Isothermal gas emissivity

Lecture 21 - Band models

Lecture 22 - Total Emissivity method

Lecture 23 - Isothermal gas enclosures

Lecture 24 - Well-stirred furnace model

Lecture 25 - Gas radiation in complex enclosures

Lecture 26 - Interaction between radiation and other modes of heat transfer

Lecture 27 - Radiation heat transfer during flow over flat plate

Lecture 28 - Radiation and Climate

Lecture 29 - Radiative-convective equilibrium

Lecture 30 - Radiative equilibrium with scattering

Lecture 31 - Radiation measurement

[Lecture 32 - Radiation with internal heat source](#)

[Lecture 33 - Particle scattering](#)

[Lecture 34 - Scattering in the atmosphere](#)

[Lecture 35 - Non-isotropic scattering](#)

[Lecture 36 - Approximate methods in scattering : 1](#)

[Lecture 37 - Approximate methods in scattering : 2](#)

[Lecture 38 - Monte Carlo method](#)

NPTEL : The monsoon and its variability (Atmospheric Science)

Co-ordinators : Prof. Sulochana Gadgil

Lecture 1 - Preamble and Introduction to the Indian Monsoon

Lecture 2 - Nature of the variability of the Indian Monsoon

Lecture 3 - Monsoon variability through the eye in the sky, seasonal variation of the surface wind and pressure

Lecture 4 - Background about the atmosphere and rotating systems

Lecture 5 - Rainfall and clouds over the tropics

Lecture 6 - Organization of clouds over mesoscale, synoptic scale and planetary scales

Lecture 7 - The Indian monsoon: is it a gigantic land-sea breeze?

Lecture 8 - Monsoons and the seasonal variation of tropical circulation and rainfall

Lecture 9 - Evolution of the ideas about the basic system responsible for the Indian monsoon - Part 1

Lecture 10 - Evolution of the ideas about the basic system responsible for the Indian monsoon - Part 2

Lecture 11 - Tropical Convergence Zones and the Indian monsoon - Part 1

Lecture 12 - Tropical Convergence Zones and the Indian monsoon - Part 2

Lecture 13 - Variability of organized convection over the tropical oceans

Lecture 14 - Heat lows and the TCZ

Lecture 15 - Monsoonal regions of the world

Lecture 16 - Seasonal transitions - Part 1 : spring to summer transition

Lecture 17 - Seasonal transitions - Part 2 : spring to summer transition

Lecture 18 - Seasonal transitions - Part 3 : Advance and retreat of the summer monsoon

Lecture 19 - Climatic clusters of the Indian region

Lecture 20 - Active-weak spells and breaks in the monsoon - Part 1

Lecture 21 - Active-weak spells and breaks in the monsoon - Part 2

Lecture 22 - Intraseasonal variation and intraseasonal oscillations

Lecture 23 - The tropical oceans

Lecture 24 - El Nino Southern Oscillation (ENSO) - Part 1

Lecture 25 - El Nino Southern Oscillation (ENSO) - Part 2

Lecture 26 - El Nino Southern Oscillation (ENSO) - Part 3

Lecture 27 - El Nino Southern Oscillation (ENSO) - Part 4

Lecture 28 - El Nino Southern Oscillation (ENSO) - Part 5

Lecture 29 - El Nino Southern Oscillation (ENSO) - Part 6

Lecture 30 - Indian Ocean and the monsoon - Part 1

Lecture 31 - Indian Ocean and the monsoon - Part 2

[Lecture 32 - Indian Ocean Dipole - Part 1](#)

[Lecture 33 - Indian Ocean Dipole - Part 2](#)

[Lecture 34 - Interannual variation of the Indian summer Monsoon rainfall: Links to events over the Pacific and Equatorial Indian Ocean](#)

[Lecture 35 - Monsoon Variability and Agriculture - Part 1](#)

[Lecture 36 - Monsoon Variability and Agriculture - Part 2](#)

[Lecture 37 - Monsoon Variability and Agriculture - Part 3](#)

[Lecture 38 - Monsoon Variability and Agriculture - Part 4](#)

[Lecture 39 - Indian Summer Monsoon, GDP and Agriculture](#)

[Lecture 40 - Monsoon Prediction - Part 1](#)

[Lecture 41 - Monsoon Prediction - Part 2](#)

[Lecture 42 - Concluding Remarks](#)

Lecture 1 - Preliminary Concepts

Lecture 2 - Vector Analysis

Lecture 3 - Analysis of Forces

Lecture 4 - Analysis of Equilibrium

Lecture 5 - Structural Mechanics - Part-1

Lecture 6 - Structural Mechanics - Part-2

Lecture 7 - Friction and its Applications - Part-1

Lecture 8 - Friction and its Applications - Part-2

Lecture 9 - Friction and its Applications - Part-3

Lecture 10 - Properties of Surfaces - Part-1

Lecture 11 - Properties of Surfaces - Part-2

Lecture 12 - Properties of Surfaces - Part-3

Lecture 13 - Moments and Products of Inertia

Lecture 14 - Methods of Virtual Work and Potential Energy - Part-1

Lecture 15 - Methods of Virtual Work and Potential Energy - Part-2

Lecture 16 - Stability of Equilibrium

Lecture 1 - Introduction

Lecture 2 - Motivation

Lecture 3 - Management

Lecture 4 - Work Ethics

Lecture 5 - Comparison Between Theories

Lecture 6 - Job Enrichment

Lecture 7 - Team Building and Participation

Lecture 8 - Other Leadership Styles

Lecture 9 - Empowerment

Lecture 10 - Barriers to Communication

Lecture 11 - Issues in Leadership

Lecture 12 - Participation Management and Team Working Part - 1

Lecture 13 - Participation Management and Team Working Part - 2

Lecture 14 - Participation Management and Team Working Part - 3

Lecture 15 - Participative Management and Team Working Part - 5

Lecture 16 - Organizations

Lecture 17 - Some Management Concepts - Part - 1

Lecture 18 - Some Management Concepts - Part - 2

Lecture 19 - Some Management Concepts - Part - 3

Lecture 20 - Diversity at Work Place and Management Issues

Lecture 21 - Industrial Relations and Conflict Management - Part - 1

Lecture 22 - Industrial Relations and Conflict Management - Part - 2

Lecture 23 - Selection and Training of Employees

Lecture 24 - Performance Management - Part - 1

Lecture 25 - Performance Management - Part - 2

Lecture 26 - Performance Management - Part - 3

Lecture 27 - Management Research: Some Methodological Issues-Part-2

Lecture 28 - Corporate Social Responsibilities

Lecture 29 - Women, Work and Organizations: Management Perspective - Part - 1

Lecture 30 - Women, Work and Organizations: Management Perspective - Part - 2

Lecture 31 - Selection, Recruitment and Training

[Lecture 32 - Management of Change in Organization](#)

[Lecture 33 - Organizational Development](#)

[Lecture 34 - Values, Ethics and Corporate Social Responsibilities - Part - 1](#)

[Lecture 35 - Values, Ethics and Corporate Social Responsibilities - Part - 2](#)

[Lecture 36 - Management: Now and Beyond - Part - 1](#)

[Lecture 37 - Management: Now and Beyond - Part - 2](#)

[Lecture 38 - Management: Now and Beyond - Part - 3](#)

[Lecture 39 - Conclusions](#)

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Lecture 2 - Internal Energy Enthalpy

Lecture 3 - Crystal Geometry

Lecture 4 - Crystal Geometry

Lecture 5 - Crystal Geometry

Lecture 6 - Crystal Structure

Lecture 7 - Close Packing of Spheres of Equal Size

Lecture 8 - Structure of Solid Materials

Lecture 9 - Non Crystalline Solids

Lecture 10 - Polymers (Continued)

Lecture 11 - Crystal Imperfections

Lecture 12 - Crystal Imperfections

Lecture 13 - Crystal Imperfections

Lecture 14 - Crystal Imperfections

Lecture 15 - Crystal Imperfections

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Lecture 17 - Phase Diagrams

Lecture 18 - Phase Diagrams

Lecture 19 - Diffusion in Solids

Lecture 20 - Diffusion in Solids

Lecture 21 - Phase Transformations

Lecture 22 - Phase Transformations

Lecture 23 - Phase Transformations

Lecture 24 - Transformations in Steels: Eutectoid Steel

Lecture 25 - Phase Transformations; Precipitation Hardening

Lecture 26 - Mechanical Behaviour of Materials

Lecture 27 - Plastic Deformation

Lecture 28 - Plastic Deformation

Lecture 29 - Plastic Deformation

Lecture 30 - Strengthening Mechanisms Creep

Lecture 31 - Fracture

[Lecture 32 - Conductors and Resistors](#)

[Lecture 33 - Conductors and Resistors](#)

[Lecture 34 - Superconductors](#)

[Lecture 35 - Superconductors](#)

[Lecture 36 - Semiconductors](#)

- Lecture 1 - Errors in Computation and Numerical Instability
- Lecture 2 - Solution of Nonlinear Algebraic Equations - Part 1
- Lecture 3 - Solution of Nonlinear Algebraic Equations - Part 2
- Lecture 4 - Solution of Nonlinear Algebraic Equations - Part 3
- Lecture 5 - Solution of Nonlinear Algebraic Equations - Part 4
- Lecture 6 - Solution of Nonlinear Algebraic Equations - Part 5
- Lecture 7 - Solution of Nonlinear Algebraic Equations - Part 6
- Lecture 8 - Solution of Nonlinear Algebraic Equations - Part 7
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- Lecture 10 - Solution of Nonlinear Algebraic Equations - Part 9
- Lecture 11 - Solution of a System of Linear Algebraic Equations - Part 1
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- Lecture 13 - Solution of a System of Linear Algebraic Equations - Part 3
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- Lecture 20 - Solution of a System of Linear Algebraic Equations - Part 10
- Lecture 21 - Solution of a System of Linear Algebraic Equations - Part 11
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- Lecture 23 - Solution of a System of Linear Algebraic Equations - Part 13
- Lecture 24 - Solution of a System of Linear Algebraic Equations - Part 14
- Lecture 25 - Interpolation and Approximation - Part 1
- Lecture 26 - Interpolation and Approximation - Part 2
- Lecture 27 - Interpolation and Approximation - Part 3
- Lecture 28 - Interpolation and Approximation - Part 4
- Lecture 29 - Interpolation and Approximation - Part 5
- Lecture 30 - Interpolation and Approximation - Part 6
- Lecture 31 - Interpolation and Approximation - Part 7

[Lecture 32 - Interpolation and Approximation - Part 8](#)

[Lecture 33 - Interpolation and Approximation - Part 9](#)

[Lecture 34 - Numerical Differentiation and Integration - Part 1](#)

[Lecture 35 - Numerical Differentiation and Integration - Part 2](#)

[Lecture 36 - Numerical Differentiation and Integration - Part 3](#)

[Lecture 37 - Numerical Differentiation and Integration - Part 4](#)

[Lecture 38 - Numerical Differentiation and Integration - Part 5](#)

[Lecture 39 - Numerical Differentiation and Integration - Part 6](#)

[Lecture 40 - Numerical Differentiation and Integration - Part 7](#)

[Lecture 41 - Numerical Differentiation and Integration - Part 8](#)

Lecture 1 - Engineering Mechanics

Lecture 2 - Equilibrium - I

Lecture 3 - Equilibrium - II

Lecture 4 - Equilibrium - III

Lecture 5 - Plan Trusses - I

Lecture 6 - Plan Trusses - II

Lecture 7 - Friction

Lecture 8 - Properties of Surfaces - I

Lecture 9 - Properties of Surfaces - II

Lecture 10 - Properties of Surfaces - III

Lecture 11 - Method of Virtual Work

Lecture 12 - Motion of Particles Planar Polar Coordinates

Lecture 13 - Motion With Constraints

Lecture 14 - Motion of Particle With Friction

Lecture 15 - Motion of Particles With Drag

Lecture 16 - Momentum

Lecture 17 - Work and Energy - I

Lecture 18 - Work and Energy - II

Lecture 19 - Work and Energy - III

Lecture 20 - Work and Energy - IV

Lecture 21 - Rotational Motion - I

Lecture 22 - Rotational Motion - II

Lecture 23 - Rotational Motion - III

Lecture 24 - Rotational Motion - IV

Lecture 25 - Rotational Motion - V

Lecture 26 - Rotational Motion - VI

Lecture 27 - Simple Harmonic Motion - I

Lecture 28 - Simple Harmonic Motion - II

Lecture 29 - Simple Harmonic Motion - III

Lecture 30 - Motion in Uniformly Accelerating Frames

Lecture 31 - Motion In Rotating Frame

[Module - 1 lecture - 1](#)

[Module - 1 lecture - 2](#)

[Module - 1 lecture - 3](#)

[Module - 1 lecture - 4](#)

[Module - 2 lecture - 1](#)

[Module - 2 lecture - 2](#)

[Module - 2 lecture - 3](#)

[Module - 2 lecture - 4](#)

[Module - 2 lecture - 5](#)

[Module - 3 lecture - 1](#)

[Module - 3 lecture - 2](#)

[Module - 3 lecture - 3](#)

[Module - 3 lecture - 4](#)

[Module - 3 lecture - 5 \(Lecture Missing\)](#)

[Module - 3 lecture - 6](#)

[Module - 3 lecture - 7](#)

[Module - 3 lecture - 8](#)

[Module - 4 lecture - 1](#)

[Module - 4 lecture - 2](#)

[Module - 4 lecture - 3](#)

[Module - 4 lecture - 4](#)

[Module - 4 lecture - 5](#)

[Module - 4 lecture - 6](#)

[Module - 4 lecture - 7](#)

[Module - 4 lecture - 8](#)

[Module - 4 lecture - 9](#)

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[Module - 4 lecture - 12](#)

Lecture 1 - Real Number

Lecture 2 - Sequences I

Lecture 3 - Sequences II

Lecture 4 - Sequences III

Lecture 5 - Continuous Function

Lecture 6 - Properties of Continuous Function

Lecture 7 - Uniform Continuity

Lecture 8 - Differentiable Functions

Lecture 9 - Mean Value Theorem

Lecture 10 - Maxima - Minima

Lecture 11 - Taylor's Theorem

Lecture 12 - Curve Sketching

Lecture 13 - Infinite Series I

Lecture 14 - Infinite Series II

Lecture 15 - Tests of Convergence

Lecture 16 - Power Series

Lecture 17 - Riemann Integral

Lecture 18 - Riemann Integrable Functions

Lecture 19 - Applications of Riemann Integral

Lecture 20 - Length of a curve

Lecture 21 - Line Integrals

Lecture 22 - Functions of Several Variables

Lecture 23 - Differentiation

Lecture 24 - Derivatives

Lecture 25 - Mean Value Theorem

Lecture 26 - Maxima Minima

Lecture 27 - Method of Lagrange Multipliers

Lecture 28 - Multiple Integrals

Lecture 29 - Surface Integrals

Lecture 30 - Green's Theorem

Lecture 31 - Stokes Theorem

Lecture 32 - Gauss Divergence Theorem

Lecture 1 - Nature and Scope of HRM

Lecture 2 - Analysing and Designing Job - I

Lecture 3 - Analysing and Designing Job - II

Lecture 4 - Human Resource Planning - I

Lecture 5 - Human Resource Planning - II

Lecture 6 - Recruitment and Selection

Lecture 7 - Performance Evaluation and Appraisal - I

Lecture 8 - Performance Evaluation and Appraisal (Continued...)

Lecture 9 - Training and Development

Lecture 10 - Employee Welfare

Lecture 11 - Safety, Health, Environment

Lecture 12 - Industrial Relations

Lecture 13 - Total Quality Management

Lecture 14 - Organization Culture

Lecture 15 - Change Management - Part - I

Lecture 16 - Change Management - Part - II

Lecture 17 - Wage and Salary Administration

Lecture 18 - Career Planning - Part - I

Lecture 19 - Career Planning - Part - II

Lecture 20 - Contemporary Issues in HRM - I

Lecture 21 - Contemporary Issues in HRM - II

Lecture 22 - Contemporary Issues in HRM - III

Lecture 1 - Introduction to Leadership: Functions

Lecture 2 - Leadership Roles: Leaders Vs Managers: Theories

Lecture 3 - Leadership Styles: Effective Vs Successful Managers

Lecture 4 - Leadership Behaviour: Emergence: Leadership and Trust

Lecture 5 - Leadership Styles: Adaptation-Studies/Case: From Sindhi to Siddhi (Part-I)

Lecture 6 - Case: From Sindhi to Siddhi (Part-II) Transformation Leadership

Lecture 7 - Leadership Skills: Leadership and Management

Lecture 8 - Competencies and Skills of Leaders: Issues in Organizational Leadership

Lecture 9 - Case: The DVC Story-A First Person Account - Leadership in Action (Part-I)

Lecture 10 - Case: The DVC Story-A First Person Account- Leadership in Action (Part-II)

Lecture 11 - Case: Rai Bahadur Mohan Singh Oberoi (Part-I) Issues in Institution Building

Lecture 12 - Case: Rai Bahadur Mohan Singh Oberoi (Part-II)

Lecture 13 - Case: Self Regulation-The Key to Institution Building - Framework of Institution Building

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Introduction - III

Lecture 4 - Concept of Information - I

Lecture 5 - Concept of Information - II

Lecture 6 - Decision Making Process

Lecture 7 - Impact of IS on Management - I

Lecture 8 - Impact of IS on Management - II

Lecture 9 - Hardware Software Overview - I

Lecture 10 - Hardware Software Overview - II

Lecture 11 - Knowledge Management

Lecture 12 - Learning Organization

Lecture 13 - Decision Analysis - I

Lecture 14 - Decision Analysis - II

Lecture 15 - Decision Analysis - III

Lecture 16 - Data Flow Diagrams - I

Lecture 17 - Data Flow Diagrams - II

Lecture 18 - Data Flow Diagrams - III

Lecture 19 - Data Flow Diagrams - IV

Lecture 20 - System Design - I

Lecture 21 - System Design - II

Lecture 22 - DBMS - I

Lecture 23 - DBMS - II

Lecture 24 - DBMS - III

Lecture 25 - DBMS - IV

Lecture 26 - DBMS - V

Lecture 27 - OOAD - I

Lecture 28 - OOAD - II

Lecture 29 - OOAD - III

Lecture 1 - Simple Harmonic Oscillators

Lecture 2 - Damped Oscillator - I

Lecture 3 - Damped Oscillator - II

Lecture 4 - Oscillator With External Forcing - I

Lecture 5 - Oscillator With External Forcing

Lecture 6 - Resonance

Lecture 7 - Coupled Oscillations

Lecture 8 - Sinusoidal Plane Waves - I

Lecture 9 - Electromagnetic waves - I

Lecture 10 - Electromagnetic Waves - II

Lecture 11 - The Vector Nature of Electromagnetic Waves

Lecture 12 - The Electromagnetic Spectrum

Lecture 13 - The Electromagnetic Spectrum - II

Lecture 14 - Interference - I

Lecture 15 - Interference - II

Lecture 16 - Interference - III

Lecture 17 - Interference - IV

Lecture 18 - Coherence

Lecture 19 - Coherence

Lecture 20 - Diffraction - I

Lecture 21 - Diffraction - II

Lecture 22 - Diffraction - III

Lecture 23 - Diffraction - IV

Lecture 24 - X-Ray Diffraction

Lecture 25 - Beats

Lecture 26 - The Wave Equation

Lecture 27 - Solving the Wave Equation

Lecture 28 - Waves

Lecture 29 - Standing Waves

Lecture 30 - Standing Waves

Lecture 31 - Polarization

[Lecture 32 - Compton Effect](#)

[Lecture 33 - Wave - Particle Duality](#)

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[Lecture 38 - Measurements](#)

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[Lecture 40 - Potential Well](#)

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[Lecture 43 - Quantum Tunneling](#)

[Lecture 44 - Quantum Tunneling](#)

Lecture 1 - Strategy: Philosophy;Competition;Competitive Advantage - Part - I

Lecture 2 - Strategy: Philosophy;Competition;Competitive Advantage - Part - II

Lecture 3 - Case Study - Group Presentation on Case - I (Baddi's Solvent)

Lecture 4 - Case Study - Group Presentation on Case - II

Lecture 5 - Case Study - Group Presentation on Case - III

Lecture 6 - Case Study - Group Presentation on Case - IV Form

Lecture 7 - Strategy: Implementation in Organizations

Lecture 8 - Strategy: Design: Process: Managing Strategic Change

Lecture 9 - Case Study: The House of Tata

Lecture 10 - Case Study: The House of Tata

Lecture 11 - Group Presentation - II

Lecture 1 - Introduction to Basic Electronics

Lecture 2 - Electronic Devices 1

Lecture 3 - Electronics Devices II Resistor in series and parallel

Lecture 4 - Some Useful Laws in Basic Electronics

Lecture 5 - Some Useful Theorems in Basic Electronics

Lecture 6 - Semi Conductor Diodes

Lecture 7 - Applications of Diodes

Lecture 8 - Wave Shaping using Diodes

Lecture 9 - Zener Diode Characteristics

Lecture 10 - Transistors

Lecture 11 - Transistor Biasing - Common Emitter Circuits, Fixed Bias, Collector to base Bias

Lecture 12 - Transistor Biasing - Emitter Current Bias, Thermal Stability (RC Coupled Amplifier)

Lecture 13 - Basic Characteristic of an Amplifier - Simple Transistor model, Common emitter Amplifier

Lecture 14 - Hybrid Equivalent Circuit, H-Parameters

Lecture 15 - Circuit Analysis using H-Parameters

Lecture 16 - Frequency Response of Amplifiers

Lecture 17 - Frequency Analysis

Lecture 18 - Power Amplifiers

Lecture 19 - Differential Amplifiers Circuit

Lecture 20 - Integrated Chip

Lecture 21 - Typical Characteristic of Operation Amplifier

Lecture 22 - Four Types of Feed Back

Lecture 23 - Four Types of Feed Back

Lecture 24 - Mathematical Operations

Lecture 25 - Mathematical Operations

Lecture 26 - Mathematical Operations

Lecture 27 - Characteristics of Operation Amplifier

Lecture 28 - Characteristics of Operation Amplifier

Lecture 29 - Characteristics of Operation Amplifier

Lecture 30 - Inverter/Non-Inverter Circuits

Lecture 31 - Applications of Op Amps

[Lecture 32 - Non-Linear Op Amp circuits](#)

[Lecture 33 - Applications of Op Amps](#)

[Lecture 34 - Active Diode Circuits](#)

[Lecture 35 - Oscillators](#)

[Lecture 36 - Logarithmic and Anti-Logarithmic Amplifier](#)

[Lecture 37 - Filters](#)

[Lecture 38 - Unit Junction Transistor](#)

[Lecture 39 - Silicon Controlled Rectifier](#)

[Lecture 40 - Field Effect Transistor](#)

- Lecture 1 - Introduction
- Lecture 2 - Newtonian mechanics
- Lecture 3 - Dynamics in phase space
- Lecture 4 - Linear dynamical systems
- Lecture 5 - Autonomous dynamical systems (Part 1)
- Lecture 6 - Autonomous dynamical systems (Part 2)
- Lecture 7 - Lagrangian formalism
- Lecture 8 - Summary of classical electromagnetism
- Lecture 9 - Charged particle in an electromagnetic field
- Lecture 10 - Hamiltonian dynamics (Part 1)
- Lecture 11 - Hamiltonian dynamics (Part 2)
- Lecture 12 - Hamiltonian dynamics (Part 3)
- Lecture 13 - Dynamical symmetry (Part 1)
- Lecture 14 - Dynamical symmetry (Part 2)
- Lecture 15 - Randomness in phase space; chaos
- Lecture 16 - Discrete-time dynamics: maps (Part 1)
- Lecture 17 - Discrete-time dynamics: maps (Part 2)
- Lecture 18 - Problems and solutions (Part 1)
- Lecture 19 - Problems and solutions (Part 2)
- Lecture 20 - Classical statistical mechanics: Introduction
- Lecture 21 - Some probability distributions; isolated system
- Lecture 22 - The microcanonical ensemble
- Lecture 23 - Thermodynamics
- Lecture 24 - The canonical ensemble
- Lecture 25 - Connection between statistical mechanics and thermodynamics
- Lecture 26 - Probability distributions
- Lecture 27 - Probability distributions (concl.). Phase transitions (Part 1)
- Lecture 28 - Phase transitions (Part 2)
- Lecture 29 - Phase transitions (Part 3)
- Lecture 30 - Phase transitions (Part 4); misc. topics
- Lecture 31 - Problems and solutions (Part 3)

[Lecture 32 - Continuous groups in physics \(Part 1\)](#)

[Lecture 33 - Continuous groups in physics \(Part 2\)](#)

[Lecture 34 - Continuous groups in physics \(Part 3\)](#)

[Lecture 35 - Noether's Theorem. Special Relativity \(Part 1\)](#)

[Lecture 36 - Special Relativity \(Part 2\)](#)

[Lecture 37 - Special Relativity \(Part 3\)](#)

[Lecture 38 - Special Relativity \(Part 4\)](#)

Lecture 1 - Introduction to Chemistry & Quantum Chemical Mechanics

Lecture 2 - Particle in a box (one and two dimensions)

Lecture 3 - Particle in a box (One and Two Dimensions) Continued

Lecture 4 - Harmonic Oscillator and Molecular Vibration

Lecture 5 - Harmonic Oscillator (Continued)

Lecture 6 - Hydrogen Atom - Radial Solution

Lecture 7 - Hydrogen Atom Part III Angular Solutions

Lecture 8 - Hydrogen Atom - Angular Solutions (Continued)

Lecture 9 - Hydrogen Atom - Angular Solutions (Continued)

Lecture 10 - Oppenheimer Approximation and Superposition

Lecture 1 - Programing Basics

Lecture 2 - Introduction to Pointers

Lecture 3 - Pointers And Arrays

Lecture 4 - External Functions and Argument Passing

Lecture 5 - Representation of Numbers

Lecture 6 - Numerical Error

Lecture 7 - Error Propagation and Stability

Lecture 8 - Polynomial Interpolation-1

Lecture 9 - Polynomial Interpolation-2

Lecture 10 - Error In Interpolation Polynomial

Lecture 11 - Polynomial Interpolation

Lecture 12 - Cubic Spline Interpolation

Lecture 13 - Data Fitting : Linear Fit

Lecture 14 - Data Fitting : Linear Fit

Lecture 15 - Data Fitting : Non Linear Fit

Lecture 16 - Matrix Elimination and Solution

Lecture 17 - Solution To Linear Equations

Lecture 18 - Matrix Elimination

Lecture 19 - Eigen Values of A Matrix

Lecture 20 - Eigen Values And Eigen Vectors

Lecture 21 - Solving NonLinear Equations

Lecture 22 - Solving NonLinear Equations Newton Raphson Method

Lecture 23 - Methods For Solving NonLinear Equations

Lecture 24 - System of NonLinear Equations

Lecture 25 - Numerical Derivations

Lecture 26 - High order Derivatives From Difference Formula

Lecture 27 - Numerical Integration - Basic Rules

Lecture 28 - Comparison of Different Basic Rules

Lecture 29 - Gaussian Rules

Lecture 30 - Comparison of Gaussian Rules

Lecture 31 - Solving Ordinary Differential Equations

[Lecture 32 - Solving ordinary differential equations](#)

[Lecture 33 - Adaptive step size Runge Kutta scheme](#)

[Lecture 34 - Partial Differential Equations](#)

[Lecture 35 - Explicit and Implicit Methods](#)

[Lecture 36 - The Crank - Nicholson Scheme For Two Spatial](#)

[Lecture 37 - Fourier Transforms](#)

[Lecture 38 - Fast Fourier Transforms](#)

Lecture 1 - Introduction to Quantum Physics;Heisenberg's uncertainty principle

Lecture 2 - Introduction to linear vector spaces

Lecture 3 - Characteristics of linear vector spaces

Lecture 4 - Functions in a linear vector space

Lecture 5 - Linear operations in a linear vector space and their eigenvalues

Lecture 6 - Classical Vs Quantum Mechanics

Lecture 7 - Quantum Physics

Lecture 8 - Quantum Physics

Lecture 9 - Quantum Physics

Lecture 10 - Quantum Physics

Lecture 11 - Quantum Physics

Lecture 12 - Quantum Physics

Lecture 13 - Quantum Physics

Lecture 14 - Quantum Physics

Lecture 15 - Quantum Physics

Lecture 16 - Quantum Physics

Lecture 17 - Quantum Physics

Lecture 18 - Quantum Physics

Lecture 19 - Quantum Physics

Lecture 20 - Quantum Physics

Lecture 21 - Quantum Physics

Lecture 22 - Quantum Physics

Lecture 23 - Quantum Physics

Lecture 24 - Quantum Physics

Lecture 25 - Quantum Physics

Lecture 26 - Quantum Physics

Lecture 27 - Quantum Physics

Lecture 28 - Quantum Physics

Lecture 29 - Quantum Physics

Lecture 30 - Quantum Physics

Lecture 31 - Quantum Physics

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Engineering Physics I (Basic Courses (Semester 1 and 2))

Co-ordinators : Prof. Rajdeep Chatterjee, Prof. B.K. Patra, Prof. M.K. Srivastava, Prof. G.D. Verma

Lecture 1 - Introduction

Lecture 2 - Malus law & Superposition of ways

Lecture 3 - Double Refraction

Lecture 4 - Interference of polarized light

Lecture 5 - Optical Activity

Lecture 6 - Introduction

Lecture 7 - Stationary Waves & Reflection, Refraction and Diffraction

Lecture 8 - Ultrasonics

Lecture 9 - Acoustics of Buildings - Part I

Lecture 10 - Acoustics of Buildings - Part II

Lecture 11 - Interference of light Part-1

Lecture 12 - Interference of light Part-2

Lecture 13 - Interference of light Part-3

Lecture 14 - Interference by Division of Wave front

Lecture 15 - Interference by Division of Amplitude

Lecture 16 - Coherence and Application of Interference

Lecture 17 - Diffraction Part-1

Lecture 18 - Diffraction Part-2

Lecture 19 - Diffraction Part-3

Lecture 20 - Diffraction by a circular aperture

Lecture 21 - Kinetic theory of gases - Part-1

Lecture 22 - Kinetic theory of gases - Part-2

Lecture 23 - Maxwellian distribution law of velocity - Part-1

Lecture 24 - Maxwellian distribution law of velocity - Part-2

Lecture 25 - Maxwellian distribution law of velocity - Part-3

Lecture 26 - Vanderwaal's equation of states - Part-1

Lecture 27 - Vanderwaal's equation of states - Part-2

Lecture 28 - Vanderwaal's equation of states - Part-3

Lecture 29 - Fluid Mechanics - Part-1

Lecture 30 - Fluid Mechanics - Part-2

Lecture 31 - Introduction of special relativity

[Lecture 32 - Consequences of special relativity-1](#)

[Lecture 33 - Consequences of special relativity-2](#)

[Lecture 34 - Consequences of special relativity-3](#)

[Lecture 35 - Consequences of special relativity-4](#)

[Lecture 36 - Consequences of special relativity-5](#)

[Lecture 37 - Introduction](#)

[Lecture 38 - Image formation by lenses](#)

[Lecture 39 - Lens aberrations - Part I](#)

[Lecture 40 - Lens aberrations - Part II](#)

Lecture 1 - Complex Integration

Lecture 2 - Contour Integration

Lecture 3 - Cauchy's Integral Theorem

Lecture 4 - Cauchy's Integral Formula

Lecture 5 - Application of Cauchy Integral Formula

Lecture 6 - Zeros, Singularities and Poles

Lecture 7 - Residue Integration Method

Lecture 8 - Residue Theorem

Lecture 9 - Evaluation of Real Integrals

Lecture 10 - Evaluation of Real Improper Integrals-1

Lecture 11 - Evaluation of Real Improper Integrals-2

Lecture 12 - Evaluation of Real Improper Integrals-3

Lecture 13 - Evaluation of Real Improper Integrals-4

Lecture 14 - Evaluation of Real Integrals - Revision

Lecture 15 - Matrix Algebra Part - 1

Lecture 16 - Matrix Algebra Part - 2

Lecture 17 - Determinants Part - 1

Lecture 18 - Determinants Part - 2

Lecture 19 - Solution of System Equation

Lecture 20 - Linear Algebra Part - 1

Lecture 21 - Linear Algebra part - 2

Lecture 22 - Linear Algebra Part - 3

Lecture 23 - Linear Algebra Part - 4

Lecture 24 - Inner Product

Lecture 25 - Linear Transformation Part - 1

Lecture 26 - Linear Transformation Part - 2

Lecture 27 - Eigenvalues Eigenvectors Part - 1

Lecture 28 - Eigenvalues Eigenvectors Part - 2

Lecture 29 - Quadratic Forms

Lecture 30 - Diagonalization Part - 1

Lecture 31 - Diagonalization Part - 2

[Lecture 32 - Solution of System of Linear Equation](#)

[Lecture 33 - Functions of Complex Variables Part - 1](#)

[Lecture 34 - Functions of Complex Variables Part - 2](#)

[Lecture 35 - Taylor Series](#)

[Lecture 36 - Laurent Series](#)

[Lecture 37 - Rank of a Matrix](#)

[Lecture 38 - Complex Numbers Their Geometrical Representation](#)

Lecture 1 - Solution of ODE of First Order and First Degree

Lecture 2 - Linear Differential Equations of the First Order

Lecture 3 - Approximate Solution of An Initial Value

Lecture 4 - Series Solution of Homogeneous Linear I

Lecture 5 - Series Solution of Homogeneous Linear II

Lecture 6 - Bessel Functions and Their Properties

Lecture 7 - Bessel Functions And Their Properties (Continued..)

Lecture 8 - Laplace Transformation

Lecture 9 - Laplace Transformation (Continued..)

Lecture 10 - Applications Of Laplace Transformation

Lecture 11 - Applications Of Laplace Transformation (Continued..)

Lecture 12 - One Dimensional Wave Equation

Lecture 13 - One Dimensional Heat Equation

Lecture 14 - Introduction to Differential Equation

Lecture 15 - First Order Differential Equations and Their Geometric Interpretation

Lecture 16 - Differential Equations of First Order Higher Degree

Lecture 17 - Linear Differential Equation of Second Order-Part - 1

Lecture 18 - Linear Differential equation of Second Order-Part - 2

Lecture 19 - Euler-Cauchy Theorem

Lecture 20 - Higher Order Linear Differential Equations

Lecture 21 - Higher Order Non homogeneous Linear Equations

Lecture 22 - Boundary Value Problems

Lecture 23 - Sturm Liouville boundary Value Problem

Lecture 24 - Fourier Series-Part - 1

Lecture 25 - Fourier Series-Part - 2

Lecture 26 - Convergence of the Fourier Series

Lecture 27 - Fourier Integrals

Lecture 28 - Fourier Transforms

Lecture 29 - Partial Differential Equation

Lecture 30 - First Order Partial Differential Equation

Lecture 31 - Second Order Partial Differential Equations - I

[Lecture 32 - Second Order Partial Differential Equations - II](#)

[Lecture 33 - Solution of One Dimensional Wave Equation](#)

[Lecture 34 - Solution of Homogeneous Non Homogeneous Equations](#)

[Lecture 35 - Fourier Integral Transform Method for Heat Equation](#)

[Lecture 36 - Three Dimensional Laplace Equation](#)

[Lecture 37 - Solution of Dirichlet Problem](#)

[Lecture 38 - Numerical Method for Laplace Poisson equation](#)

[Lecture 39 - ADI Method for Laplace and Poisson Equation](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Concept of Management and Evolution of Management Thought (Basic Courses (Semester 1 and 2))

Co-ordinators : Prof. K.B. Akhilesh

Lecture 1 - Introduction - Concept of Management

Lecture 2 - Lecture 2

Lecture 3 - Management By Objectives

Lecture 4 - Organizing & Organization

Lecture 5 - Organizing - II

Lecture 6 - Coordinating

Lecture 7 - Communication - I

Lecture 8 - Communication - II

Lecture 9 - Leadership

Lecture 10 - Controlling

Lecture 11 - Motivation and Organization Culture

Lecture 12 - Japanese Management

Lecture 13 - Comparison of Japanese and American Management

Lecture 14 - Managerial Functions in International Business

Lecture 15 - Marketing Functions: Channels of Distribution

Lecture 16 - Management and Society

Lecture 17 - Social Responsibility and Ethics - II

Lecture 18 - Functions of Personnel Management

Lecture 19 - Manpower Planning

Lecture 20 - Selection - I

Lecture 21 - Selection - II

Lecture 22 - Performance Appraisal - I

Lecture 23 - Performance Appraisal - II

Lecture 24 - Training and Development - I

Lecture 25 - Training and Development - II

Lecture 26 - Job Design and Payment Systems - I

Lecture 27 - Job Design and Compensation Systems

Lecture 28 - Organizational Development - I

Lecture 29 - Organizational Development - II

Lecture 30 - Organization Theory - I

Lecture 31 - Organization Theory - II

[Lecture 32 - Group Dynamics - I](#)

[Lecture 33 - Group Dynamics - II](#)

[Lecture 34 - Group Dynamics - III](#)

[Lecture 35 - Conflict Management - I](#)

[Lecture 36 - Conflict Management - II](#)

[Lecture 37 - Managing Creativity and Innovation](#)

[Lecture 38 - Creativity and Managing Innovation Process - II](#)

[Lecture 39 - Stress Management - I](#)

[Lecture 40 - Stress Management - II](#)

Lecture 1 - Introduction

Lecture 2 - Graphs and functions - I

Lecture 3 - Graphs and functions - II

Lecture 4 - Functions and derivatives

Lecture 5 - Calculation of derivatives

Lecture 6 - Differentiation and its application in Biology - I

Lecture 7 - Differentiation and its application in Biology - II

Lecture 8 - Differentiation and its application in Biology - III

Lecture 9 - Differentiation and its application in Biology - IV

Lecture 10 - Integration - I

Lecture 11 - Integration - II

Lecture 12 - Differential equations - I

Lecture 13 - Differential equations - II

Lecture 14 - Vectors - I

Lecture 15 - Vectors - II

Lecture 16 - Vectors - III

Lecture 17 - Nernst equation

Lecture 18 - Diffusion - I : Diffusion equation

Lecture 19 - Diffusion - II : Mean-square displacement

Lecture 20 - Diffusion - III : Einstein's relation

Lecture 21 - Statistics : Mean and variance

Lecture 22 - Statistics : Distribution function

Lecture 23 - Understanding Normal distribution

Lecture 24 - Fitting a function to experimental data

Lecture 25 - Size of a flexible protein: Simplest model

Lecture 26 - Uniform and Poisson distributions; Knudsen's analysis

Lecture 27 - Fourier Series - I

Lecture 28 - Fourier Series - II

Lecture 29 - Fourier transform

Lecture 30 - Master equation: Polymerization dynamics, Molecular motor motion

Lecture 31 - Evolution: Simplest model

[Lecture 32 - Tutorial - I](#)

[Lecture 33 - Tutorial - II](#)

[Lecture 34 - Temperature, Energy and Entropy](#)

[Lecture 35 - Partition function, Free energy](#)

[Lecture 36 - Bending fluctuations of DNA and spring-like proteins](#)

[Lecture 37 - Force-extension and looping of DNA](#)

[Lecture 38 - Thermodynamics of protein organization along DNA](#)

[Lecture 39 - Learning mathematics with the help of a computer](#)

NPTEL : Proteomics: Principles and Techniques (Biotechnology)

Co-ordinators : Prof. Sanjeeva Srivastava

[Lecture 1](#)

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[Lecture 4](#)

[Lecture 5](#)

[Lecture 6](#)

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[Lecture 40](#)

Lecture 0 - Proteins and Gel-Based Proteomics; Course Introduction

Lecture 1 - Introduction to amino acids

Lecture 2 - Introduction to proteins

Lecture 3 - Protein folding & misfolding

Lecture 4 - Protein purification techniques

Lecture 5 - Introduction to proteomics

Lecture 6 - Systems biology and proteomics

Lecture 7 - Sample preparation and pre-analytical factors

Lecture 8 - Sample preparation: Pre-analytical factors (Continued...)

Lecture 9 - Sample preparation: Protein extraction and quantification

Lecture 10 - One-dimensional electrophoresis

Lecture 11 - 2-DE: Rehydration, IEF & Equilibration

Lecture 12 - 2-DE: Second dimension, staining & destaining

Lecture 13 - 2-DE: Gel analysis

Lecture 14 - 2-DE: Applications

Lecture 15 - 2-DE: Applications (Continued...) & Challenges

Lecture 16 - 2D-DIGE: Basics

Lecture 17 - 2D-DIGE: Data analysis

Lecture 18 - 2D-DIGE: Applications

Lecture 19 - Protein identification using MALDI-TOF/TOF

Lecture 20 - Proteomics experiment data analysis & challenges

Lecture 0 - Introductory lecture

Lecture 1 - Introduction to proteomics

Lecture 2 - Proteomics and sample preparation

Lecture 3 - Bacterial protein extraction

Lecture 4 - In-gel digestion

Lecture 5 - Fundamentals of mass spectrometry

Lecture 6 - Chromatography technologies

Lecture 7 - Liquid chromatography

Lecture 8 - Mass spectrometry: Ionization sources

Lecture 9 - Mass spectrometry: Mass analyzers

Lecture 10 - MALDI sample preparation and analysis

Lecture 11 - Introduction to quantitative proteomics

Lecture 12 - Hybrid mass spectrometry configurations

Lecture 13 - SILAC: In Vivo labeling

Lecture 14 - iTRAQ: In Vitro labeling

Lecture 15 - TMT: In vitro labeling

Lecture 16 - Quantitative proteomics data analysis

Lecture 17 - Proteomics and Systems biology I

Lecture 18 - Proteomics & Systems biology II

Lecture 19 - Proteomics applications

Lecture 20 - Advances and challenges in proteomics

Lecture 1 - Introduction to Interactomics

Lecture 2 - An overview of label-free technologies

Lecture 3 - An overview of surface plasmon resonance (SPR)

Lecture 4 - An overview of surface plasmon resonance imaging (SPRi)

Lecture 5 - Basics of SPR: Surface chemistry

Lecture 6 - Basics of SPR: Experimental design

Lecture 7 - Protein immobilization for protein-protein interaction studies

Lecture 8 - Protein-protein interaction study: Binding analysis

Lecture 9 - Protein-protein interaction study: Kinetic analysis

Lecture 10 - Protein-small molecule interaction study: Immobilization and binding analysis

Lecture 11 - Protein-small molecule interaction study: Kinetic analysis

Lecture 12 - SPR: Interactive Session - I

Lecture 13 - SPR: Interactive Session - II

Lecture 14 - An overview of ellipsometry and interferometry techniques

Lecture 15 - An introduction to BioLayer Interferometry (BLI) and its applications in protein research

Lecture 16 - Kinetic analysis of protein-protein interaction using BLI

Lecture 17 - Label-free quantification of proteins using BLI

Lecture 18 - Diffraction-based biosensors - I

Lecture 19 - Diffraction-based biosensors - II

Lecture 20 - Nanotechniques in proteomics - I

Lecture 21 - Nanotechniques in proteomics - II

Lecture 22 - High throughput platforms of interactomics: Protein arrays

Lecture 23 - Conventional label based detection techniques for Protein microarrays

Lecture 24 - Novel detection techniques for Protein microarrays

Lecture 25 - Recombinational cloning and its application for Protein microarrays

Lecture 26 - An introduction to Cell-free protein synthesis

Lecture 27 - Cell-free synthesis based protein microarrays: PISA and NAPPA

Lecture 28 - Cell-free synthesis based protein microarrays: MIST, DAPA and Halotag Arrays

Lecture 29 - Digging deeper into NAPPA: Basic Workflow

Lecture 30 - Digging deeper into NAPPA: Surface Chemistry, Printing and Assessment

Lecture 31 - Application of cell free expression protein microarrays in biomarker discovery

[Lecture 32 - Application of cell free expression protein microarrays in immunological studies](#)

[Lecture 33 - Basics of microarray image scanning](#)

[Lecture 34 - Software for Image scanning and data processing](#)

[Lecture 35 - Microarray Data Analysis - Part I](#)

[Lecture 36 - Microarray Data Analysis - Part II](#)

[Lecture 37 - Application of protein microarray in biomarker discovery - I](#)

[Lecture 38 - Application of protein microarray in biomarker discovery - II](#)

[Lecture 39 - Systems biology and networks](#)

[Lecture 40 - Challenges in proteomics](#)

Lecture 1 - Introduction to amino acids

Lecture 2 - Introduction to proteins

Lecture 3 - Protein folding and misfolding

Lecture 4 - Introduction to proteomics

Lecture 5 - Lab session " Protein-protein interaction using label-free biosensors

Lecture 6 - Sample preparation and pre-analytical factors

Lecture 7 - Sample preparation: Pre-analytical factors (Continued...)

Lecture 8 - Sample preparation: Protein extraction and quantification

Lecture 9 - One-dimensional electrophoresis

Lecture 10 - Introduction to 2-DE

Lecture 11 - 2-DE: Second dimension, staining and destaining

Lecture 12 - 2-DE: Gel analysis

Lecture 13 - 2-DE Applications

Lecture 14 - 2-DE Applications (Continued...) and Challenges

Lecture 15 - Lab session - Protein/peptide pre-fractionation using OFFGEL FRACTIONATOR and data analysis

Lecture 16 - 2D-DIGE: Basics

Lecture 17 - 2D-DIGE: Data analysis

Lecture 18 - 2D-DIGE: Applications

Lecture 19 - Systems biology and proteomics - I

Lecture 20 - Systems biology and proteomics - II

Lecture 21 - Fundamentals of mass spectrometry

Lecture 22 - Chromatography technologies

Lecture 23 - Liquid chromatography

Lecture 24 - Mass spectrometry: Ionization sources

Lecture 25 - Mass spectrometry: Mass analyzers

Lecture 26 - MALDI sample preparation and analysis

Lecture 27 - Hybrid mass spectrometry configurations

Lecture 28 - Lab session - Demonstration of Q-TOF MS technology

Lecture 29 - In-gel and in-solution digestion

Lecture 30 - Lab session - Sample preparation: tissue sample preservation technology

Lecture 31 - Introduction to quantitative proteomics

[Lecture 32 - SILAC: In vivo labeling](#)

[Lecture 33 - iTRAQ: In vitro labeling](#)

[Lecture 34 - TMT: In vitro labeling](#)

[Lecture 35 - Quantitative proteomics data analysis](#)

[Lecture 36 - Proteomics applications](#)

[Lecture 37 - Challenges in proteomics](#)

[Lecture 38 - OMICS and translational research](#)

[Lecture 39 - Lab session - Targeted proteomics using triple quadrupole mass spectrometry](#)

[Lecture 40 - Lab session - Targeted proteomics: multiple reaction monitoring](#)

- Lecture 1 - Introduction to the course
- Lecture 2 - Data representation and plotting
- Lecture 3 - Arithmetic mean
- Lecture 4 - Geometric mean
- Lecture 5 - Measure of Variability, Standard deviation
- Lecture 6 - SME, Z-Score, Box plot
- Lecture 7 - Moments, Skewness
- Lecture 8 - Kurtosis, R programming
- Lecture 9 - R programming
- Lecture 10 - Correlation
- Lecture 11 - Correlation and Regression - Part-I
- Lecture 12 - Correlation and Regression - Part-II
- Lecture 13 - Interpolation and extrapolation
- Lecture 14 - Nonlinear data fitting
- Lecture 15 - Concept of Probability: introduction and basics
- Lecture 16 - Counting principle, Permutations, and Combinations
- Lecture 17 - Conditional probability
- Lecture 18 - Conditional probability and Random variables
- Lecture 19 - Random variables, Probability mass function, and Probability density function
- Lecture 20 - Expectation, Variance and Covariance - Part-I
- Lecture 21 - Expectation, Variance and Covariance - Part-II
- Lecture 22 - Binomial random variables and Moment generating function
- Lecture 23 - Probability distribution: Poisson distribution and Uniform distribution Part-I
- Lecture 24 - Uniform distribution Part-II and Normal distribution Part-I
- Lecture 25 - Normal distribution Part-II and Exponential distribution
- Lecture 26 - Sampling distributions and Central limit theorem - Part-I
- Lecture 27 - Sampling distributions and Central limit theorem - Part-II
- Lecture 28 - Central limit theorem - Part-III and Sampling distributions of sample mean
- Lecture 29 - Central limit theorem - Part-IV and Confidence intervals
- Lecture 30 - Confidence intervals Part- II
- Lecture 31 - Test of Hypothesis - 1

[Lecture 32 - Test of Hypothesis - 2 \(1 tailed and 2 tailed Test of Hypothesis, p-value\)](#)

[Lecture 33 - Test of Hypothesis - 3 \(1 tailed and 2 tailed Test of Hypothesis, p-value\)](#)

[Lecture 34 - Test of Hypothesis - 4 \(Type -1 and Type -2 error\)](#)

[Lecture 35 - T-test](#)

[Lecture 36 - 1 tailed and 2 tailed T-distribution, Chi-square test](#)

[Lecture 37 - ANOVA - 1](#)

[Lecture 38 - ANOVA - 2](#)

[Lecture 39 - ANOVA - 3](#)

[Lecture 40 - ANOVA for linear regression, Block Design](#)

- Lecture 1 - Need to Study Mechanobiology
- Lecture 2 - Cell as a Tent, Individual Components
- Lecture 3 - Cell-ECM Crosstalk
- Lecture 4 - ECM Proteins: Collagen
- Lecture 5 - Measuring Properties of Collagen Networks
- Lecture 6 - Properties of Collagen Networks
- Lecture 7 - Rheology
- Lecture 8 - Rheology of Biopolymer Networks
- Lecture 9 - Atomic Force Microscopy (AFM)
- Lecture 10 - Design of Protein Constructs for AFM
- Lecture 11 - Protein Unfolding using AFM
- Lecture 12 - Protein Unfolding using AFM
- Lecture 13 - Focal Adhesions: Focal Adhesion Proteins
- Lecture 14 - Focal Adhesion Organization
- Lecture 15 - Focal Adhesions: Role of Forces
- Lecture 16 - Cytoskeleton: Actin
- Lecture 17 - Force-velocity Relationships of Actin Networks
- Lecture 18 - Mesenchymal Cell Migration
- Lecture 19 - Actin Dynamics during Mesenchymal Migration
- Lecture 20 - Actin Dynamics during Mesenchymal Migration
- Lecture 21 - Adhesion Independent Migration
- Lecture 22 - Adhesion Independent and Collective Cell Migration
- Lecture 23 - Collective Cell Migration
- Lecture 24 - Mechanobiology of Stem Cell Fate - I
- Lecture 25 - Mechanobiology of Stem Cell Fate - II
- Lecture 26 - Mechanobiology of Stem Cell Fate - III
- Lecture 27 - Mechanobiology of Diseases: Cancer - I
- Lecture 28 - Mechanobiology of Diseases: Cancer - II
- Lecture 29 - Mechanobiology of Diseases: Cancer - III
- Lecture 30 - Mechanobiology of Diseases: Atherosclerosis and Hypertension
- Lecture 31 - Mechanobiology of Diseases: Muscular Dystrophy

[Lecture 32 - Nuclear Mechanotransduction: LINC complex](#)

[Lecture 33 - Nuclear Mechanotransduction: LINC Complex in Cell Migration](#)

[Lecture 34 - Nuclear Mechanotransduction: Gene Regulation](#)

[Lecture 35 - Mechanical Forces and DNA damage](#)

[Lecture 36 - Techniques in Mechanobiology: Hydrogels](#)

[Lecture 37 - Techniques in Mechanobiology: AFM](#)

[Lecture 38 - Techniques in Mechanobiology: Traction Force Microscopy, Trypson Deadhesion and Laser Ablation](#)

[Lecture 39 - Techniques in Mechanobiology: Microfabrication](#)

[Lecture 40 - Techniques in Mechanobiology: FRET](#)

Lecture 1 - Introduction

Lecture 2 - Graphs and Functions

Lecture 3 - Equations as Graphs

Lecture 4 - Graphs : Exponential and Periodic Functions

Lecture 5 - Graphs : Logarithmic and Other Functions

Lecture 6 - Images as 2D/3D Functions

Lecture 7 - Functions and its Derivatives

Lecture 8 - Computing Derivatives of Curves

Lecture 9 - Rules for Calculating Derivatives

Lecture 10 - Understanding Derivatives

Lecture 11 - Curvature and Second Derivative

Lecture 12 - Plotting Curves

Lecture 13 - Numerical Calculation of Derivatives

Lecture 14 - Function, Derivatives and Series Expansion

Lecture 15 - L'Hopital's Rule and Partial Derivatives

Lecture 16 - Integration

Lecture 17 - Integration : Rules

Lecture 18 - Integration : Graphical Understanding

Lecture 19 - Integration : More Examples

Lecture 20 - Integration : Product of Two Functions

Lecture 21 - Exponential Growth and Decay

Lecture 22 - Scalars and Vectors

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NPTEL : Animal Physiology (Biotechnology)

Co-ordinators : Prof. Mainak Das

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NPTEL : Bio electricity (Biotechnology)

Co-ordinators : Prof. Mainak Das

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- Lecture 27 - E.coli core metabolic Network Optimization in MATLAB
- Lecture 28 - Application of Metabolic Flux Analysis
- Lecture 29 - CRISPR-Cas system and its application in metabolic engineering - Part I
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Lecture 7 - Chemical Equilibrium - II

Lecture 8 - Chemical Equilibrium - III

Lecture 9 - Chemical Equilibrium - IV

Lecture 10 - Chemical Equilibrium - V

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Lecture 12 - Chemical Kinetics - II

Lecture 13 - Chemical Kinetics - III

Lecture 14 - Chemical Kinetics - IV

Lecture 15 - Chemical Kinetics - V

Lecture 16 - Chemical Kinetics - Reaction Mechanism - Part A

Lecture 17 - Chemical Kinetics - Reaction Mechanism - Part B

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Lecture 21 - Nitrogen chemistry - Part A

Lecture 22 - Nitrogen chemistry - Part B

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Lecture 24 - Chlorine chemistry and disinfection - Part B

Lecture 25 - Chlorine chemistry and disinfection - Part C

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[Lecture 40 - Cell Biology - III](#)

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[Lecture 42 - Microscopy - I](#)

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Lecture 3 - Ecosystem : Basic concepts of structure and function

Lecture 4 - Ecosystem : Basic concepts of structure and function (Continued...)

Lecture 5 - Microbial Ecology

Lecture 6 - Microbial Ecology (Continued...)

Lecture 7 - Microbial Ecosystems and Biogeochemical Cycling

Lecture 8 - Biogeochemical Cycles

Lecture 9 - Microbial ecology and environmental biotechnology - Part A

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Lecture 11 - Microbial ecology and environmental biotechnology - Part B (Continued...)

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Lecture 13 - Microbial ecology and environmental biotechnology - Part C

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Lecture 15 - Microbial ecology and environmental biotechnology - Part C (Continued...)

Lecture 16 - Microbial Ecology and Environmental Biotechnology - Part C (Continued...)

Lecture 17 - Microbiology of Environmental Engineering System

Lecture 18 - Microbiology of Environmental Engineering System

Lecture 19 - Microbiology of Environmental Engineering System

Lecture 20 - Microbiology of Environmental Engineering System (Continued...)

Lecture 21 - Physiological Ecology and Resource Exploitation by Microorganisms

Lecture 22 - Physiological ecology and Resource Exploitation by Microorganisms (Continued...)

Lecture 23 - Physiological ecology and Resource Exploitation by Microorganisms (Continued...)

Lecture 24 - Physiological ecology and Resource Exploitation by Microorganisms (Continued...)

Lecture 25 - Methods in Microbial Ecology with Relevance to Environmental Biotechnology

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Lecture 3 - Amino Acids - III

Lecture 4 - The Peptide Bond

Lecture 5 - Discussion Class

Lecture 6 - Primary Structure

Lecture 7 - Secondary Structure

Lecture 8 - Tertiary and Quaternary Structure

Lecture 9 - Protein Interactions

Lecture 10 - Discussion Class

Lecture 11 - Protein folding and structure

Lecture 12 - Thermodynamics of Protein Folding

Lecture 13 - Protein Structure Methods

Lecture 14 - Protein Denaturation

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Lecture 16 - Protein Isolation Methods

Lecture 17 - Protein Purification

Lecture 18 - Biophysical Methods - I

Lecture 19 - Biophysical Methods - II

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Lecture 21 - Types of Protein ligand interactions

Lecture 22 - Kinetics and Thermodynamics of protein-ligand binding

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Lecture 26 - Enzymes I - Classification

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Lecture 28 - Enzyme Mechanisms - I

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- Lecture 32 - Enzyme Kinetics - II
- Lecture 33 - Enzyme Inhibition - I
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- Lecture 35 - Discussion class
- Lecture 36 - Motor Proteins - I
- Lecture 37 - Motor Proteins - II
- Lecture 38 - Metalloproteins - I
- Lecture 39 - Metalloproteins - II
- Lecture 40 - Myoglobin and Hemoglobin
- Lecture 41 - Membrane Proteins - I
- Lecture 42 - Membrane proteins - II
- Lecture 43 - Membrane Transport - I
- Lecture 44 - Membrane Transport - II
- Lecture 45 - Electron Transport Chain
- Lecture 46 - Protein Carbohydrate Interactions - I
- Lecture 47 - Protein Carbohydrate Interactions - II
- Lecture 48 - Protein Nucleic Acid Interactions - I
- Lecture 49 - Protein Nucleic Acid Interactions - II
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- Lecture 51 - Protein Protein Interactions - I
- Lecture 52 - Protein Protein Interactions - II
- Lecture 53 - Protein Peptide Interactions
- Lecture 54 - Chaperone proteins
- Lecture 55 - Protein Nanoparticle Interactions
- Lecture 56 - Oxidative stress in Proteins
- Lecture 57 - Enzyme action and Proteolytic cleavage
- Lecture 58 - Intrinsically disordered proteins
- Lecture 59 - Viral proteins
- Lecture 60 - Overview of Course

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Lecture 2 - Introduction - 2

Lecture 3 - Signals and Systems Overview

Lecture 4 - Important Signals

Lecture 5 - System

Lecture 6 - LSI Systems

Lecture 7 - Image Quality

Lecture 8 - Local Contrast

Lecture 9 - Blurring and Noise

Lecture 10 - Physics of Radiography

Lecture 11 - Types of Ionizing Radiations

Lecture 12 - EM Radiation

Lecture 13 - Attenuation Models

Lecture 14 - Radiation Dosimetry

Lecture 15 - PR_Instrument

Lecture 16 - PR_Instru_CA

Lecture 17 - PR_Image_formation

Lecture 18 - Imaging Equation_updated

Lecture 19 - Film screen_Optical Density

Lecture 20 - PR_Image Quality

Lecture 21 - CT_Intsru

Lecture 22 - CT_Instru_finish

Lecture 23 - CT Back projection

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Lecture 25 - Fan beam_IQ

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Lecture 28 - Nuclear_Med_Radiotracers

Lecture 29 - Planar_Scintigraphy_Instru

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[Lecture 52 - MRI_RECON_S70_S82](#)

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Lecture 1 - Introduction

Lecture 2 - Next Generation Sequencing Technologies - 454 Sequencing

Lecture 3 - Illumina Sequencing By Synthesis (SBS)

Lecture 4 - Single Molecule Real Time (SMRT) Sequencing

Lecture 5 - Ion Torrent and Nanopore Sequencing

Lecture 6 - Sequencing Coverage, Quality Score and Experiment Design

Lecture 7 - Data Formats

Lecture 8 - Data Formats (Continued...)

Lecture 9 - Data Quality

Lecture 10 - Data QC and Trimming

Lecture 11 - Hands-on: Setting up the system

Lecture 12 - Basic Shell Commands

Lecture 13 - Data Download and Exploration

Lecture 14 - Hands-on 1 - Data exploration and QC

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Lecture 16 - Read Mapping

Lecture 17 - Mapping Algorithms

Lecture 18 - Suffix tree-based mapping algorithm

Lecture 19 - Burrows-Wheeler Transform (BWT)

Lecture 20 - Read Mapping with BWT

Lecture 21 - Bowtie2 tool

Lecture 22 - Mapping reads with Bowtie2

Lecture 23 - Bowtie2 output

Lecture 24 - SAM and BAM format

Lecture 25 - SAM format: Alignment section

Lecture 26 - Variant Calling

Lecture 27 - Calling SNP/SNVs and Indels

Lecture 28 - Hands-on analysis : Variant Calling

Lecture 29 - VCF Files

Lecture 30 - Variant Annotation

Lecture 31 - Analysis of CNVs and SVs

- Lecture 32 - Introduction to RNA sequencing
- Lecture 33 - RNA-seq data processing pipeline
- Lecture 34 - Transcriptome Assembly and Quantification
- Lecture 35 - Transcript Abundance Quantification
- Lecture 36 - Biases in RNA-seq experiments
- Lecture 37 - Data Normalization Methods
- Lecture 38 - Data Normalization Methods (Continued...)
- Lecture 39 - Differential Gene Expression (DGE) Analysis
- Lecture 40 - DGE analysis results and visualizations
- Lecture 41 - Multiple hypothesis testing correction
- Lecture 42 - FDR correction and interpretation of DGE analysis results
- Lecture 43 - Functional Enrichment Analysis
- Lecture 44 - RNA-seq data analysis - Hands-on 2
- Lecture 45 - Hands-on 2: Setting up the system
- Lecture 46 - Hands-on 2: Preliminary Data Analysis
- Lecture 47 - Sample Specific Bias Correction
- Lecture 48 - Differential Gene Expression Analysis I
- Lecture 49 - DGE Analysis with spike-ins
- Lecture 50 - DGE Analysis Results and Functional Enrichment Analysis
- Lecture 51 - Genome Assembly
- Lecture 52 - Shortest Common Superstring (SCS) assembly
- Lecture 53 - Overlap-Layout-Consensus (OLC) approach
- Lecture 54 - de Bruijn Graph (DBG) based assembly
- Lecture 55 - Assembly and Quality Control
- Lecture 56 - Applications of NGS in Epigenomics
- Lecture 57 - Detecting DNA Methylations
- Lecture 58 - Genome-wide Transcription Factor(TF) Binding Sites
- Lecture 59 - Chromatin Accessibility
- Lecture 60 - Genome Organization in 3D

Lecture 1 - Neuron Structure

Lecture 2 - Networks of Neurons and Synapses

Lecture 3 - Basic Structures in the Brain

Lecture 4 - Systems of neural processing

Lecture 5 - Methods of Recording Neural Activity

Lecture 6 - Membrane Potential and All or None Spike

Lecture 7 - Patch Clamp Measurements

Lecture 8 - Ion channels

Lecture 9 - Current injection: Synapses

Lecture 10 - Single Neuron Acitivity

Lecture 11 - Point and compartmental models of neurons

Lecture 12 - Hodgkin Huxley Equations - I

Lecture 13 - Hodgkin Huxley Equations - II

Lecture 14 - Reducing the HHE and Moris-Lecar Equations (MLE)

Lecture 15 - Properties of MLE

Lecture 16 - Phase Plane Analysis - I

Lecture 17 - Phase Plane Analysis - II

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Lecture 19 - Analysing HHE with Phase Plane Analysis - I

Lecture 20 - Analysing HHE with Phase Plane Analysis - II

Lecture 21 - Random variables and random process

Lecture 22 - Spike train statistics and response measure

Lecture 23 - Receptive fields and models of receptive fields

Lecture 24 - Stimulus to Response mapping (Coding) - I

Lecture 25 - Stimulus to Response mapping (Coding) - II

Lecture 26 - Stimulus to Response Mapping (Coding) - III

Lecture 27 - Response to Stimulus Mapping (Decoding)

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Lecture 29 - Basics of Information Theory - II

Lecture 30 - Maximally Informative Dimensions

Lecture 31 - Intro to Discrimination based methods

[Lecture 32 - Kullback Leibler Distance](#)

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[Lecture 58 - Optimal Coding of Deviant Stimuli in Development](#)

[Lecture 59 - Spike Timing Dependent Plasticity - a theoretical Perspective](#)

[Lecture 60 - Important Problems in Neuroscience](#)

Lecture 1 - Ionic basis of membrane potential

Lecture 2 - Physiology of voltage gated channels

Lecture 3 - Physiology of voltage gated channels

Lecture 4 - Cardiac muscle physiology

Lecture 5 - Action potential of cardiac muscle - 1

Lecture 6 - Action potential of cardiac muscle - 2

Lecture 7 - Conducting system of heart

Lecture 8 - ECG-Physiological basis

Lecture 9 - ECG-Normal, Technical aspects

Lecture 10 - ECG Interpretation

Lecture 11 - Abnormal ECG - 1

Lecture 12 - Abnormal ECG - 2

Lecture 13 - ECG and Myocardial Infarction

Lecture 14 - Heart rate and Blood pressure - Baroreflex pathway

Lecture 15 - ECG and Hypertension

Lecture 16 - Autonomic regulation of heart

Lecture 17 - Heart rate variability (HRV)

Lecture 18 - Heart rate variability-interpretation and clinical uses, Blood pressure variability

Lecture 19 - Autonomic Function Tests - 1

Lecture 20 - Autonomic Function Tests - 2

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Lecture 2 - Plant Specialized Metabolites: Waste Products or Ecochemicals?

Lecture 3 - Evolution of Specialized Metabolism from Primary Metabolism

Lecture 4 - Production of specialized metabolites through cell and organ culture

Lecture 5 - Eliciting specialized metabolism in culture

Lecture 6 - Analysis of Specialized Metabolites - Tools and Techniques

Lecture 7 - Metabolic phytochemistry-based approaches for studying plant specialized metabolism

Lecture 8 - Metabolic engineering strategies in plants

Lecture 9 - Plant genetic transformation (through natural genetic engineer)

Lecture 10 - Design of vectors for Agrobacterium-mediated gene transfer; Transformed and co-

Lecture 11 - Introduction to alkaloids

Lecture 12 - Biosynthesis of tropane alkaloids

Lecture 13 - Engineering tropane alkaloid pathways in plants - I

Lecture 14 - Engineering tropane alkaloid pathways in plants - II : Engineering tropane alkaloid pathway

Lecture 15 - Isoquinoline alkaloids - Biosynthesis and tissue localization

Lecture 16 - Isoquinoline alkaloids - Late steps of biosynthetic pathway and tissue localization

Lecture 17 - Benzyloisoquinoline alkaloids - Induced top1 mutant and natural T mutantEngineering

Lecture 18 - Benzyloisoquinoline alkaloids - Metabolic pathway engineering

Lecture 19 - RNAi-mediated replacement of morphine with nonnarcotic alkaloid reticuline in opium

Lecture 20 - Isoquinoline alkaloids - biosynthesis and tissue localization

Lecture 21 - Indole alkaloids - Early steps of biosynthesis

Lecture 22 - Indole alkaloids - Metabolic engineering of early steps of indole alkaloid pathway

Lecture 23 - Indole alkaloids - Environmental factors regulating indole alkaloid biosynthesis

Lecture 24 - Indole alkaloids - Role of elicitors in modulating alkaloids accumulation

Lecture 25 - Indole alkaloids - Late steps of indole alkaloid biosynthesis

Lecture 26 - Indole alkaloids - Regulatory roles of transcription factors in light-induced

Lecture 27 - Engineering indole alkaloid pathways in Catharanthus roseus hairy root cultures

Lecture 28 - Missing enzymes of vindoline biosynthetic pathway

Lecture 29 - Monoterpene indole alkaloid pathway cell and tissue localization

Lecture 30 - Model for biosynthesis and secretion of monoterpenoid indole alkaloids involving

Lecture 31 - Metabolic reprogramming of periwinkle plant culture

- Lecture 32 - Engineered yeast brews precursors of anticancer drug vinblastine
- Lecture 33 - Recent discovery of strychnine biosynthetic pathway
- Lecture 34 - Indole alkaloid biosynthesis - a final overview
- Lecture 35 - Recent discovery of colchicine biosynthetic pathway
- Lecture 36 - Biosynthesis of terpenoids - an outline
- Lecture 37 - Diversity of monoterpenoids
- Lecture 38 - Biosynthesis of monoterpenoids
- Lecture 39 - Diversity of sesquiterpenes, diterpenes, triterpenes and polyterpenes
- Lecture 40 - Oleoresins and polyterpenes - an outline
- Lecture 41 - Monoterpenoids as components of floral scent volatiles: Metabolic engineering of
- Lecture 42 - Biosynthesis of carotenoids and carotenoid cleavage products
- Lecture 43 - Metabolic engineering of carotenoid pathway
- Lecture 44 - Metabolic engineering of carotenoid pathway: Golden Rice Story
- Lecture 45 - Menthol story: Biosynthesis and pathway manipulation - I
- Lecture 46 - Menthol story: Biosynthesis and pathway manipulation - II
- Lecture 47 - Artemisinin, hyperforin and taxol - three promising candidates for biotechnological
- Lecture 48 - Phenolics: Origin via shikimate pathway
- Lecture 49 - Phenolics: Phenylpropanoids, benzenoids, coumarins, tannins
- Lecture 50 - Phenolics: Monolignols, lignins and lignans
- Lecture 51 - Phenolics: Metabolic engineering of monolignol pathways
- Lecture 52 - Phenolics: Biosynthesis of lignans and podophyllotoxin; Caffeic acid esters
- Lecture 53 - Phenolics: Flavonoids, Flavones, Isoflavonoids, Proanthocyanidins
- Lecture 54 - Phenolics: Biosynthesis of anthocyanins; Metabolic pathway engineering for enhance
- Lecture 55 - Phenolics: Metabolic engineering of anthocyanin pathways in flowers
- Lecture 56 - Phenolics: Alcohol acetyl transferses and volatile phenolics
- Lecture 57 - Phenolics: Biosynthesis of volatile benzenoids
- Lecture 58 - Phenolics: Biosynthesis of vanillin in plants
- Lecture 59 - Phenolics: Metabolic engineering for vanillin
- Lecture 60 - Phenolics: Biosynthesis of shikonin
- Lecture 61 - Phenolics: Metabolic engineering of shikonin pathway
- Lecture 62 - Molecular Pharming: Transplastomic plants
- Lecture 63 - Molecular Pharming: production of human somatotropin in tobacco

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Lecture 2 - Mass balance, Heat Balance, flow sheet

Lecture 3 - Costing

Lecture 4 - Costing (continued), Physical and chemical principles in Down stream

Lecture 5 - Problems in Mass balance, flow sheet

Lecture 6 - Cell Breakage

Lecture 7 - Cell breakage (Continued...)

Lecture 8 - Solid Liquid Separation

Lecture 9 - Solid Liquid Separation (Continued...)

Lecture 10 - Solid Liquid separation-problems

Lecture 11 - Pre-treatment and Filters

Lecture 12 - Adsorption

Lecture 13 - Adsorption

Lecture 14 - Adsorption

Lecture 15 - Adsorption

Lecture 16 - Liquid-Liquid Extraction

Lecture 17 - Liquid-Liquid Extraction

Lecture 18 - Liquid-Liquid Extraction

Lecture 19 - Liquid liquid extraction

Lecture 20 - Reversed micellar and aqueous two phase extraction

Lecture 21 - Membranes

Lecture 22 - Membranes

Lecture 23 - Membranes

Lecture 24 - Membranes

Lecture 25 - Precipitation

Lecture 26 - Chromatography

Lecture 27 - Chromatography

Lecture 28 - Chromatography

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NPTEL : Thermodynamics (Biotechnology)

Co-ordinators : Prof. G.K. Suraishkumar

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Lecture 2 - Need for Analysis Additional Thermodynamic Functions State and Path Variables

Lecture 3 - Equations for a Closed system Chemical Potential Concept Gibbs-Duhem Equation

Lecture 4 - Maxwell's relations

Lecture 5 - Inter-Relationships between Thermodynamic Variables

Lecture 6 - Some Useful Mathematical Manipulations

Lecture 7 - Thermodynamic Relations for a Closed System with 1 mole of a pure Substances

Lecture 8 - Maximum Work, Lost Work Review of Closed Systems

Lecture 9 - Open Systems

Lecture 10 - Equations of State - Virial Equations

Lecture 11 - Equations of State - Cubic Equations

Lecture 12 - Volume Estimation

Lecture 13 - Volume Estimation (Continued...) Generalized correlations

Lecture 14 - Generalized correlations (Continued...) Residual Properties

Lecture 15 - Residual Properties (Continued...)

Lecture 16 - Generalized Correlations and Residual Properties

Lecture 17 - Fugacity Coefficient Estimation

Lecture 18 - Review of Module 3

Lecture 19 - Learning Aspects Chemical Potential Formulations

Lecture 20 - Lewis and Randall rule partial Molar Properties

Lecture 21 - Partial Molar Property Estimation from Mixing Experiments

Lecture 22 - Partial Molar Property Estimation (Continued...) Excess Property

Lecture 23 - Activity Coefficient from Excess Property

Lecture 24 - Activity Coefficient from Excess Property (Continued...)

Lecture 25 - Activity Coefficient from Excess Property (Continued...) Models for Activity Coefficient in Binary Systems

Lecture 26 - Models for Activity Coefficient in Binary Systems (Continued...)

Lecture 27 - Review of Module 4

Lecture 28 - Criteria for Phase Equilibrium Phase Rule for Non-reacting Biosystems

Lecture 29 - Clausius - Clayperon Equation

Lecture 30 - Clausius - Clayperon Equation (Continued...) vapour-Liquid Equilibrium

Lecture 31 - Vapour-Liquid Equilibrium (Continued...) Estimation of Fugacity coefficient from Equilibrium P-V-T Data

[Lecture 32 - Liquid/Liquid and Solid/Liquid Equilibria](#)

[Lecture 33 - Review of Module 5](#)

[Lecture 34 - Criteria for Bio-reaction Equilibria](#)

[Lecture 35 - Phase rule for Reacting Biosystems Equilibrium constants](#)

[Lecture 36 - Effect of Temperature and Pressure on the Equilibrium constants](#)

[Lecture 37 - Reaction in Liquid or Solid Phases](#)

[Lecture 38 - Free energy Changes for some Bioreactions](#)

[Lecture 39 - Electrolytes](#)

[Lecture 40 - Course Review](#)

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- Lecture 2 - Mass balance, Heat Balance, Flow sheet
- Lecture 3 - Costing
- Lecture 4 - Cell Breakage
- Lecture 5 - Solid Liquid Separation
- Lecture 6 - Pre-treatment and Filters/centrifuge
- Lecture 7 - Liquid-Liquid Extraction
- Lecture 8 - Liquid-Liquid extraction (Continued...)
- Lecture 9 - Adsorption
- Lecture 10 - Reversed micellar and aqueous two phase extraction
- Lecture 11 - Membranes
- Lecture 12 - Membranes (Continued...)
- Lecture 13 - Product stabilization, Drying, Lyophilisation
- Lecture 14 - Precipitation and crystallization
- Lecture 15 - Electrophoresis / SDS PAGE
- Lecture 16 - Chromatography
- Lecture 17 - Chromatography (Continued...1)
- Lecture 18 - Chromatography (Continued...2)
- Lecture 19 - Chromatography (Continued...3)
- Lecture 20 - Future trends, Other downstream operations/Summary of the course

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Lecture 5 - Normal Distribution

Lecture 6 - Standardized Normal Distribution / t-distribution

Lecture 7 - t-distribution/confidence interval

Lecture 8 - Statistical tests

Lecture 9 - t-Test

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Lecture 11 - t-test

Lecture 12 - F-tests

Lecture 13 - F-tests

Lecture 14 - ANOVA

Lecture 15 - ANOVA

Lecture 16 - Anova

Lecture 17 - Anova

Lecture 18 - Anova

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Lecture 21 - Normality test / Odds ratio

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Lecture 23 - Chi square distribution / test

Lecture 24 - Chi square test

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Lecture 3 - Solution to PP 1.1

Lecture 4 - Some important concepts

Lecture 5 - Enzyme bioreactors, enzyme kinetics

Lecture 6 - Solution to PP 2.1

Lecture 7 - Inhibited enzyme kinetics

Lecture 8 - Solution to PP 2.2

Lecture 9 - Measurement principles and methods

Lecture 10 - Batch growth kinetics

Lecture 11 - Solution to PP 3.1

Lecture 12 - Bioreactor analysis: chemostat and fed-batch

Lecture 13 - Solution to PP 3.2

Lecture 14 - Bioreactor environment parameters

Lecture 15 - Bioreactor env. par. (DO)

Lecture 16 - Solution to PP 4.1

Lecture 17 - Shear stress, scale-up, scale-down

Lecture 18 - Cell view: stoichiometry; degree of reductance

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- Lecture 8 - Resorbability, biodegradation
- Lecture 9 - Resorbability, biodegradation (Continued...)
- Lecture 10 - Biofilm
- Lecture 11 - Biofilm (Continued...)
- Lecture 12 - Biofilm (Continued...)
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- Lecture 14 - Material characterization - Analytical instruments
- Lecture 15 - Analytical instruments
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- Lecture 17 - Analytical instruments (Continued...)
- Lecture 18 - Biological responses, compatibility, cytotoxicity
- Lecture 19 - Biological Responses
- Lecture 20 - Cell-biomaterial interaction
- Lecture 21 - Animal trials (in vivo)
- Lecture 22 - Animal trials
- Lecture 23 - Metals-types, classifications, applications
- Lecture 24 - Metals - properties
- Lecture 25 - Metals - properties (Continued...)
- Lecture 26 - Metals - properties (Continued...)
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Lecture 4 - Sequence based parameters

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NPTEL : NOC:Demystifying the Brain (Biotechnology)

Co-ordinators : Dr. V Srinivasa Chakravarthy

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- Lecture 2 - Understanding Brain's Shape - Segment 1 - Brain size and intelligence
- Lecture 3 - Understanding Brain's Shape - Segment 2 - Save Wire Principle
- Lecture 4 - Understanding Brain's Shape - Segment 3 - Brain Evolution
- Lecture 5 - Neurons and Neural Signaling: Outline
- Lecture 6 - Neural Signalling : Molecular and Cellular Basis
- Lecture 7 - Networks that Learn - Segment 1
- Lecture 8 - Multilayer Perceptrons Applications in Psychology and Neuroscience
- Lecture 9 - Organization of the Central Nervous System-Segment 1 - Cortex
- Lecture 10 - Organization of the Central Nervous System-Segment 2 - Subcortical Structures
- Lecture 11 - Maps in the Brain - Segment 1
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- Lecture 13 - Emotions in the Brain - Segment 1
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Lecture 15 - Introduction to Network Biology

Lecture 16 - Introduction to Network Biology

Lecture 17 - Introduction to Network Biology

Lecture 18 - Network Biology

Lecture 19 - Network Models

Lecture 20 - Network Models

Lecture 21 - Biological Networks

Lecture 22 - Network Perturbations

Lecture 23 - Community Detection

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Lecture 8 - Drug Solubility / permeability

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- Lecture 4 - Scaffolds: Extracellular Matrix
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Lecture 70 - Enslaving effects in finger force production - 1

Lecture 71 - Enslaving effects in finger force production - 2

Lecture 72 - Wrist posture and finger interdependence - 1

Lecture 73 - Wrist posture and finger interdependence - 2

Lecture 74 - Wrist posture and finger interdependence - 3

Lecture 75 - Measurement of orientation in 3D space - Devices

Lecture 76 - Rotation matrices in 2D and 3D

Lecture 77 - Animating using rotation matrices- Matlab Examples

Lecture 78 - Composite rotation matrix and relative orientations

Lecture 79 - Complex numbers and quaternions

Lecture 80 - Singularity, Gimbal Lock, Advantages and disadvantages of parameterization methods

Lecture 81 - Single finger kinematics measurement using IMU's

Lecture 82 - IMU based Full hand kinematics measurement system (HKMS)

Lecture 83 - Demonstration of the Hand Kinematics Measurement System (HKMS)

Lecture 84 - Introduction to Gait and running

NPTEL : Introduction to Synthetic Biology (Biotechnology)

Co-ordinators : Prof. Karthik Raman

- Lecture 1 - Introduction to Synthetic Biology - Day 1 Part 1
- Lecture 2 - Introduction to Synthetic Biology - Day 1 Part 2
- Lecture 3 - Introduction to Synthetic Biology - Day 1 Part 3
- Lecture 4 - Introduction to Synthetic Biology - Day 1 Part 4
- Lecture 5 - Introduction to Synthetic Biology - Day 2 Part 1
- Lecture 6 - Introduction to Synthetic Biology - Day 2 Part 2
- Lecture 7 - Introduction to Synthetic Biology - Day 2 Part 3
- Lecture 8 - Introduction to Synthetic Biology - Day 2 Part 4
- Lecture 9 - Introduction to Synthetic Biology - Day 3 Part 1
- Lecture 10 - Introduction to Synthetic Biology - Day 3 Part 2
- Lecture 11 - Introduction to Synthetic Biology - Day 3 Part 3
- Lecture 12 - Introduction to Synthetic Biology - Day 3 Part 4
- Lecture 13 - Introduction to Synthetic Biology - Day 4 Part 1
- Lecture 14 - Introduction to Synthetic Biology - Day 4 Part 2
- Lecture 15 - Introduction to Synthetic Biology - Day 4 Part 3
- Lecture 16 - Introduction to Synthetic Biology - Day 5 Part 1
- Lecture 17 - Introduction to Synthetic Biology - Day 5 Part 2
- Lecture 18 - Introduction to Synthetic Biology - Day 5 Part 3
- Lecture 19 - Introduction to Synthetic Biology - Day 5 Part 4
- Lecture 20 - Introduction to Synthetic Biology - Day 6 Part 1
- Lecture 21 - Introduction to Synthetic Biology - Day 6 Part 2
- Lecture 22 - Introduction to Synthetic Biology - Day 6 Part 3
- Lecture 23 - Introduction to Synthetic Biology - Day 7 Part 1
- Lecture 24 - Introduction to Synthetic Biology - Day 7 Part 2
- Lecture 25 - Introduction to Synthetic Biology - Day 7 Part 3
- Lecture 26 - Introduction to Synthetic Biology - Day 8 Part 1
- Lecture 27 - Introduction to Synthetic Biology - Day 8 Part 2
- Lecture 28 - Introduction to Synthetic Biology - Day 9 Part 1
- Lecture 29 - Introduction to Synthetic Biology - Day 9 Part 2
- Lecture 30 - Introduction to Synthetic Biology - Day 9 Part 3
- Lecture 31 - Introduction to Synthetic Biology - Day 10 Part 1

[Lecture 32 - Introduction to Synthetic Biology - Day 10 Part 2](#)

[Lecture 33 - Introduction to Synthetic Biology - Day 10 Part 3](#)

Lecture 1 - Introduction to Different OMICS Approaches and their Applications

Lecture 2 - Genetic Information in Prokaryotic

Lecture 3 - Databases and Web Resources to Store and Access the Biological Data

Lecture 4 - First and Second Generation Sequencing Technologies

Lecture 5 - Long Read Sequencing and Linked Read Sequencing - Part 1

Lecture 6 - Long Read Sequencing and Linked Read Sequencing - Part 2

Lecture 7 - Sequence Formats and Databases for Genomic Analysis

Lecture 8 - Introduction to Linux

Lecture 9 - File Handling and Remote Connectivity in Linux

Lecture 10 - Running Linux Commands and Installation of Genomic Packages

Lecture 11 - Introduction to R and Applications in Genomic Analysis

Lecture 12 - Publicly Available Tools and Need for Workstations for Genomic Analysis

Lecture 13 - Overview of Genomic and Transcriptomic Analysis

Lecture 14 - Genomic and Transcriptomic Analysis of an Organism with Case Studies

Lecture 15 - How to Collect and Confirm Sample of the Species to be Sequenced and Transcriptome Sequencing Approaches

Lecture 16 - Estimating the Amount of Sequencing Coverage for a Genome and Hybrid Sequencing Approaches

Lecture 17 - Types of Reads, Quality Filtering, Estimating the Genome Complexity and Heterozygosity

Lecture 18 - Genome Assembly and its Completion Status, Assembly Algorithms

Lecture 19 - Commonly Used Assembly Tools

Lecture 20 - Linked-Read Sequencing and Processing

Lecture 21 - Long Reads Analysis and Assembly Workflow

Lecture 22 - De novo Assembly Using Genomic and Transcriptomic Reads

Lecture 23 - Merging Assemblies to Create Hybrid Assembly and Determining the Quality of Assembly

Lecture 24 - Chromosomal Level Assembly and Case Studies

Lecture 25 - Identification and Annotation of Repeats in Genomes

Lecture 26 - De novo Transcriptome Assembly and Making the Coding Gene Set

Lecture 27 - Prediction of tRNA, rRNA and miRNA in a Genome

Lecture 28 - Functional Annotation and Identification of Metabolic Pathways in a Genome

Lecture 29 - Comprehensive Functional Annotation of Predicted Genes in a Genome

Lecture 30 - Functional Annotation of Predicted Genes by Alternate Methods

Lecture 31 - Methods and Steps to Perform the Evolutionary Analysis of a Genome

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

[Lecture 32 - Methods for Taxonomic Classification and Phylogeny Econstruction and Analysis](#)

[Lecture 33 - Epigenetics, ChIp-seq, Transcriptome and Microarrays for Regulation of Expression](#)

[Lecture 34 - Single Cell Genomics, 10X Chromium Linked-reads and Illumina Sequencing, Single Cell Gene Expression](#)

[Lecture 35 - Application of Multiomics Approaches in Human Health and Diseases Such as Cancer, Diabetes, etc.](#)

[Lecture 36 - Prokaryotic Genome Sequencing and Assembly Approaches](#)

[Lecture 37 - Gene Prediction Approaches and Common Methods for Bacterial Gene Prediction](#)

[Lecture 38 - Common Methods for Annotation of a Bacterial Genome, t-RNA, rRNA, Operon Prediction and Annotation](#)

[Lecture 39 - Phylogenetic Analysis of Bacterial Genomes](#)

[Lecture 40 - Metabolic and Comparative Analysis](#)

[Lecture 41 - Microbiome and Metagenome, Human, Organismal and Environmental Microbiomes](#)

[Lecture 42 - Sequencing and Assembly of Metagenomes, Gene Prediction, Annotation, MAGs - Part 1](#)

[Lecture 43 - Sequencing and Assembly of Metagenomes, Gene Prediction, Annotation, MAGs - Part 2](#)

[Lecture 44 - Taxonomic Analysis Using Amplicon Sequence Variants, Statistical Analysis](#)

Lecture 1 - Introduction to Homeostasis

Lecture 2 - Mechanisms of Homeostasis - Part 1

Lecture 3 - Mechanisms of Homeostasis - Part 2

Lecture 4 - Physiology of muscle - Part 1

Lecture 5 - Physiology of muscle - Part 2

Lecture 6 - Molecular Mechanism of muscle contractility - Part 1

Lecture 7 - Molecular Mechanism of muscle contractility - Part 2

Lecture 8 - How does the heart muscle work? - Part 1

Lecture 9 - How does the heart muscle work? - Part 2

Lecture 10 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 1

Lecture 11 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 2

Lecture 12 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 3

Lecture 13 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 4

Lecture 14 - Rhythmicity of heart beat - Part 1

Lecture 15 - Rhythmicity of heart beat - Part 2

Lecture 16 - Hemodynamics

Lecture 17 - Hemodynamics and Regulation - Part 1

Lecture 18 - Hemodynamics and Regulation - Part 2

Lecture 19 - Hemodynamics and Regulation - Part 3

Lecture 20 - Hemodynamics and Regulation - Part 4

Lecture 21 - Hemodynamics and Regulation - Part 5

Lecture 22 - Hemodynamics and Regulation - Part 6

Lecture 23 - Lymphatic system

Lecture 24 - Excretory system : Kidney - Part 1

Lecture 25 - Excretory system : Kidney - Part 2

Lecture 26 - Excretory system : Kidney - Part 3

Lecture 27 - Kidney and RBC production

Lecture 28 - Excretory system : Nephron - Part 1

Lecture 29 - Excretory system : Nephron - Part 2

Lecture 30 - Excretory system : Nephron - Part 2.1

Lecture 31 - Excretory system : Nephron - Part 3

[Lecture 32 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 1](#)

[Lecture 33 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 2](#)

[Lecture 34 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 3](#)

[Lecture 35 - Physiology and Introduction of Respiration - Part 1](#)

[Lecture 36 - Physiology and Introduction of Respiration - Part 2](#)

[Lecture 37 - Respiration - Part 1](#)

[Lecture 38 - Respiration - Part 2](#)

[Lecture 39 - Respiration - Part 3](#)

[Lecture 40 - Respiration - Part 4](#)

[Lecture 41 - Physiology of smooth muscles and digestive system - Part 1](#)

[Lecture 42 - Physiology of smooth muscles and digestive system - Part 2](#)

[Lecture 43 - Physiology of smooth muscles and digestive system - Part 3](#)

[Lecture 44 - Physiology of smooth muscles and digestive system - Part 4](#)

[Lecture 45 - Secretory functions of alimentary tract - Part 1](#)

[Lecture 46 - Secretory functions of alimentary tract - Part 2](#)

[Lecture 47 - Secretory functions of alimentary tract and Pancreas - Part 1](#)

[Lecture 48 - Secretory functions of alimentary tract and Pancreas - Part 2](#)

[Lecture 49 - Secretory functions of Pancreas and liver](#)

[Lecture 50 - Secretory functions of Liver and Gallbladder](#)

[Lecture 51 - Introduction to Endocrine system](#)

[Lecture 52 - Pituitary gland and growth hormone secretion - Part 1](#)

[Lecture 53 - Pituitary gland and growth hormone secretion - Part 2](#)

[Lecture 54 - Thyroid gland - Part 1](#)

[Lecture 55 - Thyroid gland - Part 2](#)

[Lecture 56 - Hormones of adrenal cortex - Part 1](#)

[Lecture 57 - Hormones of adrenal cortex - Part 2](#)

[Lecture 58 - Physiology of Glucocorticoids - Part 1](#)

[Lecture 59 - Physiology of Glucocorticoids - Part 2](#)

[Lecture 60 - Course Summary](#)

Lecture 1 - What is Biology ?

Lecture 2 - Pillars of Biology

Lecture 3 - Biology and the City

Lecture 4 - The Process of Science

Lecture 5 - A Tale of Forgotten Scientists - Part I

Lecture 6 - A Tale of Forgotten Scientists - Part II

Lecture 7 - Numbers and Scales in Biology - Part I

Lecture 8 - Numbers and Scales in Biology - Part II

Lecture 9 - Experimentation vs Theory_Discussion

Lecture 10 - How to Find Reliable Information ?

Lecture 11 - How to Read a Scientific Article ?

Lecture 12 - Biomolecules - Part I

Lecture 13 - Biomolecules - Part II

Lecture 14 - Central Dogma

Lecture 15 - Gene Regulation

Lecture 16 - Non-Coding RNA

Lecture 17 - Introduction to Cells

Lecture 18 - Our Favourite Cells - Part I

Lecture 19 - Our Favourite Cells - Part II

Lecture 20 - Cell Cycle

Lecture 21 - Cell Cycle Control

Lecture 22 - Cancer Biology (Guest Lecture) - Dr. Ramray Bhat (IISc)

Lecture 23 - Discussion on Cancer Biology - Dr. Ramray Bhat (IISc) and Dr. Divya Uma (Azim Premji University)

Lecture 24 - Genetics - I

Lecture 25 - Genetics - II

Lecture 26 - Genetics - III

Lecture 27 - Gene Mutations and Genetic Disorders (Guest Lecture) Dr. Antara Das, Azim Premji University

Lecture 28 - Studying Human Genetic Disorders using Transgenic Animals - Research talk (Guest Lecture)

Lecture 29 - Bead Microscopy (Guest Lecture) Dr. Procheta Mallik (ISPF and ThinkTac)

Lecture 30 - Molecular Biology Techniques

Lecture 31 - Bacterial DNA Isolation and PCR - Hands-on (Guest Lecture) Dr. Beena DB (Azim Premji University)

[Lecture 32 - BT Cotton - Part 1 \(Case study\)](#)

[Lecture 33 - Molecular Biology Techniques - BT Cotton - Part 2 \(Case study\)](#)

[Lecture 34 - Introduction to Evolution](#)

[Lecture 35 - Evidences of Evolution](#)

[Lecture 36 - Mechanism of Evolution](#)

[Lecture 37 - Misconceptions about Evolution - Discussion](#)

[Lecture 38 - Human Evolution](#)

[Lecture 39 - Species, Speciation and Biodiversity - I](#)

[Lecture 40 - Species, Speciation and Biodiversity - II](#)

[Lecture 41 - Measuring Biodiversity \(Tutorial\)](#)

[Lecture 42 - Speciation](#)

[Lecture 43 - Speciation \(Case studies\)](#)

[Lecture 44 - Introduction to Ecological Interactions - Part 1](#)

[Lecture 45 - Ecological Interactions - Part 2](#)

[Lecture 46 - Ecological Interactions - Part 3](#)

[Lecture 47 - Mutualism - Figs \(Case Study\)](#)

[Lecture 48 - Seed Dispersal \(Case study\)](#)

[Lecture 49 - Introduction to Public Health \(Guest Lecture\) Dr.Abha Rao \(Public Health Foundation of India\)](#)

[Lecture 50 - Public Health in India \(Guest Lecture\) Dr. Abha Rao \(Public Health Foundation of India\)](#)

[Lecture 51 - Discussion on Public Health - Dr. Abha Rao \(PHFI\) and Mr. Pratush Brahma \(University of Florida\)](#)

[Lecture 52 - Public Health - Rotavirus \(Case study\)](#)

[Lecture 53 - Public Health - Malaria \(Case study\) - Part 1](#)

[Lecture 54 - Public Health - Malaria \(Case study\) - Part 2](#)

[Lecture 55 - Biology and Climate Change - Part 1](#)

[Lecture 56 - Biology and Climate Change - Part 2](#)

[Lecture 57 - Biology and Climate Change - Part 3](#)

[Lecture 58 - Biodiversity Conservation \(Guest Lecture\) Dr. Krishnapriya Tamma \(Azim Premji University\)](#)

[Lecture 59 - Discussion on Biology and Society](#)

[Lecture 60 - Discussion on Art and Science](#)

[Lecture 61 - Biology and Society - Case study on Stray Dogs](#)

[Lecture 62 - Nature Relatedness](#)

[Lecture 63 - Course Wrap-Up](#)

- Lecture 1 - History of Neuroscience : Introduction - Part 1
- Lecture 2 - History of Neuroscience : Introduction - Part 2
- Lecture 3 - Factors that produce discoveries
- Lecture 4 - Importance of the 1950s in Neuroscience
- Lecture 5 - Advances in Molecular Biology (Genes to DNA)
- Lecture 6 - Discovery of the structure of the DNA
- Lecture 7 - How DNA works
- Lecture 8 - Molecular biology of the human brain
- Lecture 9 - Signaling molecule: The First growth Factor
- Lecture 10 - Nerve Growth Factor
- Lecture 11 - Organizing the Connections
- Lecture 12 - Axonal Transport
- Lecture 13 - Signaling molecules: The First Neurotransmitter in the brain
- Lecture 14 - The concept of Lock and Key
- Lecture 15 - The Soup vs Sparks Debate
- Lecture 16 - Intracellular Electrode, Neurotransmitter in the Brain, Dales Law
- Lecture 17 - Early evidence of Acetylcholine and Glutamate
- Lecture 18 - Early evidence of GABA and Serotonin
- Lecture 19 - Catecholamine and Hormones
- Lecture 20 - Second messengers and Hormones
- Lecture 21 - Pheromones
- Lecture 22 - Revolution in Cytology
- Lecture 23 - Synapse and the 'Neuronism vs Reticularism' debate
- Lecture 24 - Contributions by Rene Couteaux and George Koelle
- Lecture 25 - Chemical Synapse
- Lecture 26 - Synapse and the Neuromuscular Junction
- Lecture 27 - The Electrical Synapse and Myelin
- Lecture 28 - Physiology: The Action Potential - Part 1
- Lecture 29 - Recording nerve impulses and single action potentials
- Lecture 30 - Recording from nerve and plant cells
- Lecture 31 - Recording Local circuits, Hodgkin and Huxely contributions - Part 1

Lecture 32 - Hodgkin and Huxely model - Part 2 and Kenneth Cole Contributions

Lecture 33 - GHK equation and HH action potentials

Lecture 34 - First Electrophysiological Evidence for Synaptic Transmission

Lecture 35 - Bernard Katz

Lecture 36 - End-Plate Potential and Synaptic Quanta

Lecture 37 - Eccles and Spinal motor neuron

Lecture 38 - Invertebrate simple systems: Aplysia

Lecture 39 - Other studies of sensory responses

Lecture 40 - Legacy of Golgi and Ramo`n y Cajal

Lecture 41 - Dynamic polarization of Neuron

Lecture 42 - Modern Research

Lecture 43 - Synaptic Integration and Action Potential Initiation

Lecture 44 - Active properties of dendrites

Lecture 45 - Dendritic dominance

Lecture 46 - Dendritic spines

Lecture 47 - Rethinking the concept of Neuron Doctrine

Lecture 48 - Muscle spindles

Lecture 49 - Spinal cord pathways

Lecture 50 - Retinal Processing

Lecture 51 - Keffler Hartline

Lecture 52 - Stephen Kuffler and Horace Barlow

Lecture 53 - Expansion of the Reflex concept

Lecture 54 - Central Pptern genrators

Lecture 55 - The cortical column

Lecture 56 - Vernon Mountcastle

Lecture 57 - Central Visual Processing

Lecture 58 - Central Visual Processing and Feature Detectors

Lecture 59 - Intracellular recordings from the brain - Part 1

Lecture 60 - Intracellular recordings from the brain - Part 2

Lecture 61 - Two motor systems

Lecture 62 - Auditory cortex and The pattern theory of olfaction

Lecture 63 - Arousal and Reticular activating system

Lecture 64 - Sleep and Rapid Eye Movements

- Lecture 65 - Operant Conditioning by brain stimulation
- Lecture 66 - Hypothalamus and Feeding Behavior
- Lecture 67 - Brain as a gland
- Lecture 68 - Hypothalamic-Neurohypophyseal System
- Lecture 69 - Hypothalamic-Adenohypophyseal System
- Lecture 70 - Founding Modern Neuroanatomy
- Lecture 71 - Psychology and Ethology
- Lecture 72 - Karl Lashley
- Lecture 73 - Donald Hebb
- Lecture 74 - Limbic system- Limbic Lobe and Papez Circuit
- Lecture 75 - Limbic system-Kluver-Bucy Syndrome
- Lecture 76 - The Limbic system and Amygdala
- Lecture 77 - The Hippocampus and Patient H.M
- Lecture 78 - Brenda Milner
- Lecture 79 - Neurology: Foundations of Brain Imaging
- Lecture 80 - The Neurological unit of the Boston City Hospital
- Lecture 81 - Derek Denny-Brown, Raymond Adams and C. Miller Fisher
- Lecture 82 - Montreal Neurological Institute
- Lecture 83 - Cerebral Circulation
- Lecture 84 - Spreading depression of Leo and Migraine
- Lecture 85 - The Eradication of Polio
- Lecture 86 - Origin of Neurosurgery
- Lecture 87 - Harvey Cushing
- Lecture 88 - Pituitary Surgery
- Lecture 89 - Stereotaxy
- Lecture 90 - Epilepsy
- Lecture 91 - Psychosurgery
- Lecture 92 - Antipsychotic Drugs
- Lecture 93 - Reserpine
- Lecture 94 - Monoamine Oxidase Inhibitors
- Lecture 95 - Lithium
- Lecture 96 - Benzodiazepines
- Lecture 97 - Stress

Lecture 1 - Basic concepts in microscopy - 1

Lecture 2 - Basic concepts in microscopy - 2

Lecture 3 - Dark-field and phase contrast microscopy

Lecture 4 - Differential interference contrast and polarization

Lecture 5 - Fluorescence and confocal microscopy

Lecture 6 - Transmission electron microscopy

Lecture 7 - Transmission electron microscopy cont. and scanning electron microscopy

Lecture 8 - Basic concepts - 1

Lecture 9 - Basic concepts - 2

Lecture 10 - GM counting and Scintillation counting

Lecture 11 - Scintillation counting continued

Lecture 12 - Autoradiography and RIA

Lecture 13 - Safety aspects and applications

Lecture 14 - Introduction and Basic concepts in chromatography - 1

Lecture 15 - Basic concepts in chromatography - 2

Lecture 16 - Low-pressure liquid chromatography (LPLC) and high performance liquid chromatography (HPLC)

Lecture 17 - Ion-exchange chromatography

Lecture 18 - Gel-filtration chromatography

Lecture 19 - Affinity chromatography

Lecture 20 - Gas-liquid chromatography

Lecture 21 - Basic concepts in electrophoresis

Lecture 22 - Horizontal and vertical gel electrophoresis

Lecture 23 - Native gel electrophoresis and SDS-PAGE

Lecture 24 - Isoelectric focusing (IEF), 2-D gel electrophoresis and protein detection methods

Lecture 25 - Electrophoresis of nucleic acids

Lecture 26 - Immunoelectrophoresis and capillary electrophoresis

Lecture 27 - Introduction and Basic Concepts - 1

Lecture 28 - Basic concepts - 2

Lecture 29 - Types of centrifuges and analytical ultracentrifugation method

Lecture 30 - Separation methods in preparative ultracentrifuges

Lecture 31 - Types of rotors

[Lecture 32 - Types of rotors cont. and care of rotors](#)

[Lecture 33 - Introduction and basic concepts](#)

[Lecture 34 - UV-Visible spectroscopy](#)

[Lecture 35 - Infrared and fluorescence spectroscopy](#)

[Lecture 36 - Circular dichroism \(CD\) spectroscopy](#)

[Lecture 37 - Nuclear magnetic resonance \(NMR\) spectroscopy and X-ray crystallography](#)

[Lecture 38 - Atomic spectroscopy and mass spectrometry](#)

[Lecture 39 - Polymerase chain reaction\(PCR\)](#)

[Lecture 40 - DNA sequencing methods](#)

[Lecture 41 - Enzyme linked immunosorbent assay \(ELISA\)](#)

Lecture 1 - Introduction to Nano

Lecture 2 - Nano-Biomimicry

Lecture 3 - Synthesis of nanomaterials by Physical and Chemical Methods

Lecture 4 - Synthesis of nanomaterials by Biological Methods

Lecture 5 - Characterisation of Nanomaterials

Lecture 6 - DNA Nanotechnology

Lecture 7 - Protein and Glyco Nanotechnology

Lecture 8 - Lipid Nanotechnology

Lecture 9 - Bio-Nanomachines

Lecture 10 - Carbon nanotubes and Its Bio-Applications

Lecture 11 - Nanomaterials for Cancer Diagnosis

Lecture 12 - Nanomaterials for Cancer therapy

Lecture 13 - Nanotechnology in Tissue Engineering

Lecture 14 - Nano artificial cells

Lecture 15 - Nanotechnology in Organ Printing

Lecture 16 - Nanotechnology in Point-of-Care Diagnostics

Lecture 17 - Nano-Pharmacology and Drug Targeting

Lecture 18 - Cellular uptake mechanisms of nanomaterials

Lecture 19 - In vitro Methods to study antibacterial and anticancer properties of nanomaterials

Lecture 20 - Nanotoxicology

- Lecture 1 - Life Cycle of an Angiosperm
- Lecture 2 - Characteristics of Plant Growth and Development - I
- Lecture 3 - Characteristics of Plant Growth and Development - II
- Lecture 4 - Molecular Genetics of Plant Development - I
- Lecture 5 - Molecular Genetics of Plant Development - II
- Lecture 6 - Molecular Genetics of Plant Development - III
- Lecture 7 - Molecular Genetics of Plant Development - IV
- Lecture 8 - Molecular Genetics of Plant Development (Continued...) - I
- Lecture 9 - Molecular Genetics of Plant Development (Continued...) - II
- Lecture 10 - Molecular Genetics of Plant Development (Continued...) - III
- Lecture 11 - Root Development
- Lecture 12 - Root Development (Continued...)
- Lecture 13 - Root Development (Vascular Development)
- Lecture 14 - Root Branching: Lateral Root Development
- Lecture 15 - Shoot Development: SAM Maintenance
- Lecture 16 - Shoot Development: Organogenesis
- Lecture 17 - Shoot Development: Leaf Development
- Lecture 18 - Shoot Development: Flowering
- Lecture 19 - Cell-Cell Communication During Plant Development
- Lecture 20 - Techniques Used in Lab

Lecture 1 - Introduction: Why to Study Structural Biology

Lecture 2 - Introduction to Biological Macromolecules

Lecture 3 - Introduction: Decoding Biological Macromolecules

Lecture 4 - Introduction: Genome Sequencing

Lecture 5 - Introduction: Post Genomic Era

Lecture 6 - Amino acids and their properties

Lecture 7 - Protein: Protein Chemistry, Chirality, Peptide bond and Levels of protein structures

Lecture 8 - Protein: Dihedral angles, Peptide bond and Ramachandran Plot

Lecture 9 - Protein: Super Secondary Structures, Motif, Domains, Non-covalent interactions

Lecture 10 - Protein: Folding of Protein, Thermodynamics and Kinetics of protein folding, Characterization of Proteins

Lecture 11 - Introduction to Structural Biology Techniques - Part I

Lecture 12 - Introduction to Structural Biology Techniques - Part II

Lecture 13 - X-ray Crystallography: Crystallization - Part I

Lecture 14 - X-ray Crystallography: Crystallization - Part II

Lecture 15 - X-ray Crystallography: Crystal Mounting

Lecture 16 - X-ray Crystallography: Production of X-ray and its properties

Lecture 17 - X-ray Crystallography: Journey to 3D land

Lecture 18 - X-ray Crystallography: Crystal Symmetry

Lecture 19 - X-ray Crystallography: Instrumentation in X-ray Crystallography

Lecture 20 - X-ray Crystallography: Data collection and processing

Lecture 21 - X-ray Crystallography: Data Analysis - Part I

Lecture 22 - X-ray Crystallography: Data Analysis - Part II

Lecture 23 - X-ray Crystallography: Phase Problem - Part I

Lecture 24 - X-ray Crystallography: Phase Problem - Part II

Lecture 25 - X-ray Crystallography: Refinement and Structure deposition to PDB

Lecture 26 - Introduction to Spectroscopy and NMR

Lecture 27 - Basic Principles of NMR and Instrumentation

Lecture 28 - NMR Sample Preparation and Chemical Shift related concepts

Lecture 29 - Factors effecting NMR Spectra (1D and 2D)

Lecture 30 - 2D and 3D NMR Spectroscopy focusing on protein structure

Lecture 31 - Introduction to Spectroscopy

Lecture 32 - UV-Vis and CD spectroscopy

Lecture 33 - Fluorescence Spectroscopy and Green Fluorescence Protein (GFP)

Lecture 34 - Infrared and Raman Spectroscopy for protein

Lecture 35 - Raman Spectroscopy, Raman Microscopy and Raman Crystallography for studying protein

Lecture 36 - Introduction to Microscopy

Lecture 37 - Functioning details of Cryo Electron Microscopy (Cryo EM)

Lecture 38 - Cryo Electron Microscopy: Data Collection and Analysis

Lecture 39 - A concise story of advancement Cryo-EM

Lecture 40 - Protein Data Bank

Lecture 41 - History of Molecular Visualizations of Biological Macromolecules

Lecture 42 - Description of structure related files (.pdb, .mmCIF, .mtz, etc.)

Lecture 43 - Demonstration of COOT

Lecture 44 - 3D visualization using Pymol

Lecture 45 - Demonstration of Pymol

Lecture 46 - Why we need MD Simulation

Lecture 47 - Molecular Dynamic Simulation Process - Part I

Lecture 48 - Molecular Dynamic Simulation Process - Part II

Lecture 49 - Molecular Dynamic Simulation Process - Part III

Lecture 50 - Application of Molecular Dynamic Simulation

Lecture 51 - What, How and Which of Protein Engineering

Lecture 52 - How to make logical Protein Engineering: Process of Rational design

Lecture 53 - Success story of Rational Protein designing: Focusing on De Novo Process

Lecture 54 - Designing Protein by mimicking nature: Process of Directed Evolution

Lecture 55 - Achievement, Challenges, and Future direction in the field of Protein Engineering

Lecture 56 - Introduction to Structure Based Drug Discovery (SBDD)

Lecture 57 - Rational Drug Discovery

Lecture 58 - Docking Based Virtual Screening: Progress, Challenges and Future perspective

Lecture 59 - What makes a small molecule an ideal drug: Developing in silico ADMETox Model

Lecture 60 - Structure Based Drug Discovery: Case study and Conclusion

Lecture 1 - Introduction to Learning and Memory - I : Historical perspective

Lecture 2 - Introduction to Learning and Memory - II : Classification

Lecture 3 - Associative Learning I : Rules of Associative learning

Lecture 4 - Associative learning II : Garcia and Koelling's Experiment, Kamin's Blocking Experiment

Lecture 5 - Introduction to the Rescorla Wagner Model

Lecture 6 - Application of Rescorla Wagner Model - I

Lecture 7 - Application of Rescorla Wagner Model - II

Lecture 8 - Application of Rescorla Wagner Model - III

Lecture 9 - Application of Rescorla Wagner Model - IV

Lecture 10 - Limitations of Rescorla Wagner Model

Lecture 11 - Introduction of Reinforcement Learning - I : Thorndike's view, Tolman's views, Skinner Box

Lecture 12 - Introduction of Reinforcement Learning - II : Classification, Thorndike's view, Tolman's views, Skinner Box (Continued...)

Lecture 13 - Introduction of Reinforcement Learning - III : Understanding scheduling of reinforcers in operant conditioning

Lecture 14 - Sign Tracking vs Goal Oriented/Tracking; Linking complex behaviors to simple molecules

Lecture 15 - Sign Tracking vs Goal Oriented; Learning Linking complex behaviors to simple molecules - II

Lecture 16 - Memory in Molecular Terms - I : Protein synthesis in memory consolidation

Lecture 17 - Memory in Molecular Terms - II : Long term potentiation

Lecture 18 - Memory in Molecular Terms - III : Properties of a memory molecule

Lecture 19 - Memory in Molecular Terms - IV : Remote memory and its characteristics

Lecture 20 - Memory in Molecular Terms - V : Selective labelling of memory encoding neurons and their manipulation

- Lecture 1 - Drug Delivery Introduction and Pharmacokinetics
- Lecture 2 - Pharmacokinetics (Continued...)
- Lecture 3 - Pro-drugs and Polymers Introduction
- Lecture 4 - Polymers - Synthesis
- Lecture 5 - Polymers - Properties
- Lecture 6 - Biomedical Polymers
- Lecture 7 - Biodegradable Polymers and Polymer Drug Conjugates - I
- Lecture 8 - Polymer Drug Conjugates - II
- Lecture 9 - Research Paper Discussion and Diffusion Controlled Systems
- Lecture 10 - Controlled Release: Reservoir System - I
- Lecture 11 - Controlled Release: Reservoir Systems and Non-erodible Systems
- Lecture 12 - Controlled Release: Non-erodible Systems and Erodible systems
- Lecture 13 - Math Exercise
- Lecture 14 - Hydrogels - I
- Lecture 15 - Hydrogels - II
- Lecture 16 - Hydrogels - III
- Lecture 17 - Hydrogels - IV
- Lecture 18 - Nano and Micro-particles - I
- Lecture 19 - Nano and Micro-particles - II
- Lecture 20 - Nano and Micro-particles - III
- Lecture 21 - Nano and Micro-particles - IV
- Lecture 22 - Nano and Micro-particles - V
- Lecture 23 - Nano and Micro-particles - VI
- Lecture 24 - Nano and Micro-particles - VII
- Lecture 25 - Protein Adsorption - I
- Lecture 26 - Protein Adsorption - II
- Lecture 27 - Protein Adsorption - III
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Lecture 16 - Catalyst deactivation - IV : Reactor design

Lecture 17 - Diffusional effects: Introduction

Lecture 18 - Internal diffusion effects: Model development

Lecture 19 - Non-dimensionalization: Thiele modulus

Lecture 20 - Concentration profile

Lecture 21 - Internal effectiveness factor - I

Lecture 22 - Internal effectiveness factor - II

Lecture 23 - Internal effectiveness factor - III: Exothermic and endothermic reactions

Lecture 24 - Falsification of kinetics

Lecture 25 - External mass transport limitations: Mass transfer coefficient

Lecture 26 - Estimation of mass transfer coefficient

Lecture 27 - Mass transfer to a single particle with reaction

Lecture 28 - Packed-bed reactor design: External mass transfer limitations

Lecture 29 - Mass transfer coefficient in Packed-beds

Lecture 30 - Estimation of conversion in Packed-bed reactor: Example problem

Lecture 31 - Overall effectiveness factor - I

- Lecture 32 - Overall effectiveness factor - II
- Lecture 33 - Identification of internal diffusion and reaction-limited regimes
- Lecture 34 - Packed-bed reactor design
- Lecture 35 - Generalized criterion for diffusion and reaction-limited conditions
- Lecture 36 - Network of first order reactions
- Lecture 37 - Use of experimental data
- Lecture 38 - Packed-bed reactor design: External and Internal resistances
- Lecture 39 - Fluidized bed reactor design - I
- Lecture 40 - Fluidized bed reactor design - II
- Lecture 41 - Fluidized bed reactor design - III
- Lecture 42 - Fluidized bed reactor design - IV
- Lecture 43 - Fluid-solid noncatalytic reactions - I
- Lecture 44 - Fluid-solid noncatalytic reactions - II
- Lecture 45 - Fluid-solid noncatalytic reactions - III
- Lecture 46 - Fluid-solid noncatalytic reactions - IV
- Lecture 47 - Fluid-solid noncatalytic reactions - V
- Lecture 48 - Fluid-solid noncatalytic reactions - VI
- Lecture 49 - Residence time distribution (RTD): Introduction
- Lecture 50 - RTD: Non-ideal reactors
- Lecture 51 - Measurement of RTD - I
- Lecture 52 - Measurement of RTD - II
- Lecture 53 - RTD function
- Lecture 54 - Properties of RTD function
- Lecture 55 - Reactor diagnostics and troubleshooting - I
- Lecture 56 - Reactor diagnostics and troubleshooting - II
- Lecture 57 - Modeling nonideal reactors - I
- Lecture 58 - Modeling nonideal reactors - II
- Lecture 59 - Non-ideal reactors: Zero parameter models - I
- Lecture 60 - Non-ideal reactors: Zero parameter models - II

- Lecture 1 - Motivation for process control
- Lecture 2 - Functions of process control system
- Lecture 3 - Common control strategies
- Lecture 4 - Components of process control system
- Lecture 5 - Introduction to process dynamics
- Lecture 6 - First principle dynamic models
- Lecture 7 - Empirical and gray box models
- Lecture 8 - Degree of freedom analysis
- Lecture 9 - Introduction to first order dynamical systems
- Lecture 10 - Linearization of process dynamics
- Lecture 11 - Response to step input
- Lecture 12 - Response to sinusoidal input
- Lecture 13 - Introduction to second order dynamical systems
- Lecture 14 - Examples of second order dynamical systems
- Lecture 15 - Response to step input
- Lecture 16 - Effect of damping coefficient
- Lecture 17 - Higher order dynamics
- Lecture 18 - Approximation as FOPDT model
- Lecture 19 - Numerator dynamics
- Lecture 20 - Prediction of step response
- Lecture 21 - Block diagram representation
- Lecture 22 - ON-OFF control
- Lecture 23 - Proportional control
- Lecture 24 - Proportional-Integral control
- Lecture 25 - PID control
- Lecture 26 - Limitations of PID controllers
- Lecture 27 - Stability of dynamical processes
- Lecture 28 - Laplace domain analysis - Part I
- Lecture 29 - Laplace domain analysis - Part II
- Lecture 30 - Frequency response
- Lecture 31 - Frequency domain analysis

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[Lecture 33 - Selection problem](#)

[Lecture 34 - Criteria-based controller tuning](#)

[Lecture 35 - Heuristics-based controller tuning](#)

[Lecture 36 - Direct synthesis-based controller tuning](#)

[Lecture 37 - Frequency response-based controller tuning](#)

[Lecture 38 - Cascade control](#)

[Lecture 39 - Split range control and override control](#)

[Lecture 40 - Auctioneering, ratio and inferential control](#)

[Lecture 41 - Openloop control and Internal model control](#)

[Lecture 42 - Dynamic Matrix and Model predictive control](#)

[Lecture 43 - Introduction to multivariable control](#)

[Lecture 44 - Input-output pairing](#)

[Lecture 45 - Tuning of multi-loop SISO controller](#)

[Lecture 46 - Introduction to batch process control](#)

[Lecture 47 - Programmable logic control](#)

[Lecture 48 - Batch to batch control](#)

Lecture 1 - Introduction

Lecture 2 - Coupled, linear, spring-mass systems

Lecture 3 - Coupled, linear, spring-mass systems (Continued...)

Lecture 4 - Coupled, linear, spring-mass systems (Continued...)

Lecture 5 - Coupled, linear, spring-mass system: continuum limit

Lecture 6 - Normal modes of a string fixed at both ends

Lecture 7 - Vibrations of clamped membranes

Lecture 8 - Vibrations of clamped membranes (Continued...)

Lecture 9 - Introduction to Jacobian elliptic functions

Lecture 10 - The non-linear pendulum

Lecture 11 - The non-linear pendulum (Continued...)

Lecture 12 - Time period of the non-linear pendulum

Lecture 13 - Introduction to perturbation methods

Lecture 14 - Perturbation methods (Continued...)

Lecture 15 - Non-dimensionalisation

Lecture 16 - Perturbative solution to the projectile equation

Lecture 17 - Perturbative solution to the nonlinear pendulum

Lecture 18 - Lindstedt-Poincare technique

Lecture 19 - Method of multiple scales

Lecture 20 - Method of multiple scales (Continued...)

Lecture 21 - Multiple scale analysis for damped-harmonic oscillator

Lecture 22 - Duffing equation using multiple scales

Lecture 23 - Duffing equation (Continued...)

Lecture 24 - Kapitza pendulum

Lecture 25 - Introduction to Floquet theory

Lecture 26 - Floquet theorem (Continued...)

Lecture 27 - Floquet analysis of the Mathieu equation

Lecture 28 - Introduction to waves on an interface

Lecture 29 - Linearized wave equations in deep water

Lecture 30 - Linearized wave equations in deep water: dispersion relation

Lecture 31 - Linearised deep-water surface gravity waves (Continued...)

- Lecture 32 - Standing and travelling waves in deep water
- Lecture 33 - Cauchy-Poisson initial value problem for surface-gravity waves in deep water
- Lecture 34 - Cauchy-Poisson problem (Continued...)
- Lecture 35 - Cauchy-Poisson problem in cylindrical geometry
- Lecture 36 - Cauchy-Poisson problem in cylindrical geometry (Continued...)
- Lecture 37 - Group-velocity and the Cauchy-Poisson problem
- Lecture 38 - Cauchy-Poisson problem for delta function initial condition
- Lecture 39 - Cauchy-Poisson problem for delta function initial condition (Continued...)
- Lecture 40 - Capillary-gravity waves
- Lecture 41 - Waves on a pool of finite depth
- Lecture 42 - Axisymmetric Cauchy-Poisson problem visualisation: the pebble in the deep pond problem
- Lecture 43 - Rayleigh-Plateau capillary instability
- Lecture 44 - Rayleigh-Plateau capillary instability (Continued...)
- Lecture 45 - Rayleigh-Plateau capillary instability on thin film coating a rod
- Lecture 46 - Rayleigh-Plateau capillary instability of a cylindrical air column in a liquid
- Lecture 47 - Mechanism of the Rayleigh-Plateau instability
- Lecture 48 - Shape oscillations of a spherical interface
- Lecture 49 - Shape oscillations of a spherical interface (Continued...)
- Lecture 50 - Shape oscillations of a spherical interface (Continued...)
- Lecture 51 - Analysis of $l=0$ and $l=1$ modes for a spherical drop
- Lecture 52 - Faraday waves on an interface - stability of time dependent base states
- Lecture 53 - Mathieu equation for Faraday waves
- Lecture 54 - Applications of Faraday waves - atomisation and spray formation
- Lecture 55 - Waves and instability on density stratified shear flows - the KH model
- Lecture 56 - Limits of KH dispersion relation: Rayleigh-Taylor instability
- Lecture 57 - KH dispersion relation : model of wind wave generation
- Lecture 58 - Helmholtz instability of a vortex sheet and summary
- Lecture 59 - Derivation of the Stokes travelling wave
- Lecture 60 - Derivation of the Stokes travelling wave (Continued...)
- Lecture 61 - Derivation of the Stokes travelling wave (Continued...)

Lecture 1 - Properties of Hydrogen

Lecture 2 - Status of Hydrogen Supply and Demand

Lecture 3 - Methods of Hydrogen Production

Lecture 4 - Steam Methane Reforming - Part 1

Lecture 5 - Steam Methane Reforming - Part 2

Lecture 6 - Steam Reforming of Higher Hydrocarbons

Lecture 7 - Tutorial-1

Lecture 8 - Advanced Methods of Steam Reforming

Lecture 9 - Partial Oxidation Method for Hydrogen Production

Lecture 10 - Autothermal Reforming

Lecture 11 - Combined, Dry, Bi and Tri Reforming

Lecture 12 - Reforming using Alternate Energy Sources

Lecture 13 - Tutorial-2

Lecture 14 - Hydrogen Production by Methane Decomposition

Lecture 15 - Hydrogen Production from Biomass - Part 1

Lecture 16 - Hydrogen Production from Biomass - Part 2

Lecture 17 - Hydrogen Production from Biomass - Part 3

Lecture 18 - Hydrogen Production from Coal

Lecture 19 - Tutorial-3

Lecture 20 - Hydrogen Separation and Purification - Part 1

Lecture 21 - Hydrogen Separation and Purification - Part 2

Lecture 22 - Thermochemical Cycles for Hydrogen Production

Lecture 23 - Electrolysis of Water for Hydrogen Production

Lecture 24 - Fundamental of Electrolysis of Water

Lecture 25 - Electrolytic Cell Components and Electrolyzer stack

Lecture 26 - Different Types of Electrolyzer Technologies

Lecture 27 - Photoelectrochemical Hydrogen Production

Lecture 28 - Tutorial-4

Lecture 29 - Technical Comparison of Various Hydrogen Production Routes

Lecture 30 - Economics and Status of Various Hydrogen Production Routes

Lecture 31 - Introduction to Hydrogen Storage

[Lecture 32 - Underground Hydrogen Storage](#)

[Lecture 33 - Fundamentals of Hydrogen Compression and Expansion](#)

[Lecture 34 - Thermodynamics of Hydrogen Compression - Part 1](#)

[Lecture 35 - Thermodynamics of Hydrogen Compression - Part 2](#)

[Lecture 36 - Reciprocating and Diaphragm compressors for Hydrogen Compression](#)

[Lecture 37 - Linear and Liquid Hydrogen Compressors](#)

[Lecture 38 - Cryogenic and Metal Hydride based Hydrogen Compressors](#)

[Lecture 39 - Electrochemical and Adsorption based Compressors](#)

[Lecture 40 - Compressed Hydrogen Tanks](#)

[Lecture 41 - Tutorial-5](#)

[Lecture 42 - Hydrogen Liquefaction](#)

[Lecture 43 - Liquid State Hydrogen Storage](#)

[Lecture 44 - Fundamentals of Adsorption based Materials for Hydrogen Storage](#)

[Lecture 45 - Adsorption based Solid State Hydrogen Storage Materials](#)

[Lecture 46 - Metal Hydrides for Solid State Hydrogen Storage - Part 1](#)

[Lecture 47 - Fundamentals of Metal hydrides for Solid State Hydrogen Storage - Part 1](#)

[Lecture 48 - Fundamentals of Metal Hydrides for Solid State Hydrogen Storage - Part 2](#)

[Lecture 49 - Different Types of Hydrides for Hydrogen Storage](#)

[Lecture 50 - Tailoring Metal Hydrides for Practical Applications: Nanostructure - Part 1](#)

[Lecture 51 - Tailoring Metal Hydrides for Practical Applications: Nanostructure - Part 2](#)

[Lecture 52 - MH System Design and Experimental Facilities on SolidState Hydrogen Storage](#)

[Lecture 53 - Tutorial-6 \(MH systems design\)](#)

[Lecture 54 - Novel Materials and Overall Storage](#)

[Lecture 55 - Overview of Storage Methods and Economics](#)

[Lecture 56 - Hydrogen Transportation via H₂ Pipelines](#)

[Lecture 57 - Other Options for Long Distance Hydrogen Transmission](#)

[Lecture 58 - Hydrogen Transport via Road](#)

[Lecture 59 - Hydrogen Refuelling Stations](#)

[Lecture 60 - Use of Hydrogen in Internal Combustion Engines - Part 1](#)

[Lecture 61 - Use of Hydrogen in Internal Combustion Engines - Part 2](#)

[Lecture 62 - Use of Hydrogen in Fuel Cells](#)

[Lecture 63 - Hydrogen Sensing - Part 1](#)

[Lecture 64 - Hydrogen Sensing - Part 2](#)

[Lecture 65 - Properties of Hydrogen Associated with Accidents](#)

[Lecture 66 - Classification of Hydrogen related Hazards](#)

[Lecture 67 - Compressed and Liquid Hydrogen Related Hazards](#)

[Lecture 68 - Regulations, Codes and Standards](#)

[Lecture 69 - Utilisation in Different Sectors, Global Status and Future Directions](#)

Lecture 1 - Stirling's Approximation

Lecture 2 - Fourier Transforms and characteristic function

Lecture 3 - Dirac Delta function

Lecture 4 - Applications of delta function and Generating functions

Lecture 5 - Laplace Transforms and Convolution theorem

Lecture 6 - Generating function for discrete variables and Binomial distribution

Lecture 7 - Bernoulli and Poisson distributions

Lecture 8 - Waiting time distributions; Gaussian approximation to Poisson distribution

Lecture 9 - Introduction to Central Limit Theorem

Lecture 10 - Proof of Central Limit Theorem (CLT)

Lecture 11 - Universality of Normal distribution and Exceptions

Lecture 12 - Introduction to Random Walk: Extension of Central Limit Theorem

Lecture 13 - Random walk and Diffusion coefficient: Conditional and Transition

Lecture 14 - Characteristics of Stochastic Phenomena: Markov Processes

Lecture 15 - Propagating Markov processes via Transition Probability Matrix with

Lecture 16 - Chapman-Kolmogorov Equation for Multistep Transition probability and solution

Lecture 17 - Transient solutions and Continuous time Markov process

Lecture 18 - Exact solution to Symmetric (or unbiased) one-dimensional Random walk (1-D RW)

Lecture 19 - Properties of the solution for 1-D unbiased RW

Lecture 20 - 1-D unbiased RW: Asymptotic form of occupancy probability and transition

Lecture 21 - Solution to the problem of 1-D Random Walk with Bias

Lecture 22 - Generalized Random Walk with Bias and Pausing

Lecture 23 - Effect of Pausing on Mean and Variance of Random walk

Lecture 24 - Random-walk in the presence of reflecting barrier

Lecture 25 - Boundary conditions for reflected Random-Walk and formulating absorbing

Lecture 26 - The survival probability and first-passage time distribution for Random walker

Lecture 27 - Random Walk with Bias and Absorber

Lecture 28 - Drift and Survival probability for Random walk with bias and absorber

Lecture 29 - Introduction to gambler's ruin problem

Lecture 30 - Solution for ultimate winning probability in Gambler's ruin problem

Lecture 31 - Solution to gambler's ruin problem with site dependent jump probabilities

- Lecture 32 - Fourier transform method of solving lattice Random walks
- Lecture 33 - Two and higher dimensional Random walks
- Lecture 34 - Formulating the problem of Probability of Return to the origin
- Lecture 35 - Relationship between occupancy probability and first-time-return probability
- Lecture 36 - Proof of Polya's theorem on the probability of return
- Lecture 37 - Return probability estimates in various dimensions and effect of bias in 1-D
- Lecture 38 - Dependence of first time return probability (F_k) on steps
- Lecture 39 - Equilibrium solutions in lattice random walk models
- Lecture 40 - Equilibrium solution to Ehrenfest's flea model
- Lecture 41 - Differential equation formulation of stochastic phenomena
- Lecture 42 - Derivation of Fokker-Planck equation
- Lecture 43 - Generalized transition probability functions for Fokker-Planck equation
- Lecture 44 - Solution to 1-D Fokker-Planck equation for free particle: Method of Fourier
- Lecture 45 - General non-gaussian solution to translationally invariant Chapman-Kolmogorov
- Lecture 46 - Cauchy distribution, power-law and other non-gaussian solutions
- Lecture 47 - Wiener process and solution to absorbing barrier problems from Fokker-Planck
- Lecture 48 - Application of Fourier Sine transform for single absorber problem
- Lecture 49 - Setting up Langevin equation for velocity fluctuations of Brownian particles
- Lecture 50 - Understanding the origin of systematic and random parts of force from kinetic
- Lecture 51 - Kinetic derivation of a formula for delta-correlated random force
- Lecture 52 - Mean square velocity, thermal equilibrium and relationship between relaxation
- Lecture 53 - Velocity autocorrelation in Brownian motion
- Lecture 54 - Derivation of Stokes-Einstein relationship between diffusion coefficient and
- Lecture 55 - Alternative derivation of Stokes-Einstein relationship and Brownian motion with
- Lecture 56 - Numerical simulation of the Langevin equation
- Lecture 57 - Derivation of Klein-Kramers equation from Langevin equation for joint
- Lecture 58 - Illustrative solutions to the Klein-Kramers equation
- Lecture 59 - Numerical simulation: Sampling from general distributions and Central
- Lecture 60 - Numerical simulation of Random walk trajectories and method of solving Fokker

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NPTEL : Interfacial Engineering (Chemical Engineering)

Co-ordinators : Prof. A.N. Bhaskarwar

Lecture 1 - General Introduction Definitions

Lecture 2 - General Introduction, Definitions, Surface Tension

Lecture 3 - Surface Tension Free Energies and Adsorption

Lecture 4 - Properties over Curved Surfaces

Lecture 5 - Total Surface Energy

Lecture 6 - Interfacial Tension Entropy, Cohesion, Adhesion

Lecture 7 - Cohesion, Adhesion and Spreading

Lecture 8 - Spreading from Liquids and Solids

Lecture 9 - Spreading, Interfacial Tensions, Surface Tensions

Lecture 10 - Spreading, Contact Angles Free Energies

Lecture 11 - Spreading/Contact Angles Rough Surfaces, Free Energies

Lecture 12 - Spreading/Contact Angles Work of Adhesion, De-wetting

Lecture 13 - Work of Adhesion, Surface and Interfacial Tensions

Lecture 14 - Surface and Interfacial Tensions: Drop Weight and Wilhelmy Plate Methods

Lecture 15 - Surface and Interfacial Tensions: Wilhelmy Plate, Pendant Drop and Maximum Bubble Pressure Methods

Lecture 16 - Wetting Balance Method Spreading Coefficient Work of Adhesion Sessile Drop Method, Positive S

Lecture 17 - Indirect and Direct Methods for Positive S, Adhesion Energies Interfacial Potentials

Lecture 18 - Surface and Interfacial Potentials Distribution and Contact Potentials

Lecture 19 - Diffusion Potential Surface and Interfacial Potentials Components of Contact Potential

Lecture 20 - Electrically Charged Monolayers Gouy Theory

Lecture 21 - Equations of State, Cohesion Repulsion, Limiting Area

Lecture 22 - Condensed and Liquid Expanded Monolayers Phase Transformations

Lecture 23 - Films of Polymers Molecular Weight, Surface Viscosity Drag, Canal Method

Lecture 24 - Canal Method Joly's Semi-Empirical Correction Rotational Torsional Surface Viscometer Compressional Moduli

Lecture 25 - Magnitudes of Surface Compressional Moduli Surface Waves and Ripples

Lecture 26 - Surface waves and Ripples, Velocity Effect of Surface Tension and Surface Compressional Modulus Rates of adsorption and absorption Damping

Lecture 27 - Surface waves and ripples, velocity effect of surface tension and surface compressional modulus damping for clean and contaminated, surfaces, fiber from monolayers

Lecture 28 - Shear Elastic Moduli, Yield Stress Fibres from MLs, Surface Reactions

Lecture 29 - Surface Reactions, Comparison with Bulk-Phase Reactions Steric Factors, Inhibition

Lecture 30 - Hydrolyses of Esters by Alkali Acid or Enzyme Photochemical Reactions in Monolayers Polymerization in MLs,

Lactonization

Lecture 31 - Catalytic Effects Reactions in Emulsions Complex Formation

Lecture 32 - Complex Formation Penetration into Monolayers Thermodynamics of Penetration Adsorption from Vapour Phase Mass Transfer

Lecture 33 - Introductory Concepts Resistances and their Magnitudes Evaporation and its Retardation

Lecture 34 - Evaporation and its Retardation Resistances and their Analysis Diffusional Resistance in Gas Phase

Lecture 35 - Resistances in Liquid Phase and Interface and Their Importance Some Effects and Applications, Theory

Lecture 36 - Surface Instability Theories of Mass Transfer Experiments on static and Dynamic Systems

Lecture 37 - Colloids, Aerosols, Emulsions Foams, Coagulation Smoluchowski's Theory

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Lecture 1 - Flowsheet Synthesis - I

Lecture 2 - Flowsheet Synthesis - II

Lecture 3 - Mass Balance - I

Lecture 4 - Mass Balance - II

Lecture 5 - Mass and Energy Balance of Complete Flowsheet

Lecture 6 - Equipment Sizing and Costing

Lecture 7 - Economic Evaluation

Lecture 8 - Design of Batch Plants

Lecture 9 - Simulations for Process Flowsheet

Lecture 10 - Optimization Methods used for Designing

Lecture 11 - Heat Exchanger Network Design - 1

Lecture 12 - Heat Exchanger Network Design - 2

Lecture 13 - Geometric Methods for Reactor Network Synthesis

Lecture 14 - Optimization Methods for Process Design - 1

Lecture 15 - Optimization Methods for Process Design - 2

Lecture 16 - Quantifying Sustainability for Design

Lecture 17 - Process Network Analysis and Footprint Assessment

Lecture 18 - Energy, Exergy and Emergy

Lecture 19 - Ecosystems in Sustainability Assessment

NPTEL : Heat Transfer (Chemical Engineering)

Co-ordinators : Prof. A.K. Ghoshal

- Lecture 1 - Introduction to heat transfer
- Lecture 2 - General heat conduction equation
- Lecture 3 - One dimensional steady state conduction in rectangular coordinate
- Lecture 4 - One dimensional steady state conduction in cylindrical and spherical coordinate
- Lecture 5 - Critical and optimum insulation
- Lecture 6 - Extended surface heat transfer - 1
- Lecture 7 - Extended surface heat transfer - 2
- Lecture 8 - Analysis of lumped parameter model
- Lecture 9 - Transient heat flow in semi infinite solid
- Lecture 10 - Infinite body subjected to sudden convective
- Lecture 11 - Graphical solutions of unsteady state heat conduction problem
- Lecture 12 - Dimensional analysis for forced convection
- Lecture 13 - Dimensional analysis for free convection
- Lecture 14 - Heat transfer co-relations for laminar and internal flows
- Lecture 15 - Heat transfer co-relations for turbulent and internal flows
- Lecture 16 - Co-relation for turbulent and external flows
- Lecture 17 - Heat transfer co-relations for flow across tube banks
- Lecture 18 - Momentum and heat transfer analogies
- Lecture 19 - Boundary layer heat transfer
- Lecture 20 - Boundary layer equations
- Lecture 21 - Approximate analysis in boundary layer
- Lecture 22 - Theoretical concepts of natural / free convection heat transfer
- Lecture 23 - Empirical relations for free convection heat transfer
- Lecture 24 - Condensation heat transfer over vertical plate
- Lecture 25 - Condensation heat transfer for various conditions and geometries
- Lecture 26 - Fundamentals of boiling heat transfer
- Lecture 27 - Boiling heat transfer co-relations
- Lecture 28 - Classification of heat exchangers
- Lecture 29 - Various types of shell and tube heat exchangers
- Lecture 30 - Various types of compact heat exchangers
- Lecture 31 - Effectiveness-NTU, method of heat exchanger analysis

[Lecture 32 - Design of double pipe heat exchanger](#)

[Lecture 33 - Design of shell and tube heat exchanger](#)

[Lecture 34 - Introduction to evaporation and evaporators](#)

[Lecture 35 - Evaporation principles and evaporator performance](#)

[Lecture 36 - Evaporator calculations](#)

[Lecture 37 - Introduction to radiation heat transfer](#)

[Lecture 38 - Radiation intensity and radiation view factor](#)

[Lecture 39 - Radiation heat exchange](#)

[Lecture 40 - Radiation shield and gas radiation](#)

NPTEL : Mass Transfer Operations I (Chemical Engineering)

Co-ordinators : Dr. B. Mandal

- Lecture 1 - Introduction to Mass Transfer
- Lecture 2 - Molecular Diffusion
- Lecture 3 - Fick's Law of Diffusion
- Lecture 4 - Steady state molecular diffusion in fluids - Part I
- Lecture 5 - Steady state molecular diffusion in fluids - Part II
- Lecture 6 - Diffusion coefficient: Measurement and Prediction - Part I
- Lecture 7 - Diffusion Coefficient: Measurement and Prediction - Part II
- Lecture 8 - Multicomponent Diffusion and Diffusivity in Solids
- Lecture 9 - Concept of Mass Transfer Coefficient
- Lecture 10 - Dimensionless Groups and Co-relations for Convective
- Lecture 11 - Mass Transfer co-efficient in Laminar Flow Condition
- Lecture 12 - Boundary Layer Theory and Film Theory in Mass Transfer
- Lecture 13 - Mass Transfer Coefficients in Turbulent Flow
- Lecture 14 - Interphase Mass Transfer and Mass Transfer Theories - Part I
- Lecture 15 - Interphase Mass Transfer and Mass Transfer Theories - Part II
- Lecture 16 - Interphase Mass Transfer and Mass Transfer Theories - Part III
- Lecture 17 - Agitated and Sparged Vessels
- Lecture 18 - Tray Column - Part I
- Lecture 19 - Tray Column - Part II
- Lecture 20 - Packed Tower
- Lecture 21 - Introduction to Absorption and Solvent selection
- Lecture 22 - Packed Tower Design - Part I
- Lecture 23 - Packed Tower Design - Part II
- Lecture 24 - Packed Tower Design - Part III
- Lecture 25 - Mass Transfer Coefficients Correlation and HETP Concept
- Lecture 26 - Tray Tower Design and Introduction to Multicomponent System
- Lecture 27 - Introduction to Distillation and Phase diagrams
- Lecture 28 - Azeotropes and Enthalpy Concentration Diagrams
- Lecture 29 - Flash Distillation
- Lecture 30 - Batch and Steam Distillation
- Lecture 31 - Fractional Distillation

[Lecture 32 - Fractional Distillation: McCabe Thiele Method](#)

[Lecture 33 - Fractional Distillation: Minimum Reflux and Pinch Point](#)

[Lecture 34 - Fractional Distillation: Subcooled Reflux ,Tray Efficiency and Use of Open Steam](#)

[Lecture 35 - Fractional Distillation: Multiple Feeds and Side Stream](#)

[Lecture 36 - Multistage Batch Distillation with Reflux](#)

[Lecture 37 - Fractional Distillation: Ponchan and Savarit Method](#)

[Lecture 38 - Ponchan and Savarit Method and Packed Tower Distillation](#)

[Lecture 39 - Multicomponent Distillation](#)

Lecture 1 - General Introduction to the Course and Syllabus

Lecture 2 - Hierarchical Approach to Process Design - I

Lecture 3 - Hierarchical Approach to Process Design - Examples

Lecture 4 - Input Information and Design Aspects of Batch vs. Continuous Process

Lecture 5 - Input / Output Structure of Flowsheet - Part I

Lecture 6 - Input / Output Structure of Flowsheet - Part II

Lecture 7 - Input / Output Structure of Flowsheet - Part III and Recycle Structure of Flowsheet - Part I

Lecture 8 - Recycle Structure of Flowsheet - Part II

Lecture 9 - Recycle Structure of Flowsheet - Part III

Lecture 10 - Recycle Structure of Flowsheet - Part IV and Tutorial - Part I

Lecture 11 - Tutorial - Part II

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- Lecture 9 - Porous and non-porous membranes, characterization of porous membranes and MF membrane
- Lecture 10 - MF membrane characterization: Bubble point, Mercury intrusion, Permeability method
- Lecture 11 - UF membrane characterization: Gas adsorption-desorption, Thermoporometry, MWCO method
- Lecture 12 - Passive transport, active transport, description of transport process
- Lecture 13 - Transport through porous membrane and nonporous membrane
- Lecture 14 - Concept of osmosis and reverse osmosis, thermodynamic analysis
- Lecture 15 - Revision of concepts and fundamentals
- Lecture 16 - HP and LP RO, membrane materials, modules, models for RO transport
- Lecture 17 - Advantages of RO, fouling, RO applications, Pressure retarded osmosis
- Lecture 18 - Nanofiltration basics, transport mechanism, fouling model and applications
- Lecture 19 - Basic principles of UF, membranes and modules, UF configurations
- Lecture 20 - Models for UF transport, mass transfer coefficient, membrane rejection and sieving coefficient
- Lecture 21 - Factors affecting UF performance, fouling and permeate flux enhancement, UF applications I
- Lecture 22 - Micellar-enhanced UF, affinity UF, UF based bioseparation
- Lecture 23 - Basic principles, advantages of MF, cross-flow and dead-end MF, membranes and modules
- Lecture 24 - Models for MF transport, plugging and throughput, fouling in MF, MF applications
- Lecture 25 - Problems and solutions based on RO and MF
- Lecture 26 - Problems and solutions based on UF
- Lecture 27 - Dialysis, membranes and modules, mass transport in dialysis, diffusion analysis, applications
- Lecture 28 - Ion-exchange membranes, ED process, energy requirement, applications, reverse ED
- Lecture 29 - PV principle, advantages, mass transfer and applications, hybrid distillation/PV
- Lecture 30 - Problems and solutions based on ED and PV
- Lecture 31 - Concept, types of LM, mechanism of mass transfer in LM, choice of solvent and carrier, applications

[Lecture 32 - Basic principle of gas separation, transport mechanism, factors affecting gas separation, applications](#)

[Lecture 33 - Basic principle of MD, mechanism, process parameters, membranes, applications](#)

[Lecture 34 - Mechanism, coupled transport, carrier agent, active and passive transport, applications](#)

[Lecture 35 - Gas-liquid and liquid-liquid contactors, membrane reactors and bioreactors, PEM hydrogen fuel cell](#)

[Lecture 36 - Perstraction, membrane chromatography and controlled drug delivery](#)

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Lecture 2 - Linear Regression

Lecture 3 - Multiple, Polynomial and General Linear Least Square Regression

Lecture 4 - Nonlinear Regression

Lecture 5 - Regression : MATLAB Implementation

Lecture 6 - Teaching Learning Based Optimization

Lecture 7 - Implementation of TLBO in MATLAB

Lecture 8 - Supplementary: Preliminary Statistical analysis for metaheuristic techniques

Lecture 9 - Supplementary: Preliminary Statistical analysis - MATLAB implementation

Lecture 10 - Particle Swarm Optimization

Lecture 11 - Implementation of Particle Swarm Optimization using MATLAB

Lecture 12 - Differential Evolution

Lecture 13 - Implementation of Differential Evolution using MATLAB

Lecture 14 - Binary Coded Genetic Algorithm

Lecture 15 - Real Coded Genetic Algorithm

Lecture 16 - Implementation of Real Coded Genetic Algorithm using MATLAB

Lecture 17 - Artificial Bee Colony Algorithm

Lecture 18 - Working of Artificial Bee Colony Algorithm

Lecture 19 - Implementation of Artificial Bee Colony using MATLAB

Lecture 20 - Comparison of Variation Operators and Survival Strategies

Lecture 21 - Black-Box Optimization Problems

Lecture 22 - Constraint-Handling in Metaheuristic Techniques

Lecture 23 - Case Study: Production planning

Lecture 24 - Case Study: Production planning MATLAB Implementation

Lecture 25 - Parallelization and Vectorization of Fitness Function

Lecture 26 - Constraint-Handling using Correction Approach

Lecture 27 - MATLAB inbuilt functions: Linear and Mixed Integer Linear Programming

Lecture 28 - MATLAB inbuilt functions: Nonlinear and Mixed Integer Nonlinear Programming

Lecture 29 - MATLAB Optimization Tool: Options, Output Function, Vectorization, Parallelization

Lecture 30 - MATLAB inbuilt functions: Multi-objective Optimization

Lecture 31 - Simplex Method for LP

[Lecture 32 - Branch and Bound Method for MILP](#)

[Lecture 33 - MILP formulation of Production Planning Problem](#)

[Lecture 34 - Generalized Algebraic Modelling System](#)

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[Lecture 36 - IBM ILOG CPLEX Optimization Studio](#)

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- Lecture 1 - Definition, History, Role of Chemical Engineer
- Lecture 2 - Basic Features of Chemical Process
- Lecture 3 - Unit systems and dimensions
- Lecture 4 - Variables and Properties of Material in System
- Lecture 5 - Pressure and Temperature of Flow Process
- Lecture 6 - Rate of Process
- Lecture 7 - Principles of material balance and calculation
- Lecture 8 - Material Balances on Processes with Recycle and Bypass
- Lecture 9 - Material balances on reactive processes
- Lecture 10 - Material balances on combustion reactions
- Lecture 11 - State Equation of Ideal Gas and Calculation
- Lecture 12 - State Equation of non-Ideal Gas and Calculation
- Lecture 13 - Phase equilibrium
- Lecture 14 - Equilibrium Laws, Humidity and Saturation
- Lecture 15 - Humidity, Saturation Psychrometric chart
- Lecture 16 - Process of phase change: Condensation and vaporization
- Lecture 17 - Principles of Energy
- Lecture 18 - Laws and properties of thermodynamics
- Lecture 19 - Standard Heat of Formation
- Lecture 20 - The mechanical energy balance
- Lecture 21 - Enthalpy balances without reaction
- Lecture 22 - Energy balance with multiple streams without reaction
- Lecture 23 - Energy balance on heat of solution
- Lecture 24 - Energy balance with heat of reaction
- Lecture 25 - Energy balance with heat of reaction (Continued...)
- Lecture 26 - Energy balance with heat of combustion
- Lecture 27 - Material balance of transient process
- Lecture 28 - Unsteady state energy balance
- Lecture 29 - Least Square Method Linear equation fitting
- Lecture 30 - Non-linear algebraic equation system
- Lecture 31 - Numerical Integration

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Lecture 2 - Solar radiation

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Lecture 4 - Practice problems - Part II

Lecture 5 - Non-concentrating solar collectors - Part I

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Lecture 7 - Non-concentrating solar collectors - Part III

Lecture 8 - Practice problems - Part I

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Lecture 11 - Parabolic solar collectors

Lecture 12 - Practice problems

Lecture 13 - Thermal energy storage systems - Part I

Lecture 14 - Thermal energy storage systems - Part II

Lecture 15 - Solar energy utilization methods

Lecture 16 - Classification of energy resources

Lecture 17 - Broad classification and compositional analysis

Lecture 18 - Characteristics and properties of biomass

Lecture 19 - Properties and structural components of biomass

Lecture 20 - Biomass residues and energy conversion routes

Lecture 21 - Utilisation of biomass through bio-chemical and thermo-chemical routes

Lecture 22 - Conversion mechanism of biomass to biogas and its properties

Lecture 23 - Classification of biogas plants

Lecture 24 - Practice problems - I

Lecture 25 - Practice problems - II

Lecture 26 - Practice problems - III

Lecture 27 - Bioconversion of substrates into alcohol

Lecture 28 - Thermo-chemical conversion, torrefaction and combustion processes

Lecture 29 - Thermo-chemical conversion of biomass to solid, liquid and gaseous fuels

Lecture 30 - Gasification process

Lecture 31 - Thermo-chemical conversion processes: pyrolysis, liquefaction and conversion processes

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[Lecture 34 - Turbine terms, types and theories - Part I](#)

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[Lecture 36 - Characteristics and Power Generation from Wind Energy - Part I](#)

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Lecture 2 - Need for biomass based industries

Lecture 3 - Biomass basics

Lecture 4 - Dedicated energy crops

Lecture 5 - Oil crops and microalgae

Lecture 6 - Enhancing biomass properties

Lecture 7 - Basic concepts and types

Lecture 8 - Feedstocks and properties

Lecture 9 - Economics and LCA

Lecture 10 - Barriers and Types

Lecture 11 - Dilute acid, alkali, ozone

Lecture 12 - Hybrid methods

Lecture 13 - Physical Processes

Lecture 14 - Gasification and Pyrolysis

Lecture 15 - Products and Commercial Success Stories

Lecture 16 - Types, fundamentals, equipments, applications

Lecture 17 - Details of various processes

Lecture 18 - Products and Commercial Success Stories

Lecture 19 - Diesel from vegetable oils, microalgae and syngas

Lecture 20 - Transesterification; FT process, catalysts

Lecture 21 - Biodiesel purification, fuel properties

Lecture 22 - Biooil and biochar production, reactors

Lecture 23 - Factors affecting biooil, biochar production, fuel properties characterization

Lecture 24 - Biooil upgradation technologies

Lecture 25 - Microorganisms, current industrial ethanol production technology

Lecture 26 - Cellulase production, SSF and CBP

Lecture 27 - ABE fermentation pathway and kinetics, product recovery technologies

Lecture 28 - Biohydrogen production, metabolics, microorganisms

Lecture 29 - Biogas technology, fermenter designs, biogas purification

Lecture 30 - Methanol production and utilization

Lecture 31 - Biomass as feedstock for synthetic organic chemicals, lactic acid, polylactic acid

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[Lecture 34 - Concept, lignocellulosic biorefinery](#)

[Lecture 35 - Aquaculture and algal biorefinery, waste biorefinery](#)

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Lecture 2 - Understanding Resources and My Exchange, Start using Aspen Plus

Lecture 3 - Overview of setting up of property environment

Lecture 4 - Using Model Palette - Mixers/Splitters, Separators

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Lecture 13 - Property Methods and Property Sets with example

Lecture 14 - Analysis tools (Pure Components and Binary mixtures)

Lecture 15 - Analysis tools (Ternary mixtures), Data and Regression (Part 1)

Lecture 16 - Data and Regression (Part 2), Property Estimation

Lecture 17 - Practice problems on pure components

Lecture 18 - Practice problems on binary mixtures

Lecture 19 - Miscellaneous practice problems and case studies

Lecture 20 - Model Analysis Tools

Lecture 21 - Separation of Hydrocarbon Mixture

Lecture 22 - Synthesis of Acetaldehyde from Ethanol

Lecture 23 - BTX Separation through Distillation

Lecture 24 - Synthesis of Methanol from Syngas

Lecture 25 - Synthesis of Dimethyl Ether from Carbon Dioxide and Hydrogen

Lecture 26 - Synthesis of Ammonia in Cryogenic Process

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- Lecture 3 - Infrared Spectroscopy: Fundamentals
- Lecture 4 - Infrared Spectroscopy: IR Bands and Applications
- Lecture 5 - Infrared Spectrophotometer Instrumentation
- Lecture 6 - Raman Spectroscopy
- Lecture 7 - NMR: Concepts and Fundamentals
- Lecture 8 - Chemical Shifts
- Lecture 9 - Factors Affecting Chemical Shift and 2D NMR
- Lecture 10 - Physisorption: Surface Area and Pore Analysis
- Lecture 11 - Physisorption Measurements
- Lecture 12 - Chemisorption
- Lecture 13 - Surface Tension and its Measurement - Part 1
- Lecture 14 - Surface Tension and its Measurement - Part 2
- Lecture 15 - Interfacial Tension and its Application
- Lecture 16 - Interfacial Tension and Influence of Surface Curvature
- Lecture 17 - Rheology: Fundamentals and Principles
- Lecture 18 - Complex Fluids and their Properties
- Lecture 19 - Rheology: Case Study on Hydrogel Synthesis
- Lecture 20 - Electron Spectroscopy for Surface Analysis
- Lecture 21 - Quantification in XRF and XPS Spectroscopy
- Lecture 22 - XPS Instrument and Application
- Lecture 23 - Introduction to Electrochemical Characterization Techniques
- Lecture 24 - Electrode Potential, Kinetics and Mass Transfer Resistance
- Lecture 25 - Voltammetry and Galvanostatic Charge-Discharge

- Lecture 1 - Important Steps for Process Development
- Lecture 2 - Structure of Chemical Industry
- Lecture 3 - Safety and Loss Prevention
- Lecture 4 - Sulfuric Acid: Reactions and Thermodynamics
- Lecture 5 - SO₂ Conversion Reactor and Sulfuric Acid Production Process
- Lecture 6 - Sulfur Production: Claus Process
- Lecture 7 - Synthesis Gas Production
- Lecture 8 - Coal Gasification
- Lecture 9 - Coal Gasifiers
- Lecture 10 - Gasification Technology and Applications
- Lecture 11 - Thermodynamics of Ammonia Synthesis
- Lecture 12 - Integrated Ammonia Plant and Hydrogen Recovery - I
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- Lecture 14 - Urea Production
- Lecture 15 - Nitric acid: Reactions and Thermodynamics
- Lecture 16 - Production of Phosphoric Acid: Dihydrate Process
- Lecture 17 - Production of Phosphoric Acid: Hemihydrate Process
- Lecture 18 - Emission Abatement in Phosphoric Acid Plants
- Lecture 19 - Chlorine Production
- Lecture 20 - Soda Ash Process
- Lecture 21 - Heterogeneous Catalysis
- Lecture 22 - Catalysis with Zeolites and production of Iso-butene
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- Lecture 24 - Periodic Flow Reversal and Production of Styrene
- Lecture 25 - Selective Oxidation Processes and Ethene Production
- Lecture 26 - Monolith Reactors for Automotive Emission
- Lecture 27 - Methanol Production
- Lecture 28 - Methanol and Formaldehyde Production
- Lecture 29 - Fischer-Tropsch Synthesis
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- Lecture 2 - Basic Unit Processes and Unit Operations of OCT
- Lecture 3 - Introduction to Chemical Plant Design
- Lecture 4 - Edible and Essential Oils
- Lecture 5 - Vegetable Oils and Processing
- Lecture 6 - Processing of Oils and Waxes
- Lecture 7 - Soaps and Glycerine Manufacture
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- Lecture 9 - Carbohydrates Industry - Sugar
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- Lecture 11 - Carbohydrates Industry - Beet Sugar and Starch
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- Lecture 13 - Fermentation Industry – Ethanol
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- Lecture 18 - Petroleum Industry
- Lecture 19 - Petroleum Refinery Products, Characteristics and Processes
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- Lecture 22 - Chemicals from C1 Compounds: Methanol and Formaldehyde
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Lecture 2 - Characteristics of Single particle

Lecture 3 - Particle size and Its distribution in mixture

Lecture 4 - Mechanism of Size Reduction

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Lecture 10 - Flow Past a Cylinder and Spherical Particle

Lecture 11 - Terminal velocity of single particle

Lecture 12 - Multiple particle Interaction/Sedimentation: Hindered settling velocity

Lecture 13 - Basic law and terminology of flow through granular bed

Lecture 14 - General expressions for flow through packed beds-Ergun Equation

Lecture 15 - Two-phase flow through packed bed

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Lecture 17 - Degree of mixing and Its Assessment

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Lecture 21 - Biochemical conversion processes - Anaerobic Digestion in Landfills

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- Lecture 5 - Thermodynamic Properties of Ideal Monoatomic Gases
- Lecture 6 - Monoatomic Gases and Gibbs Entropy Equation
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- Lecture 20 - Semi Grand Canonical Ensemble and Comparison of Ensembles
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- Lecture 25 - Thermodynamic Properties from Virial Equation of State
- Lecture 26 - Interaction Potentials for Spherical Molecules
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NPTEL : Fluid Mechanics (Chemical Engineering)

Co-ordinators : Dr. V. Shankar

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NPTEL : Mass Transfer II (Chemical Engineering)

Co-ordinators : Prof. Nishith Verma

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- Lecture 12 - Control of Distillation Columns
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- Lecture 15 - Control of Complex Column Configurations
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- Lecture 28 - Plantwide control structure design
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NPTEL : Novel Separation Processes (Chemical Engineering)

Co-ordinators : Prof. S. De

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NPTEL : NOC:Metallocene and Metal-Carbene based Organometallic Compounds as Industrially Important Advanced Polyolefin Catalysts (Chemical Engineering)

Co-ordinators : Prof. Sanjib K. Patra

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Lecture 2 - A Brief Introduction to Polymers (Continued...)

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Lecture 4 - Polyethylene and Polypropylene: Chemical structure and properties (Continued...)

Lecture 5 - Common polymerization protocol and mechanism

Lecture 6 - Common polymerization protocol and mechanism (Continued...)

Lecture 7 - Common polymerization protocol and mechanism: Controlled Polymerization

Lecture 8 - Anionic living polymerization and Coordination polymerization

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Lecture 10 - Metallocene compounds: Structure and Bonding

Lecture 11 - Metallocene compounds: Structure and Bonding (Continued...)

Lecture 12 - Bonding in Metallocene, MOT and Electronic nature

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Lecture 14 - Bonding and Electronic nature in Bent Metallocene (Continued...)

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Lecture 16 - Properties and Unique Reactivities of parallel and bent Metallocenes

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Lecture 21 - Coordination polymerization of olefin by Metallocene Catalysts: A new avenue in polyolefin catalysts

Lecture 22 - Coordination polymerization of olefin by Metallocene Catalysts: A new avenue in polyolefin catalysts (Continued...)

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Lecture 24 - Symmetry of metallocene and Stereoregularity in polyolefin (Continued...)

Lecture 25 - Metallocene to Post-metallocene catalysts for olefin polymerization

Lecture 26 - Metallocene to Post-metallocene catalysts for olefin polymerization (Continued...)

Lecture 27 - Polymerization strategy for industrial preparation of LLDPE

Lecture 28 - Polymerization strategy for industrial preparation of LLDPE (Continued...)

Lecture 29 - Metallocene and Post-metallocene Catalysts: Homogeneous to Heterogeneous and Lab to Industry

Lecture 30 - Metallocene and Post-metallocene Catalysts: Homogeneous to Heterogeneous and Lab to Industry (Continued...)

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[Lecture 31 - Depolymerization of synthetic polymers: Role of organometallic and metallocene based catalysts](#)

[Lecture 32 - Depolymerization of synthetic polymers: Role of organometallic and metallocene based catalysts](#)

[Lecture 33 - Metal-carbene complexes as versatile catalysts for multiple useful reactions: A short introduction](#)

[Lecture 34 - Metal-carbene complexes as versatile catalysts for multiple useful reactions: A short introduction \(Continued...\)](#)

[Lecture 35 - Bonding and Electronic properties in Metal-carbene complexes](#)

[Lecture 36 - General synthetic protocol of Metal-carbene complexes](#)

[Lecture 37 - N-Heterocyclic carbene \(NHC\) complex: Bonding and General synthetic protocol](#)

[Lecture 38 - Alkene metathesis by metal-carbene catalysts and its mechanism](#)

[Lecture 39 - Utility of metal-carbene catalysts in alkene polymerization](#)

[Lecture 40 - Industrially important polymers by ROMP: Recent development and scope; Overall summary of this course](#)

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- Lecture 5 - Kinematics - 5 - Shear Stress
- Lecture 6 - Kinematics - 6 and Conservation Equation - 1
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- Lecture 8 - Conservation Equation - 3 - Conservation of Momentum
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- Lecture 20 - Boundary Layer Analysis - 5: Momentum Integral Method - 1
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Lecture 11 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration

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Lecture 13 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

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Lecture 20 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 21 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 22 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 23 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 24 - Practical demonstration on UV-Visible spectroscopy

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Lecture 26 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy

Lecture 27 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

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Lecture 28 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 29 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 30 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 31 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites

Lecture 32 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

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Lecture 34 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

Lecture 35 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

Lecture 36 - Thermal analysis techniques and application in polymer, elastomer and composites

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Lecture 41 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

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Lecture 44 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

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Lecture 46 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 47 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

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Lecture 50 - Applications of microscopy in polymers, elastomers and composites

Lecture 51 - Applications of microscopy in polymers, elastomers and composites (Continued...)

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Lecture 53 - Practical demonstration on atomic force microscopy (AFM)

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Lecture 55 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances

Lecture 56 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

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Lecture 4 - Forces acting on a control volume; Stress tensor; Derivation of the momentum conservation equation ; Closure problem; Deformation of a fluid element in fluid flow

Lecture 5 - Kinematics of deformation in fluid flow; Stress vs strain rate relation; Derivation of the Navier-Stokes equations

Lecture 6 - Equations governing flow of incompressible flow; Initial and boundary conditions; Wellposedness of a fluid flow problem

Lecture 7 - Equations for some simple cases; Generic scalar transport equation form of the governing equations; Outline of the approach to the solution of the N-S equations.

Lecture 8 - cut out the first 30s; Spatial discretization of a simple flow domain; Taylor's series expansion and the basis of finite difference approximation of a derivative; Central and one-sided difference approximations; Order of accuracy of finite difference ap

Lecture 9 - Finite difference approximation of pth order of accuracy for qth order derivative; cross -derivatives; Examples of high order accurate formulae for several derivatives

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Lecture 11 - Numerical solution of the unsteady advection equation using different finite difference approximations

Lecture 12 - Need for analysis of a discretization scheme; Concepts of consistency, stability and convergence and the equivalence theorem of Lax ; Analysis for consistency

Lecture 13 - Statement of the stability problem; von Neumann stability analysis of the first order wave equation

Lecture 14 - Consistency and stability analysis of the unsteady diffusion equation; Analysis for two- and three -dimensional cases; Stability of implicit schemes

Lecture 15 - Interpretation of the stability condition; Stability analysis of the generic scalar equation and the concept of upwinding ; Diffusive and dissipative errors in numerical solution; Introduction to the concept of TVD schemes

Lecture 16 - Template for the generic scalar transport equation and its extension to the solution of Navier-Stokes equations for a compressible flow.

Lecture 17 - Illustration of application of the template using the MacCormack scheme for a three-dimensional compressible flow

Lecture 18 - Stability limits of MacCormack scheme; Limitations in extending compressible flow schemes to incompressible flows ; Difficulty of evaluation of pressure in incompressible flows and listing of various approaches

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Lecture 26 - Convergence analysis of basic iterative schemes; Diagonal dominance condition for convergence; Influence of source terms on the diagonal dominance condition; Rate of convergence

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Lecture 28 - Advanced iterative methods: Alternating Direction Implicit Method; Operator splitting

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Lecture 34 - Turbulence; Characteristics of turbulent flow; Dealing with fluctuations and the concept of time-averaging

Lecture 35 - Derivation of the Reynolds -averaged Navier -Stokes equations; identification of the closure problem of turbulence; Boussinesq hypothesis and eddy viscosity

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Lecture 41 - Transformation of the governing equations; Illustration for the Laplace equation; Appearance and significance of cross - derivative terms; Concepts of structured and unstructured grids.

Lecture 42 - Finite volume method for complicated flow domain; Illustration for the case of flow through a duct of triangular cross - section.

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Lecture 44 - Generation of a structured grid for irregular flow domain; Algebraic methods; Elliptic grid generation method

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Lecture 24 - Rayleigh-Benard convection: Physics and governing equations

Lecture 25 - Rayleigh-Benard convection: Linear stability analysis - Part 1

Lecture 26 - Rayleigh-Benard convection: Linear stability analysis - Part 2

Lecture 27 - Rayleigh-Benard convection: Linear stability analysis - Part 3

Lecture 28 - Rayleigh Benard convection: Discussion of results

Lecture 29 - Rayleigh-Taylor "heavy over light" instability

Lecture 30 - Rayleigh-Taylor instability (Continued...)

Lecture 31 - Capillary jet instability: Problem formulation

[Lecture 32 - Capillary jet instability: Linear stability analysis](#)

[Lecture 33 - Capillary jet instability: Rayleigh's Work Principle](#)

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[Lecture 35 - Turing patterns: Instability in reaction-diffusion systems](#)

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[Lecture 43 - Viscous Fingering: Darcy's law](#)

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Lecture 3 - Introduction - Lecture 1.2 A

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Lecture 5 - Basic Definitions and concepts - Lecture 2.1 (Basic Definitions and concepts - Part I)

Lecture 6 - Basic Definitions and concepts - Lecture 2.2 (Basic Definitions and concepts - Part II)

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Lecture 9 - A review of Fourier transforms - Lecture 3.2 (Continuous time Fourier transform)

Lecture 10 - A review of Fourier transforms - Lecture 3.3 (Discrete time Fourier series)

Lecture 11 - A review of Fourier transforms - Lecture 3.4 (Discrete time Fourier transform)

Lecture 12 - A review of Fourier transforms - Lecture 3.5 (Properties of Fourier transforms)

Lecture 13 - A review of Fourier transforms - Lecture 3.6 (Discrete Fourier transform)

Lecture 14 - A review of Fourier transforms - MATLAB demo of Fourier transform and periodogram

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Lecture 16 - Duration and Bandwidth - Bandwidth equation and Instantaneous frequency

Lecture 17 - Duration and Bandwidth - Instantaneous frequency and analytic signals

Lecture 18 - Duration and Bandwidth - Duration-Bandwidth principle

Lecture 19 - Duration and Bandwidth - Requirements of time-frequency analysis techniques

Lecture 20 - Duration and Bandwidth - Requirements of time-frequency analysis and techniques

Lecture 21 - Short-time Fourier transform - Short-time Fourier transform

Lecture 22 - Short-time Fourier transform - Auxillary (MATLAB demonstration)

Lecture 23 - Short-time Fourier transform - Properties of STFT

Lecture 24 - Practical aspects of STFT

Lecture 25 - Closing Remarks

Lecture 26 - Wigner-Ville Distributions

Lecture 27 - Properties of WVD

Lecture 28 - Properties of WVD 2

Lecture 29 - Discrete WVD

Lecture 30 - Pseudo and Smoothed WVD

Lecture 31 - Cohens class and smoothed WVD

- Lecture 32 - Cohens class and smoothed WVD
- Lecture 33 - Cohens class and Ambiguity functions
- Lecture 34 - Affine class and closing remarks
- Lecture 35 - Continuous Wavelet Transform
- Lecture 36 - Continuous Wavelet Transforms
- Lecture 37 - Scale to Frequency
- Lecture 38 - Computational aspects of CWT
- Lecture 39 - Scalogram and MATLAB demonstration
- Lecture 40 - Scalogram and MATLAB demonstration
- Lecture 41 - Scaling function
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- Lecture 46 - Applications of CWT
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- Lecture 49 - Orthogonal scaling function bases and MRA
- Lecture 50 - Orthogonal scaling function bases and MRA.
- Lecture 51 - Wavelet Filters and Fast DWT Algorithm
- Lecture 52 - Wavelet Filters and Fast DWT Algorithm (Continued...)
- Lecture 53 - Wavelet Filters and Fast DWT Algorithm (Continued...)
- Lecture 54 - Wavelets for DWT
- Lecture 55 - Wavelets for DWT (Continued...)
- Lecture 56 - Wavelets for DWT (Continued...)
- Lecture 57 - DWT computation
- Lecture 58 - DWT computation (Continued...)
- Lecture 59 - DWT computation (Continued...)

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Lecture 2 - CVD Reactor and Process Design Fundamentals

Lecture 3 - Overview of CVD Process Fundamentals

Lecture 4 - Basics of Chemical Equilibrium Calculations and Flow Dynamics

Lecture 5 - Introduction to CVD Films

Lecture 6 - Film Structure and Properties

Lecture 7 - Pressure Effects on CVD Processes

Lecture 8 - CVD of Metals

Lecture 9 - CVD of Coatings

Lecture 10 - CVD Film Property Measurements

Lecture 11 - CVD Film Property Measurements: Qualitative and Quantitative

Lecture 12 - CVD in Tungsten Filament Lamps

Lecture 13 - CVD in Tungsten Filament Lamps: Design Aspects

Lecture 14 - CVD in Hot Corrosion

Lecture 15 - CVD Transport Phenomena: Conservation Equations

Lecture 16 - CVD Transport Phenomena: Constitutive Laws

Lecture 17 - CVD Transport Phenomena: Mass Transfer Mechanisms

Lecture 18 - CVD Transport Phenomena: Mass Transfer Analogy Condition (MTAC)

Lecture 19 - CVD Transport Phenomena: Effect of Homogeneous Reactions on MTAC

Lecture 20 - CVD Applications: Hot Filament CVD (HFCVD)

Lecture 21 - CVD Applications: Aerosol CVD (ACVD)

Lecture 22 - CVD Applications: CVD of Silicon

Lecture 23 - CVD Applications: CVD in Free-Molecular Flow Regime (FMFR)

Lecture 24 - CVD Applications: CVD of nano-Structured Films

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Lecture 26 - Review of CVD Basics: Part-I (PDF Lecture)

Lecture 27 - Review of CVD Basics: Part-II (PDF Lecture)

Lecture 28 - CVD Question Bank (PDF Lecture)

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Lecture 30 - Basics of Nano-Structured Material Synthesis: Part-II

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[Lecture 32 - Undesirable CVD: Moolten Salt Deposition in Combustion Systems \(Adobe Presenter\)](#)

[Lecture 33 - Undesirable CVD: Hot Corrosion \(Adobe Presenter\)](#)

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[Lecture 35 - Multi-component Transport Fundamentals: Mass Conservation Equations \(Adobe Presenter\)](#)

[Lecture 36 - Multi-component Transport Fundamentals: Momentum and Energy Conservation \(Adobe Presenter\)](#)

[Lecture 37 - Multi-component Transport Fundamentals: Entropy conservation \(Adobe Presenter\)](#)

[Lecture 38 - Multi-component Transport Fundamentals: Constitutive Laws for Mass and Momentum \(Adobe Presenter\)](#)

[Lecture 39 - Multi-component Transport Fundamentals: Constitutive Laws for Energy and Entropy \(Adobe Presenter\)](#)

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- Lecture 2 - Motivation and Introduction - Part II
- Lecture 3 - What is Chemical Engineering - Part I
- Lecture 4 - What is Chemical Engineering - Part II
- Lecture 5 - What is Chemical Reaction Engineering - Part I
- Lecture 6 - What is Chemical Reaction Engineering - Part II
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- Lecture 8 - Homogeneous and Heterogeneous Reactions - Part II
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- Lecture 10 - Design of Batch reactors - Part I
- Lecture 11 - Design of Batch reactors - Part II
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- Lecture 16 - Basics of Mixed Flow Reactors
- Lecture 17 - Design of Mixed Flow Reactors
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- Lecture 22 - Kinetics of Homogeneous reactions
- Lecture 23 - Reaction rate for Homogeneous reactions
- Lecture 24 - Gas Phase Homogeneous reactions
- Lecture 25 - (Continued...) And later Reactor Design of PFR
- Lecture 26 - Reactor Design for MFR and Combination of reactors
- Lecture 27 - PFR and MFR in series.
- Lecture 28 - Unsteady state MFR and PFR
- Lecture 29 - Recycle Reactors
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[Lecture 43 - Non-Isothermal Batch Reactors](#)

[Lecture 44 - Non-isothermal Plug Flow Reactors - Part I](#)

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[Lecture 57 - Multi-parameter model \(MFR with dead space and bypass\)](#)

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[Lecture 59 - Direct use of RTD to predict conversion \(Macro and Micro-fluid as well as Macro & Micro-mixing Concept\) Part II](#)

[Lecture 60 - Direct use of RTD to predict conversion \(Macro and Micro-fluid as well as Macro & Micro-mixing Concept\) Part III](#)

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- Lecture 2 - Intro to Kinetics (Continued...) for catalytic reactions in different reactors
- Lecture 3 - Heterogeneous rate of reactions and different types of kinetic models for non-catalytic reactions
- Lecture 4 - Basics of Kinetics of type A & B reactions (Shrinking core model & Porous particle homogeneous model)
- Lecture 5 - Shrinking Core Model (Continued...)
- Lecture 6 - Shrinking Core Model (Continued...)
- Lecture 7 - (Continued...) & Proof of Pseudo steady state assumption
- Lecture 8 - Shrinking core model (Continued...) for type D reactions
- Lecture 9 - Shrinking core model (Continued...) for type D reactions (Continued...)
- Lecture 10 - Reactors, Homogeneous reaction model, Design of non-catalytic gas solid reactors
- Lecture 11 - Design of non-catalytic gas solid reactors (Continued...)
- Lecture 12 - Design of non-catalytic gas solid reactors (Continued...)
- Lecture 13 - Design equation for MF of solids, uniform gas composition, const. single particle size, Shrinking core model.
- Lecture 14 - Design equation for MF of solids, mixture of particles for different sizes but unchanging size, uniform gas composition, SCM
- Lecture 15 - Design equation for MF of solids with elutriation, mixture of particles of different size, uniform gas composition, SCM
- Lecture 16 - General Performance equation for non-catalytic gas solid reactions
- Lecture 17 - Catalytic reactions (LHHW Kinetic model)
- Lecture 18 - LHHW Kinetic model (Continued...) - Part I
- Lecture 19 - LHHW Kinetic model (Continued...) - Part II
- Lecture 20 - Industrially important catalytic reaction models
- Lecture 21 - Inter and Intraphase effectiveness factor
- Lecture 22 - Interface effectiveness factor & Generalized nonisothermal effectiveness factor for external mass transfer step
- Lecture 23 - Generalized nonisothermal effectiveness factor for external mass transfer step (Continued...)
- Lecture 24 - Mass transfer correlations for various reactors
- Lecture 25 - Isothermal intraphase effectiveness factor - Part I
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- Lecture 27 - Non-isothermal intraphase effectiveness factor
- Lecture 28 - Inter and Intraphase effectiveness factor (Continued...)
- Lecture 29 - Inter and Intraphase Mass transfer
- Lecture 30 - Packed (fixed) bed catalytic reactor design

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[Lecture 41 - Continued... \(Davidson Harrison model and Kunii Levenspiel model\)](#)

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[Lecture 43 - Slurry Reactor Design](#)

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Lecture 2 - Basics of Programming using MATLAB

Lecture 3 - Array Operations in MATLAB

Lecture 4 - Loops and Execution Control

Lecture 5 - Tutorial: Using Arrays

Lecture 6 - MATLAB Files -- Scripts and Functions

Lecture 7 - Plotting and Output

Lecture 8 - How to submit MATLAB Assignment

Lecture 9 - Errors in Numerical Computation

Lecture 10 - Truncation Errors and Taylors Series

Lecture 11 - Round-Off Errors; and Iterative Methods

Lecture 12 - Step-wise Methods and Error Propagation

Lecture 13 - How to get MATLAB Online access (for all enrolled students of this course)

Lecture 14 - Differentiation in Single Variable

Lecture 15 - Higher Order Differentiation Formulae

Lecture 16 - Partial Differentials (Bonus)

Lecture 17 - Numerical Integration

Lecture 18 - Multiple Applications of Integration Formulae

Lecture 19 - In-Build MATLAB Integration Functions

Lecture 20 - Basics of Linear Algebra

Lecture 21 - Gauss Elimination and Back-Substitution

Lecture 22 - LU Decomposition and Partial Pivoting

Lecture 23 - Gauss Siedel Method

Lecture 24 - (Tutorial)

Lecture 25 - Tri-Diagonal Matrix Algorithm

Lecture 26 - Nonlinear Equations in Single Variable

Lecture 27 - Using MATLAB command fzero

Lecture 28 - Fixed Point Iteration in Single Variable

Lecture 29 - Newton-Raphson (single variable)

Lecture 30 - Using MATLAB command fsolve (multi-variable)

Lecture 31 - Newton-Raphson (multi Variable)

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[Lecture 42 - Stiff Systems & Solution using ode15s](#)

[Lecture 43 - Method of Lines for transient PDEs](#)

[Lecture 44 - A Final Example](#)

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Lecture 1 - Motivation

Lecture 2 - Flow in a rectangular duct: Problem formulation

Lecture 3 - Flow in a rectangular duct: Discretization of flow domain

Lecture 4 - Tutorial 1: Converting PDE to algebraic equation using FD approximation

Lecture 5 - Tutorial 1 (Continued...) Solution for algebraic equations using Gauss-Seidel Method

Lecture 6 - Flow in a triangular duct: Problem formulation

Lecture 7 - Flow in a triangular duct: Discretization of flow domain

Lecture 8 - Tutorial 2: Converting PDE to algebraic equation using Finite Volume method

Lecture 9 - Tutorial 2 (Continued...) Description of FV method and solution using G-S Method

Lecture 10 - Effect of grid spacing & upcoming course outline

Lecture 11 - Mass conservation equations

Lecture 12 - Momentum conservation equations

Lecture 13 - Forces acting on control volume

Lecture 14 - Kinematics of deformation in fluid flow

Lecture 15 - Equations governing fluid flow in incompressible fluid

Lecture 16 - Navier-Stokes equation for simple cases of flow

Lecture 17 - Energy conservation equations

Lecture 18 - Practical cases of fluid flow with heat transfer in CFD point of view

Lecture 19 - Practical cases of fluid flow with mass transfer in CFD point of view

Lecture 20 - Equations governing fluid flow with chemical reactions

Lecture 21 - Concept of wellposedness of mathematical problems

Lecture 22 - Introduction to finite difference methods

Lecture 23 - Finite difference approximation on a uniform mesh

Lecture 24 - Higher order and mixed derivatives

Lecture 25 - Solution of Poisson equation in rectangular duct-Tutorial

Lecture 26 - Discretization of time domain

Lecture 27 - FD approx. on a non-uniform mesh and need of analysis of obtained discretization

Lecture 28 - Need for the analysis of discretized equation

Lecture 29 - Properties of Numerical Schemes: Accuracy, Conservation property, Boundedness, Consistency, Stability and Convergence

Lecture 30 - Properties of Numerical Schemes: Stability analysis

Lecture 31 - Tutorial on Stability Analysis

- Lecture 32 - Analysis of Generic 1-d scalar transport equation
- Lecture 33 - Introduction to the solution of coupled N-S equations
- Lecture 34 - N-S equation in compressible flow- Mac Cormack Scheme
- Lecture 35 - Stability limits of Mac-Cormack Scheme and the intro to Beam-Warming Scheme
- Lecture 36 - Implicit Beam-Warming Scheme
- Lecture 37 - Compressible flow to Incompressible flow
- Lecture 38 - Solution of coupled equations: Incompressible flow
- Lecture 39 - Artificial compressibility method, Stream function-vorticity method
- Lecture 40 - Pressure equation method, Staggered grid system
- Lecture 41 - Pressure Correction Method
- Lecture 42 - Tutorial on Pressure Correction Method
- Lecture 43 - Tutorial on Pressure Correction Method (Continued...)
- Lecture 44 - Introduction to the basic numerical methods
- Lecture 45 - Direct Methods: solution of the system of algebraic equations
- Lecture 46 - Tri-diagonal Matrix Algorithm: Derivation
- Lecture 47 - TDMA and other iterative methods
- Lecture 48 - Recap of basic iterative methods.
- Lecture 49 - Convergence analysis of basic iterative methods
- Lecture 50 - Successive Over Relaxation (SOR) method
- Lecture 51 - Alternating Direction Implicit (ADI) method
- Lecture 52 - Strongly Implicit Procedure (ILU) method
- Lecture 53 - Multigrid method
- Lecture 54 - Body Fitted Grid Approach
- Lecture 55 - Formulation Of Finite Volume Method
- Lecture 56 - Methods For Unstructured Grid Generation
- Lecture 57 - Triangulation: The Advancing Front Method
- Lecture 58 - The Advancing Front Method continuation
- Lecture 59 - Time and length scale of turbulence
- Lecture 60 - The turbulent closure problem
- Lecture 61 - The generic formulation for turbulence
- Lecture 62 - More generic formulation and summary

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Lecture 3 - Probability and Statistics: Review - Part 2

Lecture 4 - R Tutorial 1

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Lecture 7 - Statistics for sample mean

Lecture 8 - Statistics for Variance and Proportion

Lecture 9 - Type I and Type II errors

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Lecture 11 - Hypothesis testing of means

Lecture 12 - Hypothesis testing of variance and proportions

Lecture 13 - Confidence interval construction

Lecture 14 - Hypothesis testing using confidence interval

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- Lecture 8 - Lecture 4 - Part 2 - Probability and Statistics Review 1B
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- Lecture 11 - Lecture 6 - Part 1 - Probability and Statistics Review 2A
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- Lecture 19 - Lecture 9 - Part 1 - Probability and Statistics Review 2I
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- Lecture 26 - Lecture 11 - Part 3 - Autocovariance & Autocorrelation Functions 1
- Lecture 27 - Lecture 12 - Part 1 - Autocovariance & Autocorrelation Functions 2
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NPTEL : System Identification (Chemical Engineering)

Co-ordinators : Dr. Arun K.Tangirala

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NPTEL : Synthetic and Natural Supramolecular Architectures: An Approach Towards Molecular Technology (Chemical Engineering)

Co-ordinators : Prof. Chebrolu Pulla Rao

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Lecture 5 - Coal carbonization and Coke oven plant

Lecture 6 - Gasification of Coal,Petrocoke and Biomass

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Lecture 8 - Pulping and Bleaching

Lecture 9 - Recovery of Chemicals

Lecture 10 - Stock preparation and paper making

Lecture 11 - Introduction to Soap and detergent, Soap making and Recovery of Glycerine

Lecture 12 - Synthetic detergent and Linear alkyl benzene

Lecture 13 - Sugar and Fermentation industry

Lecture 14 - Ethanol as Biofuel and Chemical feed stock

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Lecture 16 - Evaluation of Crude oil,Petroleum Products and Petrochemicals

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Lecture 18 - Thermal Cracking: Visbreaking and Delayed Coking

Lecture 19 - Catalytic cracking: Fluid Catalytic cracking and Hydro cracking

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Lecture 24 - Naphtha and gas cracking for production of olefins

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Lecture 27 - Ethylene derivatives: Ethylene Oxide, Ethylene glycol, Ethylene dichloride and Vinyl chloride

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Lecture 33 - Polyvinylchloride, polycarbonate, thermoset resin: phenolformaldehyde, uriaformaldehyde and melamineformaldehyde

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Lecture 35 - Polymides or Nylons(PA)

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NPTEL : Mechanical Operations (Chemical Engineering)

Co-ordinators : Prof. Shabina Khanam

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Lecture 10 - Size reduction

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Lecture 12 - Examples of Laws of comminution - 1

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- Lecture 2 - Classification of polymers, Types of polymerization, Average molecular weights and polydispersity
- Lecture 3 - Motivation to study polymer physics
- Lecture 4 - Random Walk Models of Single Chain I: end-to-end distance of a polymer chain, freely jointed chain, drunkard walk
- Lecture 5 - Random Walk Models of Single Chain II: general random walk on a lattice
- Lecture 6 - Random Walk Models of Single Chain III: Freely rotating chain, definition of persistence length
- Lecture 7 - Models of semiflexible chains (Kratky Porod Model) - Part I
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- Lecture 9 - Probability density of an ideal chain - Part I
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- Lecture 11 - Entropic Elasticity, Bead-Spring Model, Simulations of random walk models
- Lecture 12 - Derivation of Diffusion equation, Einstein notation
- Lecture 13 - Definition of Radius of gyration
- Lecture 14 - Radius of gyration for an ideal chain, concept of ideality
- Lecture 15 - Nonbonded interactions, hydrophobic and hydrophilic behaviour
- Lecture 16 - Definition of excluded volume; good, bad, and theta solvent
- Lecture 17 - Virial expansion, Flory theory for good solvent
- Lecture 18 - Flory theory for bad solvent, self-similarity and fractal nature of polymers
- Lecture 19 - Derivation of fractal dimension, concentration regimes and overlap concentration
- Lecture 20 - Size, shape, and structure. Gyration tensor and measures of asphericity.
- Lecture 21 - Order-disorder transition
- Lecture 22 - Scattering experiments, Pair correlation function
- Lecture 23 - Structure of polymer chain, Introduction to Monte Carlo simulations of polymer chains
- Lecture 24 - Monte Carlo algorithm: Detailed Balance, Metropolis algorithm
- Lecture 25 - Practical aspects of Monte Carlo simulation
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Lecture 2 - Molecular basis of energy and entropy

Lecture 3 - Probability and probability distributions

Lecture 4 - Probability distributions and thermodynamic equilibrium

Lecture 5 - Energy distribution in molecular systems

Lecture 6 - First and second law of thermodynamics

Lecture 7 - Reversible and irreversible processes; third law of thermodynamics; legendre transformation; thermodynamic functions for one component system

Lecture 8 - Thermodynamic functions for multi-component systems; chemical potential; why do we minimize thermodynamic functions?

Lecture 9 - Extensive and intensive variables; gibbs duhem relation; euler theorem; maxwell relations

Lecture 10 - Discrete and continuous probabilities; stirling approximation

Lecture 11 - Binomial distribution approaches Gaussian distribution for large n; definition of drunkard walk

Lecture 12 - Solution of drunkard walk; Lagrange multipliers

Lecture 13 - Energy distribution in molecular system revisited; introduction to thermodynamic ensembles

Lecture 14 - Canonical ensemble: most probable distribution, partition function

Lecture 15 - Definition of temperature; third law of thermodynamics

Lecture 16 - Canonical ensemble: Helmholtz free energy, averages and fluctuations, specific heat, deriving ideal gas law

Lecture 17 - Partition function of a dense gas; grand canonical ensemble: partition function, most probable distribution

Lecture 18 - Computing properties in grand canonical ensemble

Lecture 19 - Isothermal isobaric ensemble

Lecture 20 - Summary of thermodynamic ensembles; partition function of an ideal gas

Lecture 21 - Mixing and phase separation, phase equilibrium of a multiphase multicomponent system, Gibbs phase rule

Lecture 22 - Pure component phase diagram; solution thermodynamics: Helmholtz free energy density

Lecture 23 - Characterizing mixing and phase separation using Helmholtz free energy density

Lecture 24 - Common tangent construction, definition of binodal, spinodal, and critical point

Lecture 25 - Osmotic pressure and chemical potential

Lecture 26 - Lattice model of liquid solutions - I

Lecture 27 - Lattice model of liquid solutions - II

Lecture 28 - Lattice model of liquid solutions - III

Lecture 29 - Critical review of Lattice model, theoretical basis of molecular dynamics simulation

Lecture 30 - Theoretical basis of molecular dynamics simulation

Lecture 31 - Interaction energy and force field

Lecture 32 - Liouville theorem; theoretical basis of Monte Carlo simulation

Lecture 33 - Introduction to Monte Carlo simulation method

Lecture 34 - Markov chain algorithm, condition for equilibrium and detailed balance

Lecture 35 - Metropolis algorithm, periodic boundary condition

Lecture 36 - Numerical implementation of Monte Carlo simulation: Python Examples - I

Lecture 37 - Numerical implementation of Monte Carlo simulation: Python Examples - II

Lecture 38 - Numerical implementation of Monte Carlo simulation: Python Examples - III

Lecture 39 - Numerical implementation of Monte Carlo simulation: Python Examples - IV

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Lecture 42 - Pair potentials

Lecture 43 - Saving CPU time: short range and long range interactions

Lecture 44 - Bonded and non-bonded interactions, force fields

Lecture 45 - Practical aspects of molecular simulations

Lecture 46 - Numerical implementation of MD; thermostat and barostat

Lecture 47 - MD simulations - efficiency and parallelization, sampling and averaging, analysis of simulation trajectories

Lecture 48 - MD simulations - analysis of simulation trajectories (continued), Case Studies - I

Lecture 49 - MD simulations - Case Studies - II

Lecture 50 - MD simulations - Case Studies - III

Lecture 51 - Free energies and phase behavior; extension of canonical ensemble Monte Carlo to other ensembles

Lecture 52 - Extension of canonical ensemble Monte Carlo to other ensembles (Continued...)

Lecture 53 - Monte Carlo in Gibbs ensemble and semi-grand canonical ensemble, thermodynamic integration

Lecture 54 - Thermodynamic integration (continued); Widom's particle insertion; overlapping distribution method

Lecture 55 - Multiple histogram method; umbrella sampling; thermodynamic cycle; potential of mean force; pulling simulations; metadynamics; tackling time scale issues

Lecture 56 - Tackling time scale issues (continued); nonequilibrium molecular dynamics; mesoscale simulations: Langevin dynamics and Brownian dynamics, kinetic Monte Carlo simulations; dissipative particle dynamics

Lecture 57 - Multiparticle collision dynamics; lattice Boltzmann method; coarse-graining

Lecture 58 - Case studies

Lecture 59 - Simulations of chemical reactions using Kinetic Monte Carlo simulations

Lecture 60 - Reactive force fields; Ab initio molecular dynamics and other advanced methods; molecular simulations in chemical engineering; concluding remarks

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Lecture 6 - Heat Transfer Utilities - I

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Lecture 11 - Heat Transfer Media and Solar energy

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Lecture 13 - Water Chemistry

Lecture 14 - Inhibition and Water Treatment

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- Lecture 42 - Pipeline Mechanical design - Natural Gas Transmission - IV
- Lecture 43 - Cooling Tower; Theory and Some Basic Calculations
- Lecture 44 - Concept of Heat Transfer in Cooling Tower and it's Components
- Lecture 45 - Types and Components of Cooling Tower
- Lecture 46 - Components and Materials of Construction and Applications of Cooling Tower
- Lecture 47 - Control and Maintenance in cooling towers
- Lecture 48 - Pressure Levels and Terminology - I
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- Lecture 50 - Gauges for Pressure Measurement
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- Lecture 52 - Introduction to Refrigeration
- Lecture 53 - Refrigeration System Components
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- Lecture 55 - Refrigeration Systems
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Lecture 6 - Pollution types and sources

Lecture 7 - Pollution: Impacts/Consequences

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Lecture 16 - Sampling and characterization - 1 (Gas, air ,emission)

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Lecture 19 - Environmental laws and regulatory framework

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- Lecture 36 - Advanced secondary processes - 3
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- Lecture 41 - Sludge management - 1
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- Lecture 54 - Solid waste and hazardous waste management - 4
- Lecture 55 - Tutorial-11
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- Lecture 58 - Management of special category wastes - 1
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- Lecture 2 - Microorganisms in Biological Wastewater Treatment
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- Lecture 12 - Reaction Kinetics
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- Lecture 15 - Reactor Hydraulics - I
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- Lecture 19 - Coagulation, Flocculation, and Sedimentation - I
- Lecture 20 - Coagulation, Flocculation, and Sedimentation - II
- Lecture 21 - Lagoon
- Lecture 22 - Activated Sludge Process
- Lecture 23 - Sequential Batch Reactor
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- Lecture 26 - Up-flow Anaerobic Sludge Blanket (UASB) reactor
- Lecture 27 - UASB and Biotower
- Lecture 28 - Advanced Biological Wastewater Treatment: Fluidized Bed Bioreactors
- Lecture 29 - Advanced Biological Wastewater Treatment: Membrane Bioreactors
- Lecture 30 - Advanced Biological Wastewater Treatment: Moving Bed Biofilm Reactor (MBBR)
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Lecture 8 - Effect of Pressure Drop on Reactor design (PBR)_(X vs W)_(P vs W)

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Lecture 14 - Catalyst Deactivation_Temperature (T) - Time (t) trajectories

Lecture 15 - Moving Bed Reactor_Catalyst deactivation

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Lecture 29 - Steady State Non Isothermal reactor design_Example

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- Lecture 32 - SS Non Isothermal reactor design_Equilibrium conversion
- Lecture 33 - SS Non Isothermal reactor design_Optimum feed temperature
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- Lecture 37 - SS Non Isothermal reactor design_Energy Balance:Multiple rxn in a CSTR/PFR (Examples)
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- Lecture 42 - One parameter Model-Tank in Series model (TIS)
- Lecture 43 - Non-ideal flow-Dispersion model - Part 1
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- Lecture 46 - Two parameter Models-Modeling real reactors with Combinations of Ideal Reactors
- Lecture 47 - Solid Catalyzed Reaction: Reaction and Diffusion - Part 1
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Lecture 8 - Amino Acid Titrations

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Lecture 11 - Phosphorus and its components

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Lecture 13 - Tetrapotassium diphosphate preparation

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Lecture 15 - P₄S₁₀ and phosphide preparation

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Lecture 18 - Sulfuric acid, catalyst and S₂Cl₂, applications

Lecture 19 - Sulfur dichloride, thionyl chloride

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Lecture 21 - Sodium hydroxyl methanesulfinate and hydrogen sulfide

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Lecture 53 - Specialty ceramic products

Lecture 54 - Ferrites and porcelain enamel

Lecture 55 - Layers of enamelling

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Lecture 58 - Metallic hard materials: Carbides, borides, silicides

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Lecture 2 - Biological Macromolecules and Small molecules: Importance and functions

Lecture 3 - Amino Acids: The building block of proteins

Lecture 4 - Amino acids: separation and detection, Electrophoresis and Ninhydrin reaction

Lecture 5 - Method of determination of Amino acid sequence: primary structure of polypeptide/protein

Lecture 6 - Selective peptide bond cleavage: Enzymatic and Non-enzymatic methods

Lecture 7 - Peptide synthesis: Protecting groups for amine and carboxyl functionality

Lecture 8 - Peptide synthesis (Continued...) Protection, coupling and deprotection method

Lecture 9 - Recent development of coupling agents; Merrifield's method of solid phase peptide synthesis

Lecture 10 - Hierarchical structure of proteins: Secondary, tertiary and quaternary structure

Lecture 11 - Ramachandran plot and protein purification techniques

Lecture 12 - Protein purification techniques (Continued...)

Lecture 13 - Introduction to Enzymes and its kinetics

Lecture 14 - Enzyme catalysed reactions and introduction to catalytic activity of proteases

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Lecture 18 - Problems on Enzyme Kinetics and Enzyme Inhibition

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Lecture 26 - DNA sequencing method (Continued...)

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Lecture 30 - Central dogma: DNA replication, transcription and translation (Continued...)

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[Lecture 49 - Chemistry of penicillins](#)

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[Lecture 59 - Aromatase inhibition and Anti-ulcer drugs](#)

[Lecture 60 - Cholesterol lowering agents](#)

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Lecture 1 - Importance of Polymer Science and Brief Historical background

Lecture 2 - Definitions/Terminologies, Classifications

Lecture 3 - Classifications, Nomenclature

Lecture 4 - Classification by Polymerization Mechanism, Nomenclature

Lecture 5 - Molecular Weight, Big Picture of Polymer Science, Common Polymers

Lecture 6 - Examples of Step Polymers, Linear Step Polymerization

Lecture 7 - Linear Step Polymerization: MW Control, MW Distribution, Kinetics

Lecture 8 - Linear Step Polymerization: Kinetics (Continued...), Equilibrium Consideration, General Requirements for Achieving High MW; Non-linear Step Polymerization

Lecture 9 - Linear Step Polymerization: Summary - General Requirement, Non-Linear Step Polymerization

Lecture 10 - Types of Chain polymerization, Mechanism and Kinetics of Radical Chain Polymerization

Lecture 11 - Kinetics of Radical Chain Polymerization (Continued...), Various Types of Initiators

Lecture 12 - Thermal Initiation (Continued...), Molecular Weight and Kinetic Chain Length, Other Types of Radical Initiators, Transfer Reactions

Lecture 13 - Transfer Reactions, Effect of Temperature on Rate and MW, MW Distribution, ceiling Temperature

Lecture 14 - Energetics and Thermodynamics of Chain Polymerization, MW Distribution, Common Polymers

Lecture 15 - Thermodynamics of Chain Polymerization, MW Distribution, Common Polymers

Lecture 16 - Process Conditions, Emulsion Polymerization

Lecture 17 - Emulsion Polymerization (Continued...), Common Polymers by Radical Chain Polymerization, RDRP

Lecture 18 - Reversible - Deactivation Radical Polymerizations (RDRP)

Lecture 19 - RAFT Polymerization (Continued...), Ionic Polymerization

Lecture 20 - Polymer Stereochemistry and Zeigler - Natta Coordination Polymerization

Lecture 21 - Ring Opening Polymerization, Copolymers

Lecture 22 - Copolymerization (Continued...)

Lecture 23 - Polymers in Solution : Flory - Huggins Theory

Lecture 24 - Polymers in Solution : Application of Flory - Huggins Theory

Lecture 25 - Polymers in Solution : Solubility Parameter, Polymer Phase Separation and Fractionation

Lecture 26 - Polymers Chain Dimensions

Lecture 27 - Frictional Properties of Polymer Molecules in Dilute Solution, Determination of Polymer MW (Overview)

Lecture 28 - Membrane Osmometry, End Group Analysis, Dilute Solution Viscometry

Lecture 29 - Dilute Solution Viscometry, Light Scattering Techniques for MW

Lecture 30 - Gel Permeation Chromatography

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[Lecture 33 - Polymer Processing](#)

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[Lecture 35 - Thermal Properties: Amorphous State](#)

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[Lecture 37 - Thermal Properties: Factors Influencing \$T_m\$, Determination of \$T_g\$ and \$T_m\$, Other Thermal Properties](#)

[Lecture 38 - Thermomechanical Properties, Viscoelasticity](#)

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[Lecture 42 - Polymer Blends, Concluding Remarks](#)

NPTEL : NOC:Structure, Stereochemistry and Reactivity of Organic Compounds and Intermediates: A Problem Solving Approach (Chemistry and Biochemistry)

Co-ordinators : Prof. A. Basak

Lecture 1 - Introduction to structure and stereochemistry of organic molecules: salient features of symmetry elements; Role of principal axis, sigma plane, centre of symmetry, and alternating axis of symmetry in deciding chirality

Lecture 2 - Introduction to point group notation, classification, symmetry number and order

Lecture 3 - Examples of various point group notations, chiral and achiral point groups, examples of various point groups

Lecture 4 - Solving problems on point groups (C_n , C_{nv} , C_{nh} , D_{nd})

Lecture 5 - Conformational Analysis of Perhydrophenanthrene

Lecture 6 - Concept Clearing Session on Achiral Point Groups

Lecture 7 - Axial, Planar and Helical Chirality, assignment of absolute configuration to such molecules

Lecture 8 - Concept of pseudoasymmetry; Reflection variance/invariance problem; methods of nomenclature system

Lecture 9 - Conformational analysis of bicyclic systems: the Decalins

Lecture 10 - Conformational analysis of Perhydrophenanthrene

Lecture 11 - Conformational analysis of Perhydroanthracene

Lecture 12 - Revisiting conformational analysis of Perhydrophenanthrene

Lecture 13 - Revisiting conformational analysis of Perhydroanthracene

Lecture 14 - Introduction to Linear Polarized light and interaction with chiral materials; Circular Birefringence, Circular Dichroism

Lecture 15 - ORD, CD and Cotton Effect (CE); Empirical rule to determine the sign of CE, 2-axial haloketone rule

Lecture 16 - Octant rule: application to substituted cyclohexanone and decalone system

Lecture 17 - Application of Octant rule to tricyclic system; drawing of octant projection

Lecture 18 - Application of Octant rule to steroidal ketones; drawing of octant projection

Lecture 19 - Stereoelectronic effects on conformation and reactivity

Lecture 20 - Examples of anomeric effect and Stereoelectronic effect

Lecture 21 - Baldwin rules

Lecture 22 - Cyclization in enolic systems

Lecture 23 - Problem solving on Baldwin rules

Lecture 24 - Reactive Functionalities: Chemistry of Alkynes

Lecture 25 - Reactive Functionalities: Chemistry of Alkynes (Continued...), arynes and enediynes

Lecture 26 - Reactive Functionalities: Ene-diynes (Continued...), allenes and Ketenes

Lecture 27 - Beta - Lactam Synthesis

Lecture 28 - Chemistry of radicals

Lecture 29 - Reactivity of radicals: Frontier orbital approach.

Lecture 30 - Radical mediated C-C bond formation

[Lecture 31 - Radical mediated C-C bond formation \(Continued...\)](#).

[Lecture 32 - Radical mediated decarboxylation and deoxygenation](#)

[Lecture 33 - Dynamic Stereochemistry: Conformationally rigid and mobile systems](#)

[Lecture 34 - Dynamic Stereochemistry: Conformational analysis of elimination and addition](#)

[Lecture 35 - Dynamic Stereochemistry: Stereoselectivity in carbonyl reduction](#)

[Lecture 36 - Dynamic Stereochemistry: Reactivity of unsaturated carbonyl and enolate systems](#)

[Lecture 37 - Dynamic Stereochemistry: Enolate as nucleophile](#)

[Lecture 38 - Dynamic Stereochemistry: stereochemical issues in cyclohexenone reduction and alpha-electrophilic substitution in carbonyls](#)

[Lecture 39 - Dynamic Stereochemistry: Asymmetric aldol reactions](#)

[Lecture 40 - Dynamic Stereochemistry: Asymmetric aldol reaction \(Continued...\)](#)

Lecture 1 - Review of Quantum Chemistry

Lecture 2 - Postulates of Quantum Mechanics - I

Lecture 3 - Postulates of Quantum Mechanics - II

Lecture 4 - Exactly Solvable Models - I

Lecture 5 - Exactly Solvable Models - II

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Lecture 8 - Potential ligands of different types

Lecture 9 - Metal ion insertion

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Lecture 18 - Transport of metal ions in fungi and mammals

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Lecture 20 - Homeostasis in fungi and mammals

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- Lecture 32 - Heme proteins for (O₂) transport and storage
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- Lecture 5 - Revisit again, Different mode of asymmetric induction in enolate alkylation
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Lecture 11 - Hexose Monophosphate Shunt : Regulation and Significance

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Lecture 55 - Integration of Metabolism - II (Starve feed cycle)

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Lecture 14 - Chirality and Stereochemistry - Part 1

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Lecture 2 - Defining Molality and Normality, relationship with Molarity

Lecture 3 - Defining other parameters for concentration (% , ppm/ppb, p-value)

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Lecture 7 - Using a spreadsheet towards basic statistical analysis, exact equation of error propagation, accuracy and precision

Lecture 8 - Error propagation and its application to a few examples, significant figures

Lecture 9 - Introduction to use spreadsheets to analyze errors, reiteration of significant figures, repeats and reproducibility

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Lecture 11 - A look at uncertainties in a measurement taking an example

Lecture 12 - A comprehensive and step-wise look at an experimental protocol towards understanding systematic errors in an experiment

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Lecture 19 - Protocol for undertaking ANOVA - Part 1

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Lecture 21 - ANOVA and Least Significant Difference (LSD)

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Lecture 25 - Using spreadsheet and MATLAB towards data analysis with example of rate kinetics

Lecture 26 - Simulating simple straight lines and kinetic curves using MATLAB

Lecture 27 - Simulating the Michaelis Menten kinetics using MATLAB

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- Lecture 36 - Analytical Separations - Chromatography - Part 1
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- Lecture 42 - Chromatography - Rate Theory
- Lecture 43 - Practice of Chromatography - HPLC
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Lecture 4 - A Simple Quantum Mechanical System: Particle in a one Dimensional Box

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Lecture 6 - Intensity of a Transition Depends on the Transition Dipole Moment - I

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Lecture 11 - Spectroscopic Timescales

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Lecture 13 - Diatomic Rigid Rotor

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Lecture 20 - Polyatomic Molecules - II and Numericals

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- Lecture 32 - Ro-vibrational Spectrum - III
- Lecture 33 - Vibration of Polyatomic Molecules - I
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- Lecture 37 - Introduction to Raman Spectroscopy
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- Lecture 1 - Introduction to stereochemistry
- Lecture 2 - Nomenclature of Various Organic Molecules
- Lecture 3 - Nomenclature of Cyclic molecules and other functional groups
- Lecture 4 - Nomenclature of some complex molecules
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- Lecture 6 - Symmetry, Stereochemistry and Applications
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Co-ordinators : Dr. T.I. Eldho

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NPTEL : Structural Analysis II (Civil Engineering)

Co-ordinators : Dr. P. Banerji

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Co-ordinators : Dr. Deepankar Choudhury

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Lecture 13 - Key Hydrological Parameters 2 - Part 3

Lecture 14 - Key Hydrological Parameters 2 - Part 4

Lecture 15 - Key Hydrological Parameters 2 - Part 5

Lecture 16 - Introduction to Groundwater hydrology - Part 1

Lecture 17 - Introduction to Groundwater hydrology - Part 2

Lecture 18 - Introduction to Groundwater hydrology - Part 3

Lecture 19 - Introduction to Groundwater hydrology - Part 4

Lecture 20 - Introduction to Groundwater hydrology - Part 5

Lecture 21 - Groundwater components - Part 1

Lecture 22 - Groundwater components - Part 2

Lecture 23 - Groundwater components - Part 3

Lecture 24 - Groundwater components - Part 4

Lecture 25 - Groundwater components - Part 5

Lecture 26 - Surface water hydrology - Part 1

Lecture 27 - Surface water hydrology - Part 2

Lecture 28 - Surface water hydrology - Part 3

Lecture 29 - Surface water hydrology - Part 4

Lecture 30 - Surface water hydrology - Part 5

Lecture 31 - Water Mass Balance Equation - Part 1

[Lecture 32 - Water Mass Balance Equation - Part 2](#)

[Lecture 33 - Water Mass Balance Equation - Part 3](#)

[Lecture 34 - Water Mass Balance Equation - Part 4](#)

[Lecture 35 - Water Mass Balance Equation - Part 5](#)

[Lecture 36 - Rural water management issues, data challenges and observation records - Part 1](#)

[Lecture 37 - Rural water management issues, data challenges and observation records - Part 2](#)

[Lecture 38 - Rural water management issues, data challenges and observation records - Part 3](#)

[Lecture 39 - Rural water management issues, data challenges and observation records - Part 4](#)

[Lecture 40 - Rural water management issues, data challenges and observation records - Part 5](#)

[Lecture 41 - Rural water resource management infrastructure \(engineered\) - Part 1](#)

[Lecture 42 - Rural water resource management infrastructure \(engineered\) - Part 2](#)

[Lecture 43 - Rural water resource management infrastructure \(engineered\) - Part 3](#)

[Lecture 44 - Rural water resource management infrastructure \(engineered\) - Part 4](#)

[Lecture 45 - Rural water resource management infrastructure \(engineered\) - Part 5](#)

[Lecture 46 - Rural water resource management infrastructure \(nature based\) - Part 1](#)

[Lecture 47 - Rural water resource management infrastructure \(nature based\) - Part 2](#)

[Lecture 48 - Rural water resource management infrastructure \(nature based\) - Part 3](#)

[Lecture 49 - Rural water resource management infrastructure \(nature based\) - Part 4](#)

[Lecture 50 - Rural water resource management infrastructure \(nature based\) - Part 5](#)

[Lecture 51 - Solving case studies in rural water resource management - Part 1](#)

[Lecture 52 - Solving case studies in rural water resource management - Part 2](#)

[Lecture 53 - Solving case studies in rural water resource management - Part 3](#)

[Lecture 54 - Solving case studies in rural water resource management - Part 4](#)

[Lecture 55 - Solving case studies in rural water resource management - Part 5](#)

[Lecture 56 - Rural hydrological databases for India - Part 1](#)

[Lecture 57 - Rural hydrological databases for India - Part 2](#)

[Lecture 58 - Rural hydrological databases for India - Part 3](#)

[Lecture 59 - Rural hydrological databases for India - Part 4](#)

[Lecture 60 - Rural hydrological databases for India - Part 5](#)

Lecture 1 - Introduction

Lecture 2 - Shear Strength of Soils - I

Lecture 3 - Shear Strength of Soils - II

Lecture 4 - Shear Strength of Soils - III

Lecture 5 - Shear Strength of Soils - IV

Lecture 6 - Testing for shear strength parameters: Introduction

Lecture 7 - Direct shear box test

Lecture 8 - Direct Shear Interpretation of Test Results - I

Lecture 9 - Direct Shear Interpretation of Test Results - II

Lecture 10 - Kf line

Lecture 11 - Selection of Parameter (Shear Strength,SS) - I

Lecture 12 - Selection of Parameter (Shear Strength,SS) - II

Lecture 13 - Shear Strength of Cohesive Soils - I

Lecture 14 - Shear Strength of Cohesive Soils - II

Lecture 15 - Triaxial Test - I

Lecture 16 - Triaxial Test - II

Lecture 17 - Triaxial Test - III

Lecture 18 - Interpretation of Triaxial test Results - I

Lecture 19 - Interpretation of Triaxial test Results - II

Lecture 20 - Interpretation of Triaxial test Results - III

Lecture 21 - Pore Pressure Parameters - I

Lecture 22 - Pore Pressure Parameters - II

Lecture 23 - Stress Paths - I

Lecture 24 - Stress Paths - II

Lecture 25 - Plastic Equilibrium in Soils

Lecture 26 - Mechanisms of Development of Plastic Equilibrium in Soils - I

Lecture 27 - Mechanisms of Development of Plastic Equilibrium in Soils - II

Lecture 28 - Earth Pressure Analysis (Trial Wedge) - I

Lecture 29 - Earth Pressure Analysis (Trial Wedge) - II

Lecture 30 - Earth Pressure Analysis (Trial Wedge) - III

Lecture 31 - Analysis of Completely Submerged Retaining wall

[Lecture 32 - Gravity Walls Supporting Cohesive Soil Mass \(Backfill\)](#)

[Lecture 33 - Sloping Backfill](#)

[Lecture 34 - Earth Pressure Analysis - I](#)

[Lecture 35 - Earth Pressure Analysis - II](#)

[Lecture 36 - Sheet Pile Wall Introduction - I](#)

[Lecture 37 - Sheet Pile Wall Introduction - II](#)

[Lecture 38 - Sheet pile wall Introduction - III](#)

[Lecture 39 - Analysis of sheet piles - I](#)

[Lecture 40 - Analysis of sheet piles - II](#)

[Lecture 41 - Anchored Bulkheads](#)

[Lecture 42 - Cantilever Sheet Piles](#)

[Lecture 43 - Lateral Earth Pressure Braced Sheet Pile Walls](#)

[Lecture 44 - Slope Stability - I](#)

[Lecture 45 - Slope Stability - II](#)

[Lecture 46 - Slope Instability - I](#)

[Lecture 47 - Slope Instability - II](#)

[Lecture 48 - Slope Instability - III](#)

[Lecture 49 - Analysis of Finite Slopes - I Planar Failure Surface](#)

[Lecture 50 - Analysis of Finite Slopes - II Circular Failure Surface](#)

[Lecture 51 - Finite Slopes Friction Circle Method](#)

[Lecture 52 - Slip Circle Method](#)

- Lecture 1 - Introduction to course - Rural development (RD)
- Lecture 2 - Water security (SF) and Water security (GW) and issues
- Lecture 3 - Food security and issues
- Lecture 4 - Agriculture and rural infrastructure issues
- Lecture 5 - Rural Development
- Lecture 6 - Data and mapping issues for Rural regions
- Lecture 7 - Introduction to Remote Sensing and need
- Lecture 8 - Remote Sensing for Water and Food Security
- Lecture 9 - Remote Sensing for Rural infrastructures
- Lecture 10 - Remote Sensing for Rural Development
- Lecture 11 - Intro to Remote Sensing Data for Rural Development
- Lecture 12 - Intro to Remote Sensing Data for Rural Development : Water
- Lecture 13 - Intro to Remote Sensing Data for Rural Development : Soil and Climate
- Lecture 14 - Intro to Remote Sensing Data for Rural Development : NASA datasets for water
- Lecture 15 - Intro to Remote Sensing Data for Rural Development
- Lecture 16 - Intro to GIS and QGIS
- Lecture 17 - Intro to GIS data types and download
- Lecture 18 - Intro to GIS vector data type and QGIS panel
- Lecture 19 - Vector Tools in QGIS
- Lecture 20 - QGIS tutorials for vector analysis and data searching
- Lecture 21 - Intro to Raster Data type in GIS
- Lecture 22 - Raster data type formats and uses
- Lecture 23 - Raster data and Vector data quality issues
- Lecture 24 - Raster data tools: Raster calculator and Raster Align
- Lecture 25 - Raster data tools: Clip and Masking tools
- Lecture 26 - Intro to GIS Projections and Co-ordinate systems
- Lecture 27 - Intro to digitization of images for raster data
- Lecture 28 - Digitization of scanned maps into raster data
- Lecture 29 - Extracting point and line features from georeferenced data
- Lecture 30 - Extracting polygon features from georeferenced data
- Lecture 31 - Creating shapefiles from georeferenced maps

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[Lecture 32 - Google Earth Pro introduction for extracting data](#)

[Lecture 33 - Ground Control points from Google Earth Pro and Basemaps](#)

[Lecture 34 - Digital Elevation models and sources](#)

[Lecture 35 - Digital Elevation models \(hands on example\)](#)

[Lecture 36 - Introduction to Land Use Land Cover](#)

[Lecture 37 - Data for LULC and proxy data](#)

[Lecture 38 - Analyzing Bhuvan LULC data - Part 1](#)

[Lecture 39 - Analyzing Bhuvan LULC data - Part 2](#)

[Lecture 40 - Analyzing USGS LULC data](#)

[Lecture 41 - Different types of LULC classifications](#)

[Lecture 42 - Different types of LULC classifications](#)

[Lecture 43 - Remote Sensing for irrigation assessments](#)

[Lecture 44 - Remote Sensing for Groundwater irrigation assessments](#)

[Lecture 45 - Methods for Crop Statistics using Remote Sensing data](#)

[Lecture 46 - Remote Sensing based indicators for rural development](#)

[Lecture 47 - Remote Sensing methods for crop area and health assessments](#)

[Lecture 48 - NDVI data access](#)

[Lecture 49 - NDVI data from NASA platforms](#)

[Lecture 50 - NDVI data from Sentinel and NASA platforms](#)

[Lecture 51 - Remote Sensing based indicators database](#)

[Lecture 52 - Synergized mapping using Remote Sensing and Crowd Sourced data for rural infrastructures](#)

[Lecture 53 - RS and OSM for mapping rural infrastructures: Schools](#)

[Lecture 54 - RS and OSM for mapping rural infrastructures: Hospitals](#)

[Lecture 55 - RS and OSM for mapping rural infrastructures: Adding data, crops and water bodies](#)

[Lecture 56 - RS and GIS application for Rural Development: Monitoring and Evaluation](#)

[Lecture 57 - RS and GIS application for Rural Development: Monitoring and Evaluation using NDVI and NDWI](#)

[Lecture 58 - RS and GIS application for Rural Development: Water Quality Assessment](#)

[Lecture 59 - RS and GIS application for Rural Development: Indicators and Dashboards](#)

[Lecture 60 - RS and GIS for Rural Development - Summary, Wrap and Ways Forward](#)

NPTEL : Concrete Technology (Civil Engineering)

Co-ordinators : Dr. B. Bhattacharjee

Lecture 1 - Production and Composition

Lecture 2 - Structure and Hydration

Lecture 3 - Structure and Hydration

Lecture 4 - Properties and Tests

Lecture 5 - Types and Use

Lecture 6 - Aggregates (Size, Shape)

Lecture 7 - Packing, FM, SM

Lecture 8 - Properties

Lecture 9 - Chemical Admixtures

Lecture 10 - Chemical Admixtures

Lecture 11 - Mineral Admixtures

Lecture 12 - Mineral Admixtures

Lecture 13 - Mineral Admixtures

Lecture 14 - Mix Proportioning of Concrete: General Principles

Lecture 15 - Mix design of Concrete: General and IS Method

Lecture 16 - Mix Design of Concrete: Is Example and British (DOE) Method

Lecture 17 - Mix Design of concrete: ACI 211 Method

Lecture 18 - Mix Design of concrete: Packing Density, Rheology

Lecture 19 - Batching and Mixing of concrete: General Principles

Lecture 20 - RMC and Transporting Concrete

Lecture 21 - Workability and Pumping of Concrete

Lecture 22 - Compaction and Curing Concrete

Lecture 23 - Strength of Concrete: Factors Affecting

Lecture 24 - Strength of Concrete: Aggregate Contribution

Lecture 25 - Strength of Concrete: Factors Affecting Test Results

Lecture 26 - Mechanical Properties of Concrete: Elastic Modulus, Poisson's Ratio, Fatigue, Impact

Lecture 27 - Creep of Concrete

Lecture 28 - Creep and Shrinkage of Concrete

Lecture 29 - Shrinkage of Concrete

Lecture 30 - Shrinkage of Concrete

Lecture 31 - Fundamental Concepts, Degradation Process, Attacks

[Lecture 32 - Frost Action and Rebar Corrosion](#)

[Lecture 33 - Carbonation and Chloride Affect](#)

[Lecture 34 - Rebar Corrosion](#)

[Lecture 35 - Rebar Corrosion and General Strategy](#)

[Lecture 36 - High Strength Concrete](#)

[Lecture 37 - High Strength Matrics and SCC](#)

[Lecture 38 - Self Compacting Concrete](#)

[Lecture 39 - Fiber Concrete](#)

[Lecture 40 - Fiber and Roller Compacted Concrete](#)

[Lecture 41 - Special Concrete and Sustainability](#)

- [Lecture 1 - Seismology](#)
- [Lecture 2 - Seismology \(Continued...\)](#)
- [Lecture 3 - Seismology \(Continued...\)](#)
- [Lecture 4 - Seismology \(Continued...\)](#)
- [Lecture 5 - Seismic Inputs](#)
- [Lecture 6 - Seismic Inputs \(Continued...\)](#)
- [Lecture 7 - Seismic Inputs \(Continued...\)](#)
- [Lecture 8 - Seismic Inputs \(Continued...\)](#)
- [Lecture 9 - Response Analysis for Specified Ground Motion](#)
- [Lecture 10 - Response Analysis for Specified Ground Motion \(Continued...\)](#)
- [Lecture 11 - Response Analysis for Specified Ground Motion \(Continued...\)](#)
- [Lecture 12 - Response Analysis for Specified Ground Motion \(Continued...\)](#)
- [Lecture 13 - Response Analysis for Specified Ground Motion \(Continued...\)](#)
- [Lecture 14 - Response Analysis for Specified Ground Motion \(Continued...\)](#)
- [Lecture 15 - Frequency Domain Spectral Analysis](#)
- [Lecture 16 - Frequency Domain Spectral Analysis.](#)
- [Lecture 17 - Frequency Domain Spectral Analysis \(Continued...\)](#)
- [Lecture 18 - Frequency Domain Spectral Analysis \(Continued...\)](#)
- [Lecture 19 - Frequency Domain Spectral Analysis \(Continued...\)](#)
- [Lecture 20 - Response Spectrum Method of Analysis](#)
- [Lecture 21 - Response Spectrum Method of Analysis.](#)
- [Lecture 22 - Response Spectrum Method of Analysis \(Continued...\)](#)
- [Lecture 23 - Response Spectrum Method of Analysis \(Continued...\)](#)
- [Lecture 24 - Response Spectrum Method of Analysis \(Continued...\)](#)
- [Lecture 25 - Inelastic Seismic Response of Structures](#)
- [Lecture 26 - Inelastic Seismic Response of Structures \(Continued...\)](#)
- [Lecture 27 - Inelastic Seismic Response of Structures \(Continued...\)](#)
- [Lecture 28 - Inelastic Seismic Response of Structures \(Continued...\)](#)
- [Lecture 29 - Inelastic Seismic Response of Structures \(Continued...\)](#)
- [Lecture 30 - Inelastic Seismic Response of Structures \(Continued...\)](#)

- Lecture 1 - Functions Of Buildings
- Lecture 2 - Role Of Material In Construction
- Lecture 3 - Concrete:Material
- Lecture 4 - Concrete Production (Continued...)
- Lecture 5 - Concrete Production (Continued...)
- Lecture 6 - Concrete:Production Pumping, Placing
- Lecture 7 - Concrete:Production Curing
- Lecture 8 - Cement: Hydration
- Lecture 9 - Cement and Cementitious Material
- Lecture 10 - Fresh Concrete
- Lecture 11 - Fresh Concrete : Role of Mix Parameters
- Lecture 12 - Fresh Concrete : Role of Admixtures
- Lecture 13 - Fresh Concrete : Segregation Bleeding
- Lecture 14 - Strength of Concrete - I
- Lecture 15 - Strength of Concrete - II
- Lecture 16 - Strength of Concrete - III
- Lecture 17 - Mechanical Properties of Concrete - I
- Lecture 18 - Mechanical Properties of Concrete - II
- Lecture 19 - Strength of Concrete : Non Destructive
- Lecture 20 - Durability of Concrete - I
- Lecture 21 - Durability of Concrete - II
- Lecture 22 - Durability of Concrete - III
- Lecture 23 - Cement Aggregate and Water Selection
- Lecture 24 - Mix Design of Concrete
- Lecture 25 - Mix Design Of concrete IS Method
- Lecture 26 - Mix Design Of Concrete: British
- Lecture 27 - Masonry : Materials
- Lecture 28 - Masonry : Walls
- Lecture 29 - Masonry : Walls; Resistance - I
- Lecture 30 - Masonry : Walls; Resistance - II
- Lecture 31 - Walls : Functional Performances

[Lecture 32 - Walls : Defects and Durability](#)

[Lecture 33 - Metals Fundamentals](#)

[Lecture 34 - Metals and Iron Systems](#)

[Lecture 35 - Steel : Uses in Construction](#)

[Lecture 36 - Steel : Uses in Rebar](#)

[Lecture 37 - Polymer in Construction](#)

[Lecture 38 - Polymer in Construction : Uses](#)

[Lecture 39 - Glass and Timber : Glass](#)

[Lecture 40 - Glass and Timber : Timber](#)

[Lecture 41 - Roof and Floor Construction](#)

NPTEL : Water Management (Civil Engineering)

Co-ordinators : Dr. A.K. Gosain

- Lecture 1 - Introduction to Irrigation Water Management
- Lecture 2 - Soil - Water - Plant Relationships
- Lecture 3 - Soil - Water - Plant Relationships (Continued...)
- Lecture 4 - Soil - Water - Plant Relationships (Continued...)
- Lecture 5 - Soil - Water - Plant Relationships (Continued...)
- Lecture 6 - Soil - Water - Plant Relationships (Continued...) and Infiltration
- Lecture 7 - Crop Water Requirements
- Lecture 8 - Crop Water Requirements (Continued...)
- Lecture 9 - Crop Water Requirements (Continued...)
- Lecture 10 - Crop Water Requirements (Continued...)
- Lecture 11 - Crop Water Requirements (Continued...)
- Lecture 12 - Crop Water Requirements (Continued...)
- Lecture 13 - Crop Water Requirements (continued...)
- Lecture 14 - Irrigation Efficiencies - Part I
- Lecture 15 - Irrigation Efficiencies - Part II and Irrigation Methods and their Suitability
- Lecture 16 - Irrigation Methods - III
- Lecture 17 - Irrigation Methods - IV
- Lecture 18 - Irrigation Methods - V
- Lecture 19 - Irrigation Methods - VI
- Lecture 20 - Irrigation Methods and their Suitability
- Lecture 21 - Border Irrigation System - I
- Lecture 22 - Border Irrigation System - II
- Lecture 23 - Border Irrigation System - III
- Lecture 24 - Border Irrigation System - IV
- Lecture 25 - Furrow Irrigation System - I
- Lecture 26 - Furrow Irrigation System - II
- Lecture 27 - Furrow Irrigation System - III
- Lecture 28 - Furrow Irrigation System - IV
- Lecture 29 - Sprinkler Irrigation System - I
- Lecture 30 - Sprinkler Irrigation System - II
- Lecture 31 - Sprinkler Irrigation System - III

[Lecture 32 - Sprinkler Irrigation System - IV](#)

[Lecture 33 - Sprinkler Irrigation System - V](#)

[Lecture 34 - Sprinkler Irrigation System - VI](#)

[Lecture 35 - Sprinkler Irrigation System - VII](#)

[Lecture 36 - Sprinkler Irrigation System - VIII](#)

[Lecture 37 - Drip Irrigation System - I](#)

[Lecture 38 - Drip Irrigation System - II](#)

[Lecture 39 - Drip Irrigation System - III](#)

[Lecture 40 - Drip Irrigation System - IV](#)

**NPTEL : NOC:Geoenvironmental Engineering (Environmental Geotechnology) Landfills, Slurry Ponds and Contaminated Sites
(Civil Engineering)**

Co-ordinators : Prof. Manoj Datta

Lecture 1 - Introduction to Geoenvironmental Engineering

Lecture 2 - Sources and Impact of Contamination

Lecture 3 - Waste-Soil Interaction

Lecture 4 - Solid Waste Generation and Disposal

Lecture 5 - Waste Minimization by Integrated Solid Waste Management (ISWM)

Lecture 6 - Integrated Solid Waste Management (ISWM) - Case Studies

Lecture 7 - Principles of Landfilling

Lecture 8 - Planning of Landfills - Part 1

Lecture 9 - Planning of Landfills - Part 2

Lecture 10 - Liners for Landfills - Part 1

Lecture 11 - Liners for Landfills - Part 2

Lecture 12 - Liners for Landfills - Part 3

Lecture 13 - Liners for Landfills - Part 4

Lecture 14 - Covers for Landfills - Part 1

Lecture 15 - Covers for Landfills - Part 2

Lecture 16 - Generation and Control of Leachate

Lecture 17 - Generation and Control of Landfill Gas

Lecture 18 - Stability of Slopes - Part 1

Lecture 19 - Stability of Slopes - Part 2

Lecture 20 - Stability of Slopes - Part 3

Lecture 21 - (Lecture Missing)

Lecture 22 - Some Solved Examples

Lecture 23 - Subsurface Monitoring Around Landfills - Part 1

Lecture 24 - Subsurface Monitoring Around Landfills - Part 2

Lecture 25 - Cost of Geotechnical Components of Landfills

Lecture 26 - Construction and Operation of Landfills

Lecture 27 - Site Selection for Landfills

Lecture 28 - Closure, Rehabilitation and Expansion of MSW Landfills

Lecture 29 - Control and Remedial Measures at Contaminated Sites - Part 1

Lecture 30 - Control and Remedial Measures at Contaminated Sites - Part 2

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[Lecture 31 - Slurry Disposal on Land](#)

[Lecture 32 - Disposal of Slurry Waste in Ponds and Impoundments and Dry Waste in Mounds](#)

[Lecture 33 - Geotechnical Properties of Coal Ash and Mine Tailings - Part 1](#)

[Lecture 34 - Geotechnical Properties of Coal Ash and Mine Tailings - Part 2](#)

[Lecture 35 - Planning and Design of Slurry Ponds](#)

[Lecture 36 - Stability of Incrementally Raised Embankments - Part 1](#)

[Lecture 37 - Stability of Incrementally Raised Embankments - Part 2](#)

[Lecture 38 - Remedial Measures for Slope Failures in Embankments / Dykes of Slurry Ponds](#)

[Lecture 39 - Environmental Control at Slurry Ponds](#)

[Lecture 40 - Geotechnical Reuse of Waste Materials - Part 1](#)

[Lecture 41 - Geotechnical Reuse of Waste Materials - Part 2](#)

[Lecture 42 - End-of-the-Course Review](#)

- Lecture 1 - Introduction to Environmental Factors - 1
- Lecture 2 - Introduction to Environmental Factors - 2
- Lecture 3 - Introduction to Environmental Factors - 3
- Lecture 4 - Introduction to Environmental Factors - 4
- Lecture 5 - Introduction to Environmental Factors - 5
- Lecture 6 - Introduction to Environmental Factors - 6
- Lecture 7 - Introduction to Environmental Factors - 7
- Lecture 8 - Comfort and Heat Transfer Concepts
- Lecture 9 - Heat Flow in Buildings - 1
- Lecture 10 - Heat Flow in buildings - 2
- Lecture 11 - Heat Flow in buildings - 3
- Lecture 12 - Admittance Method - 1
- Lecture 13 - Admittance Method - 2
- Lecture 14 - Heat Flow in buildings - 1 (Frequency Domain)
- Lecture 15 - Heat Flow in buildings - 2 (Frequency Domain)
- Lecture 16 - Heat Flow in buildings - 2 (Frequency Domain)
- Lecture 17 - Heat flow in buildings
- Lecture 18 - Admittance Method
- Lecture 19 - Comfort - 1
- Lecture 20 - Comfort - 2
- Lecture 21 - Comfort and Thermal Design of Buildings - 1
- Lecture 22 - Comfort and Thermal Design of Buildings - 2
- Lecture 23 - Comfort and Thermal Design of Buildings - 3
- Lecture 24 - Thermal Design of Unconditioned Building
- Lecture 25 - External Shading Multipliers for external suns shading
- Lecture 26 - Passive Concepts
- Lecture 27 - Design for Thermal Efficiency
- Lecture 28 - Ventilation - 1
- Lecture 29 - Ventilation - 2
- Lecture 30 - Natural ventilation design
- Lecture 31 - Noise and Acoustic Fundamentals - 1

- Lecture 32 - Noise and Acoustic Fundamentals - 2
- Lecture 33 - Noise and Acoustic Fundamentals - 3
- Lecture 34 - Noise and Acoustic Fundamentals, Noise Outdoors
- Lecture 35 - Noise outdoors
- Lecture 36 - Sound within enclosure - 1
- Lecture 37 - Sound within enclosure - 2
- Lecture 38 - Sound within enclosure - 3
- Lecture 39 - Sound within enclosure - 4
- Lecture 40 - Sound within enclosure - 5
- Lecture 41 - Sound within enclosure - 6
- Lecture 42 - Sound within enclosure, isolation
- Lecture 43 - Isolation - 1
- Lecture 44 - Isolation - 2
- Lecture 45 - Auditorium - 1
- Lecture 46 - Auditorium - 2
- Lecture 47 - Daylighting - 1
- Lecture 48 - Daylighting - 2
- Lecture 49 - Daylighting - 3
- Lecture 50 - Daylighting - 4
- Lecture 51 - Daylighting - 5
- Lecture 52 - Daylighting - 6
- Lecture 53 - Artificial Lighting
- Lecture 54 - Design Sky models
- Lecture 55 - Live Session

Lecture 1 - Basic concepts of Fire Protection - I

Lecture 2 - Basic concepts of Fire Protection - II

Lecture 3 - Fire Resistance

Lecture 4 - Introduction Process of Combustion

Lecture 5 - ventilation and fuel Process of Combustion controlled fire

Lecture 6 - Process of Combustion: Flashover condition

Lecture 7 - Effect of Fire on Construction Materials

Lecture 8 - Design for Fire Resistance: Steel

Lecture 9 - Design for Fire Resistance: Steel

Lecture 10 - Design for Fire Resistance: Concrete

Lecture 11 - Fire Safety: Urban Planning

Lecture 12 - Fire Safety: Escape and Refuge

Lecture 13 - Fire safety: Internal planning, Detection and Suppression

Lecture 14 - Fire Safety: Detection and Suppression

Lecture 15 - Introduction to Lift Design

Lecture 16 - Design of Lift systems

Lecture 17 - Design of Lift systems: expected stops and floor of reversal

Lecture 18 - Design of Lift systems: Different cases

Lecture 19 - Design of Lift systems: Simulation and arrangement and Escalators

Lecture 20 - Introduction to System and Flow Systems

Lecture 21 - Water Supply System: Constant Demand

Lecture 22 - Water Supply System: Variable Demand and Diversity Factor

Lecture 23 - Diversity factor (Continued...)

Lecture 24 - Control Systems

Lecture 25 - Introduction to HVAC

Lecture 26 - Governing Equations for HVAC Process

Lecture 27 - Numerical Problem on HVAC System

Lecture 28 - Numerical Problem on HVAC System (Continued...)

Lecture 29 - Psychrometric Chart: Equation based Approach

Lecture 30 - Flow in Pipe Networks and Fixture Units

Lecture 31 - Flow in Pipe Networks (Continued...) and Design of Water Supply Distribution System

[Lecture 32 - Design of Water Supply Distribution System \(Continued...\) and Flow in Waste Water pipes](#)

[Lecture 33 - Electrical Systems \(introduction\)](#)

[Lecture 34 - Design of Electrical Systems](#)

[Lecture 35 - Intelligent Building](#)

[Lecture 36 - Life cycle cost and basics of building maintenance](#)

[Lecture 37 - Stages of maintenance management](#)

[Lecture 38 - Planning for building maintenance](#)

[Lecture 39 - Periodicity of maintenance management](#)

[Lecture 40 - Estimation of repair cycle](#)

[Lecture 41 - Cost profile of maintenance](#)

[Lecture 42 - Lamp replacement](#)

[Lecture 43 - Building inspection, Planned and Ad-hoc maintenance](#)

[Lecture 44 - Condition survey and health evaluation of buildings](#)

[Lecture 45 - Diagnosis of building by visual survey](#)

[Lecture 46 - Case studies of visual survey](#)

[Lecture 47 - Effect of corrosion and Alkali Aggregate Reaction](#)

[Lecture 48 - Sampling and choice of test location](#)

[Lecture 49 - Non Destructive Testing - 1](#)

[Lecture 50 - Non Destructive Testing - 2](#)

[Lecture 51 - Core strength test](#)

[Lecture 52 - Carbonation and Chloride measurement](#)

[Lecture 53 - Electrical methods of progress measurement](#)

[Lecture 54 - Repair, Rehabilitation and Retrofit](#)

[Lecture 55 - Periodicity and economics of condition survey](#)

[Lecture 56 - Interpretation of test results](#)

Lecture 1 - Introduction and Planet Equivalent

Lecture 2 - Basics of Carbon Cycle

Lecture 3 - Factors Affecting carbon Cycle

Lecture 4 - Fundamentals of Sustainability

Lecture 5 - Role of Materials and Embodied Energy

Lecture 6 - Case Study for Energy in Building

Lecture 7 - Calculation of Ecological Footprint

Lecture 8 - Role of Cement in Sustainability and Calculation of Chemical Exergy

Lecture 9 - Fuel for Cement

Lecture 10 - Cementitious/Supplementary Cementitious Materials and Their Characterization

Lecture 11 - Strength of Concrete With Supplementary Cementitious Materials and Composite Cements

Lecture 12 - Types of Composite Cements

Lecture 13 - Alternative Fuel for cement and Embodied Energy

Lecture 14 - Life Cycle Embodied Energy and Concrete Sustainability

Lecture 15 - Strength of Concrete and Use of Admixtures

Lecture 16 - Curing Methods and Use of Waste Water for Mixing and Curing

Lecture 17 - Modern Composite Concrete

Lecture 18 - Recycled Aggregate-ITZ and Processing

Lecture 19 - Classification of Recycled Aggregate: Crushing and Grinding of Aggregates

Lecture 20 - Crushing and Grinding: Bond's Law+Operational Energy: U-Value

Lecture 21 - Operational Energy: Thermal Conductivity Models

Lecture 22 - Operational Energy: Thermal Conductivity Models (Continued...)

Lecture 23 - Operational Energy: Estimation of Thermal Conductivity

Lecture 24 - Thermal Diffusivity and Clay Bricks

Lecture 25 - Types of Bricks Kilns and Carbon Balance

Lecture 26 - Carbon Balance, Comparison of Various Types of Brick Kilns and Sealants, Paints, Adhesive

Lecture 27 - Sealants, Health Hazards of Building Materials and Emission Models

Lecture 28 - Emission Models and Testing

Lecture 29 - Energy Efficient Design of Buildings

Lecture 30 - Design Optimization of Buildings

Lecture 31 - Building Design Optimization Using Genetic Algorithm

[Lecture 32 - Urban Heat Island: Radiation Concepts](#)

[Lecture 33 - Urban Heat Island: Urban Canopy Layer](#)

[Lecture 34 - Evapotranspiration: Theory and Models](#)

[Lecture 35 - Evapotranspiration: Case Study and Surface Water Balance](#)

[Lecture 36 - Energy Conservation Building Code \(ECBC2007\)](#)

[Lecture 37 - Energy Conservation Building Code \(ECBC2007\) \(Continued...\)](#)

[Lecture 38 - ECBC Compliant Methodology](#)

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[Lecture 40 - Solar Energy and Solar Cells](#)

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[Lecture 43 - Design Strategies and the Green Design Process](#)

[Lecture 44 - Green Building Rating Systems](#)

[Lecture 45 - Autoclaved Aerated Concrete, Insulated Precast System and Insulated Precast Forms](#)

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[Lecture 47 - Modular Construction](#)

Lecture 1 - Introduction to Projects

Lecture 2 - Inputs to Scheduling

Lecture 3 - Critical Path Method

Lecture 4 - Precedence Diagramming Method

Lecture 5 - Line of Balance Method

Lecture 6 - Resource-driven Scheduling

Lecture 7 - Information-driven Scheduling

Lecture 8 - Dependency Structure Matrix - I

Lecture 9 - Dependency Structure Matrix - II

Lecture 10 - Dependency Structure Matrix - III

Lecture 11 - Beeline Diagramming Method

Lecture 12 - Other Scheduling Techniques

Lecture 1 - Introduction to Safety in Construction

Lecture 2 - Introduction to Safety Standards; Signs, Signals in Construction

Lecture 3 - Role of Stakeholders in Construction safety

Lecture 4 - Cost of Injury Vs Investment in Safety

Lecture 5 - Safety Program Accident/Incident Investigation

Lecture 6 - PPE in Construction

Lecture 7 - A Case Study on Construction Safety

Lecture 8 - Introduction to Fatal Falls

Lecture 9 - Fall hazard in Concerting

Lecture 10 - Fall hazard in Demolition Works

Lecture 11 - Safety in Demolition Work Practical Examples

Lecture 12 - Trench Cav-ins

Lecture 13 - Tunneling Safety

Lecture 14 - Struck by and Caught-inbetween

Lecture 15 - Crane Safety

Lecture 16 - A case Study on Construction Safety - Jigar-Crane

Lecture 17 - A case Study on Construction Safety - Safety Talk

Lecture 18 - Fire Safety and Steel Construction

Lecture 19 - Electrical Safety

Lecture 20 - A case Study on Construction Safety - Contractual Provision on Construction Zone Safety

Lecture 21 - Health Issues in Construction

Lecture 22 - Ergonomics and Health Issues with Concerting

Lecture 23 - General Safety Precautions

Lecture 24 - Safety in MEP Services

Lecture 25 - Managing Hazards in Construction

Lecture 26 - BIM for Construction

Lecture 27 - BIM for Safety

- Lecture 1 - Introduction - advanced hydraulics & course structure
- Lecture 2 - Various classifications of open channel flows
- Lecture 3 - Flow classifications & velocity distribution
- Lecture 4 - Pressure distribution
- Lecture 5 - Equation of continuity & energy
- Lecture 6 - Specific energy & critical flow
- Lecture 7 - Energy, momentum & specific force
- Lecture 8 - Computation of critical flow - Part 1
- Lecture 9 - Critical flow computations
- Lecture 10 - Introduction to uniform flow
- Lecture 11 - Manning's equation and normal depth
- Lecture 12 - Uniform Flow Computations - Part 1
- Lecture 13 - Uniform flow in compound sections, concept of normal slope
- Lecture 14 - Uniform flow approximation for flood discharge
- Lecture 15 - Design of channels for uniform flow
- Lecture 16 - Design of channels using uniform flow
- Lecture 17 - Design of erodible channels
- Lecture 18 - Introduction to gradually varied flows
- Lecture 19 - Gradually varied flow equations
- Lecture 20 - Classification of gradually varied flow - Part 1
- Lecture 21 - Classification of gradually varied flow - Part 2
- Lecture 22 - Gradually varied flow profiles with change in bed slopes
- Lecture 23 - GVF profile properties and transitional depths
- Lecture 24 - Gradually varied flow computations - Part 1
- Lecture 25 - Gradually varied flow computations RK method - Part 2
- Lecture 26 - Standard step method for gradually varied flow computations
- Lecture 27 - Spatially varied flow
- Lecture 28 - Features on spatially varied flow
- Lecture 29 - Rapidly varied flow - introduction
- Lecture 30 - Theoretical aspects of hydraulic jump
- Lecture 31 - Characteristics of jumps in rectangular channel

[Lecture 32 - Features of hydraulic jumps](#)

[Lecture 33 - Jumps as energy dissipators](#)

[Lecture 34 - Jump controls](#)

[Lecture 35 - Surges - Part 1](#)

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[Lecture 37 - Channel transitions - Part 1](#)

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[Lecture 39 - Channel transitions - Part 3](#)

[Lecture 40 - Application of momentum principles](#)

[Lecture 41 - Pumps - 1](#)

[Lecture 42 - Turbines - Part 3 \(pumps, turbines\)](#)

[Lecture 43 - Turbines, cavitation](#)

- Lecture 1 - Introduction to Design of Steel Structures
- Lecture 2 - Connections
- Lecture 3 - Riveted Connections
- Lecture 4 - Design of Rivet Joint
- Lecture 5 - Welding
- Lecture 6 - Design of Fillet and Butt Welds
- Lecture 7 - Bolted Connection
- Lecture 8 - Eccentric Connections: Rivet Joints
- Lecture 9 - Design of Eccentric Connection With Load Lying in Plane of Joint Rivet Bolt
- Lecture 10 - Eccentric Connection With Load Perpendicular to Plane of Riveted Joint
- Lecture 11 - Analysis and Design of Join with Seat Connection
- Lecture 12 - Eccentric Connection
- Lecture 13 - Load Lying Perpendicular to the Plane of Weld Joint
- Lecture 14 - Tension Member
- Lecture 15 - Design of Tension Member
- Lecture 16 - Design of Tension Member: Gusset Plates, Lug Angles and Tension Splices
- Lecture 17 - Design of Tension Member: Subjected to Axial and Bending
- Lecture 18 - Compression Member
- Lecture 19 - Design of Compression Member
- Lecture 20 - Design of Eccentrically Loaded tension Member
- Lecture 21 - Built up Compression Member
- Lecture 22 - Design of Built up Compression Member
- Lecture 23 - Lacing for Built Up Compression Member
- Lecture 24 - Design of Lacing System
- Lecture 25 - Design of Batten Plates
- Lecture 26 - Introduction to Flexural Members: Beams
- Lecture 27 - Design Procedure of Beam Members
- Lecture 28 - Design of Laterally Supported Beams
- Lecture 29 - Design of Laterally Unsupported Beams
- Lecture 30 - Built-Up Beams
- Lecture 31 - Built-Up Beams: Curtailment of the Flange Plates and Shear Connections

[Lecture 32 - Design of a Built-Up Beams](#)

[Lecture 33 - Design of Shear Connections and Purlins](#)

[Lecture 34 - Gantry Girders](#)

[Lecture 35 - Design of Gantry Girders](#)

[Lecture 36 - Introduction to Plate Girders - Part 1](#)

[Lecture 37 - Introduction to Plate Girders - Part 2](#)

[Lecture 38 - Design of a Plate Girder](#)

[Lecture 39 - Column Base - Part 1](#)

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- Lecture 1 - Introduction to Hydraulics
- Lecture 2 - Open Channel Hydraulics - Part 1
- Lecture 3 - Open Channel Hydraulics - Part 2
- Lecture 4 - Velocity and Pressure Distribution
- Lecture 5 - Practical use of velocity co-efficient in channel flow
- Lecture 6 - Conservation Principles & Governing Equations
- Lecture 7 - Uniform Flow
- Lecture 8 - Uniform Flow Formula
- Lecture 9 - Computation of Uniform Flow - Part 1
- Lecture 10 - Computation of Uniform Flow - Part 2
- Lecture 11 - Uniform Flow in Mobile Boundary Channel
- Lecture 12 - Incipient Motion Condition and Regime of Flow
- Lecture 13 - Concept of Specific Energy
- Lecture 14 - Computation of Critical Depth
- Lecture 15 - Specific Force, Critical Depth & Sequent Depth
- Lecture 16 - Non-uniform Flow: Gradually Varied Flow
- Lecture 17 - Classification of Gradually Varied Flow
- Lecture 18 - Characteristic of Gradually Varied Flow
- Lecture 19 - Characteristic of Gradually Varied Flow & its Computation
- Lecture 20 - Gradually Varied Flow & its Computation
- Lecture 21 - Computation of Gradually Varied Flow
- Lecture 22 - Gradually Varied Flow: Numerical Methods and Problem Solving
- Lecture 23 - Rapidly Varied Flow: Hydraulic Jump
- Lecture 24 - Hydraulic Jump
- Lecture 25 - Flow Over Hump and Channel Contraction
- Lecture 26 - Canal Design - 1
- Lecture 27 - Canal Design - 2
- Lecture 28 - Design of Alluvial Channel - 1
- Lecture 29 - Design of Alluvial Channel - 2
- Lecture 30 - Design of Alluvial Channel - 3
- Lecture 31 - Unsteady Flow: Waves and its Classification

[Lecture 32 - Unsteady Flow Part - 2](#)

[Lecture 33 - Unsteady Flow Part - 3](#)

[Lecture 34 - Pipe Flow: Friction Loss](#)

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[Lecture 38 - Water Hammer & Surge Tank](#)

[Lecture 39 - Pipe Flow Friction Loss](#)

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Lecture 1 - Introduction to Higher Surveying

Lecture 2 - Understanding reference system, reference frame, and coordinate system for Earth

Lecture 3 - Coordinate and datum transformations

Lecture 4 - Projected coordinate system

Lecture 5 - Fundamentals of astronomy

Lecture 6 - Applications of concepts of astronomy

Lecture 7 - Time

Lecture 8 - Application of concepts of astronomy and time

Lecture 9 - Fundamental concepts of error, accuracy, and error propagation

Lecture 10 - Applications of error propagation

Lecture 11 - Observation Equation Method of adjustments

Lecture 12 - Condition Equation Method and Combined Method of adjustments

Lecture 13 - Analysis of adjustments and reporting of errors

Lecture 14 - Global Positioning System (GPS)

Lecture 15 - Introduction to Photogrammetry

Lecture 16 - Vertical photogrammetry

Lecture 17 - Stereo photogrammetry

Lecture 18 - Analytical photogrammetry - I

Lecture 19 - Analytical photogrammetry - II

Lecture 20 - Photogrammetric products

Lecture 21 - Image matching

Lecture 22 - Close range photogrammetry

Lecture 23 - Fundamentals of LiDAR

Lecture 24 - LiDAR data acquisition

Lecture 25 - Geolocation and errors of LiDAR data

Lecture 26 - Information extraction from LiDAR data

Lecture 27 - RADAR fundamentals - I

Lecture 28 - RADAR fundamentals - II

Lecture 29 - RADAR fundamentals - III

Lecture 30 - Radargrammetry

Lecture 31 - Geoscience perspective for RADAR applications

[Lecture 32 - Fundamental concepts of hydrographic survey](#)

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[Lecture 34 - Modern techniques for hydrographic Survey](#)

[Lecture 35 - Navigation](#)

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Lecture 1 - Fundamental Aspects of Unsaturated Soil Mechanics and its Basic Principles

Lecture 2 - Phases of Unsaturated Soils-I

Lecture 3 - Phases of Unsaturated Soils-II

Lecture 4 - Equilibrium between Air and Water Phases

Lecture 5 - Capillary Phenomenon in Unsaturated Soils - I

Lecture 6 - Capillary Phenomenon in Unsaturated Soils - II

Lecture 7 - Summary: Fundamental Principles and Constitutive Relationships

Lecture 8 - Concept of Water Retention and Soil Water Characteristics - I

Lecture 9 - Concept of Water Retention and Soil Water Characteristics - II

Lecture 10 - Hydraulic conductivity functions and determination of state variables

Lecture 11 - Suction Measurement/Control Techniques - I

Lecture 12 - Suction Measurement/Control Techniques - II

Lecture 13 - Summary: Suction Measurement and Control Techniques

Lecture 14 - HCF Determination

Lecture 15 - SWCC and HCF Models

Lecture 16 - HCF Modelling

Lecture 17 - Fitting of SWCC and HCF modelling

Lecture 18 - Pedo-transfer Functions (PTF)

Lecture 19 - Steady-State Flow Through Soils

Lecture 20 - Steady-State and Transient Flow

Lecture 21 - Analytical Methods for Transient Flow - I

Lecture 22 - Analytical Methods for Transient Flow - II

Lecture 23 - Shear Strength of Unsaturated Soils

Lecture 24 - Suction-Controlled Direct Shear Test

Lecture 25 - Suction-Controlled Triaxial Test

Lecture 26 - Extended M-C Criterion - I

Lecture 27 - Extended M-C Criterion - II

Lecture 28 - Extended M-C Criterion - III

Lecture 29 - Concept of Suction Stress - I

Lecture 30 - Concept of Suction Stress - II

Lecture 31 - Concept of Suction Stress - III

[Lecture 32 - Summary: Shear Strength of Unsaturated Soils and Introduction to Volume Change](#)

[Lecture 33 - Swelling Behaviour of Soils](#)

[Lecture 34 - Estimation of Swelling Pressure in the Laboratory and Behaviour of Collapsible soil](#)

[Lecture 35 - Volume Change Behaviour of Bentonite and Kaolin Clay](#)

[Lecture 36 - Demonstration of Various Experiments Related to Unsaturated Soil Mechanics](#)

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Lecture 2 - Phases and classification of subsurface Investigation

Lecture 3 - Test Pits+ Borings

Lecture 4 - Ground water table and rock drilling

Lecture 5 - Standard Penetration Test

Lecture 6 - Cone Penetration Test

Lecture 7 - Dilatometer Test

Lecture 8 - Pressuremeter Test

Lecture 9 - Seismic reflection method

Lecture 10 - Seismic refraction method

Lecture 11 - Electrical Resistivity Survey

Lecture 12 - Magnetic Survey

Lecture 13 - Surface wave method

Lecture 14 - Gravity Survey

Lecture 15 - Offshore Investigation

Lecture 16 - Geophysical Investigation in Offshore Environment

Lecture 17 - Sampling and Geotechnical Investigations in Offshore Environment

Lecture 18 - Important Terminologies in Offshore Environment

Lecture 19 - Dynamic Testing in Pile Driving

Lecture 20 - Dynamic Testing in Pile (Low Strain)

Lecture 21 - Conclusion

- Lecture 1 - Basic Concepts of Fluid
- Lecture 2 - Properties of Fluid
- Lecture 3 - Properties of Fluid
- Lecture 4 - Concepts of Hydrostatic
- Lecture 5 - Measurement of Pressure and Hydrostatic forces
- Lecture 6 - Buoyancy, Metacentre, Stability and Rigid body motion
- Lecture 7 - Reynolds Transport Theorem
- Lecture 8 - Conservation of Mass
- Lecture 9 - Conservation of Momentum
- Lecture 10 - Conservation of Momentum Applications
- Lecture 11 - Bernoulli's Equation
- Lecture 12 - Applications of Bernoulli's Equation
- Lecture 13 - Fluid Statics Applications: Example Problems
- Lecture 14 - Conservation of Momentum: Example problems
- Lecture 15 - Bernoulli's Equation: Problems Solving on Black Board
- Lecture 16 - Lagrangian and Eulerian Descriptions
- Lecture 17 - Motion and deformation of fluid elements
- Lecture 18 - Problems Solving on Black Board
- Lecture 19 - Dimensional Homogeneity
- Lecture 20 - Dimensional Analysis and Similarity
- Lecture 21 - Laminar and Turbulent Flows
- Lecture 22 - Losses in Pipe Fittings
- Lecture 23 - Flow in Noncircular Conduits and Multiple Path Pipeflow
- Lecture 24 - Mass Conservation Equation - I
- Lecture 25 - Mass Conservation Equation - II
- Lecture 26 - Stream Function
- Lecture 27 - Cauchy's Equation
- Lecture 28 - The Navier-Stokes Equation - Part I
- Lecture 29 - The Navier-Stokes Equation - Part II
- Lecture 30 - The Navier-Stokes Equation - Part III
- Lecture 31 - Approximate solutions of Navier Stokes Equation: Boundary Layer Approximation

[Lecture 32 - Boundary Layer Approximation - II](#)

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[Lecture 34 - Open Channel Flow - I](#)

[Lecture 35 - Open Channel Flow - II](#)

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[Lecture 37 - Drag and Lift](#)

Lecture 1 - Overview and Introduction

Lecture 2 - Basics of Remote Sensing

Lecture 3 - Error corrections in satellite image

Lecture 4 - Error Identification and Correction - I

Lecture 5 - Error Identification and Correction - II

Lecture 6 - Error Identification and Correction - III

Lecture 7 - DIP - I

Lecture 8 - DIP - II

Lecture 9 - DIP - III

Lecture 10 - DIP - IV

Lecture 11 - Image Classification - I

Lecture 12 - Image Classification - II

Lecture 13 - Photogrammetry

Lecture 14 - Thermal Remote Sensing

Lecture 15 - Microwave Remote Sensing

Lecture 16 - HRS - I

Lecture 17 - HRS - II

Lecture 18 - HRS - III

Lecture 19 - HRS - IV

Lecture 20 - HRS - V

Lecture 21 - GIS - I

Lecture 22 - GIS - II

Lecture 23 - Applications of Remote Sensing and GIS - I

Lecture 24 - Applications of Remote Sensing and GIS - II

- Lecture 1 - Introduction to River Engineering
- Lecture 2 - Basic properties of sediment - I
- Lecture 3 - Basic properties of sediment - II
- Lecture 4 - Mass Conservation
- Lecture 5 - Linear Momentum Equation
- Lecture 6 - Navier-Stokes Equations
- Lecture 7 - St. Venant Equation and Solver
- Lecture 8 - Specific Energy and Critical Flow
- Lecture 9 - Hydraulic Jump and Celerity
- Lecture 10 - Floodwave Celerity and Loop Rating Curve
- Lecture 11 - Sediment Transport in River - I
- Lecture 12 - Sediment Transport in River - II
- Lecture 13 - Sediment Transport in River - III
- Lecture 14 - Physical River Models
- Lecture 15 - Bridge Scour: processes and estimation
- Lecture 16 - Bridge Scour-II
- Lecture 17 - Jet Scour and River Navigation
- Lecture 18 - River Training Work
- Lecture 19 - Riverbank Stabilization - I
- Lecture 20 - Riverbank Stabilization - II
- Lecture 21 - Riverbank Protection and Control Structures
- Lecture 22 - River Equilibrium - I
- Lecture 23 - River Equilibrium - II
- Lecture 24 - River Equilibrium - III

Lecture 1 - Introduction to solid waste

Lecture 2 - Functional elements

Lecture 3 - Types and sources of solid waste

Lecture 4 - Sampling and characteristics

Lecture 5 - Estimation of solid waste quantity

Lecture 6 - Factors affecting solid waste generation rate

Lecture 7 - Handling, separation and storage at source

Lecture 8 - Processing at source

Lecture 9 - Primary collection

Lecture 10 - Types of collection system

Lecture 11 - Analysis of collection system - Part I

Lecture 12 - Analysis of collection system - Part II

Lecture 13 - Analysis of collection system - Part III

Lecture 14 - Need and types of transfer station

Lecture 15 - Transport means and methods

Lecture 16 - Unit operation for component separation

Lecture 17 - Material recovery facilities (MRF)

Lecture 18 - Recycling of dry waste components

Lecture 19 - Waste as a fuel

Lecture 20 - Incineration/Combustion

Lecture 21 - Flue gas characteristics and treatment

Lecture 22 - Solid residue generation, characterization and treatment

Lecture 23 - Waste-to-energy (WtE) plants (case studies) pyrolysis and gasification

Lecture 24 - Definition and phases of composting

Lecture 25 - Factors affecting composting process

Lecture 26 - Types of composting - I

Lecture 27 - Types of composting - II

Lecture 28 - Compost quality

Lecture 29 - Vermicomposting

Lecture 30 - Definition, stages and factors affecting anaerobic digestion

Lecture 31 - Pretreatment and co-digestion for enhancement of biogas production

[Lecture 32 - Types of biogas digesters](#)

[Lecture 33 - Site selection and types of landfill](#)

[Lecture 34 - Leachate collection and treatment](#)

[Lecture 35 - Landfill gas collection and treatment](#)

[Lecture 36 - Design of landfill and Bio-minning of old dumpsite](#)

[Lecture 37 - Construction and demolition waste](#)

[Lecture 38 - Management of bio-medical, e-waste and inert waste](#)

[Lecture 39 - Integrated solid waste management \(ISWM\)](#)

[Lecture 40 - Municipal solid waste management rules](#)

[Lecture 41 - Financing in MSWM projects](#)

[Lecture 42 - Public-Private-Partnership \(PPP\)](#)

[Lecture 43 - Public-Private-Partnership \(PPP\) in MSWM projects](#)

Lecture 1 - Planning process of equipment

Lecture 2 - Estimation of Ownership cost (Average Annual Investment method)

Lecture 3 - Estimation of Ownership cost (Time value method)

Lecture 4 - Operating cost of Equipment

Lecture 5 - Equipment cost estimation

Lecture 6 - Equipment life and replacement analysis - Part 1

Lecture 7 - Equipment life and replacement analysis - Part 2

Lecture 8 - Equipment life and replacement analysis - Part 3

Lecture 9 - Engineering Fundamentals of Moving Earth

Lecture 10 - Bull Dozers

Lecture 11 - Scrapers - Part 1

Lecture 12 - Scrapers - Part 2

Lecture 13 - Front End loaders

Lecture 14 - Excavators

Lecture 15 - Trucks

Lecture 16 - Piles and Pile driving equipment - Part 1

Lecture 17 - Piles and Pile driving equipment - Part 2

Lecture 18 - Cranes - Part 1

Lecture 19 - Cranes - Part 2

Lecture 20 - Concreting Equipment - Part 1

Lecture 21 - Concreting Equipment - Part 2

Lecture 22 - Summary

- Lecture 1 - Introduction to course content
- Lecture 2 - Stress acting at a point - Cauchy stress
- Lecture 3 - Stress acting at a point - Stress tensor
- Lecture 4 - Stress acting on a plane
- Lecture 5 - Stress acting on a plane example
- Lecture 6 - Transformation of stress tensor
- Lecture 7 - Stress invariants
- Lecture 8 - Relationship between stress invariants
- Lecture 9 - Principle stresses and Eigen vectors
- Lecture 10 - Strain in soils
- Lecture 11 - Cause effect relationship
- Lecture 12 - Important constitutive relationship
- Lecture 13 - 3D to 2D idealization
- Lecture 14 - Mathematical formulation plane stress plane strain
- Lecture 15 - Mathematical formulation axisymmetric
- Lecture 16 - Summary of Module 1
- Lecture 17 - Basics of shear strength
- Lecture 18 - Stress representation
- Lecture 19 - Shear strength granular soil - I
- Lecture 20 - Shear strength granular soil - II
- Lecture 21 - Shear strength cohesive soil
- Lecture 22 - Shear strength cohesive soil - Stress strain
- Lecture 23 - Pore water pressure and Skemptions equation
- Lecture 24 - Overall pore water pressure parameter
- Lecture 25 - Pore water pressure - plane strain-effect of sampling
- Lecture 26 - Pore water pressure estimation
- Lecture 27 - Triaxial test
- Lecture 28 - Interpretation triaxial test - UU UCS
- Lecture 29 - Interpretation triaxial test - CU
- Lecture 30 - Interpretation triaxial test - CD
- Lecture 31 - Some additional aspects of shear strength

- Lecture 32 - Summary of Module 2
- Lecture 33 - Stress path and representation
- Lecture 34 - Failure line in stress path
- Lecture 35 - Stress path-some common cases - I
- Lecture 36 - Stress path-some common cases - II
- Lecture 37 - Stress path-triaxial test-drained
- Lecture 38 - Stress path-triaxial test-undrained
- Lecture 39 - Stress path-additional undrained case
- Lecture 40 - Stress path-field cases - I
- Lecture 41 - Stress path-field cases - II
- Lecture 42 - Stress path problems
- Lecture 43 - Summary of Module 3
- Lecture 44 - Introduction-critical state soil mechanics
- Lecture 45 - Introduction-critical state soil mechanics
- Lecture 46 - CSSM-2 D representation
- Lecture 47 - Peak state
- Lecture 48 - Soil yielding
- Lecture 49 - Cam clay
- Lecture 50 - Modified Cam clay
- Lecture 51 - Prediction of soil behavior from MCCM
- Lecture 52 - Prediction of soil behavior from MCCM
- Lecture 53 - Strain from MCCM
- Lecture 54 - State boundary surface
- Lecture 55 - CSSM problems
- Lecture 56 - Summary of Module 4
- Lecture 57 - Closure of Advanced Soil Mechanics Course

- Lecture 1 - Introduction, classification of plates and some useful relations
- Lecture 2 - Theory of thin plate bending
- Lecture 3 - Plate equations and boundary conditions with examples
- Lecture 4 - Exercises on the plate bending theory
- Lecture 5 - Simply supported plate subjected to distributed loading
- Lecture 6 - Simply supported plate subjected to concentrated load and couple
- Lecture 7 - Simply supported plate resting on elastic foundation and other examples
- Lecture 8 - General formulation for rectangular plate with two opposite edges simply supported
- Lecture 9 - Levy's solution for different loading and boundary conditions
- Lecture 10 - Rectangular plate with Levy's boundary condition subjected to edge moment
- Lecture 11 - Transformation of plate equation from rectangular co-ordinates to polar co-ordinates
- Lecture 12 - Axi-symmetrical bending of circular plate under pure moment and uniformly distributed load
- Lecture 13 - Examples in axisymmetrical bending of solid and annular plate
- Lecture 14 - Variational principle in plate problem
- Lecture 15 - Applications of Rayleigh-Ritz and Gallerkin's method
- Lecture 16 - Finite difference method in plate bending
- Lecture 17 - Plate subjected to inplane forces and transverse load
- Lecture 18 - Buckling load of rectangular plate plate with Navier's boundary condition
- Lecture 19 - Buckling load of rectangular with Levy's boundary condition
- Lecture 20 - Rayleigh-Ritz and Gallerkin method in buckling of plate
- Lecture 21 - Finite difference method in buckling of plate
- Lecture 22 - Introduction to shell structure and behavior of stretched membrane
- Lecture 23 - Classification of shell structure
- Lecture 24 - Stress resultants and couples in shells
- Lecture 25 - Membrane analysis of shells of surface of revolution
- Lecture 26 - Analysis of Spherical dome
- Lecture 27 - Some examples of axi-symmetrical cases in surface of revolution
- Lecture 28 - Membrane theory in pressure vessels
- Lecture 29 - Membrane theory in pressure vessel in the form a Torus and in a tank of arbitrary meridian
- Lecture 30 - Membrane theory of hyperboloid of revolution: Application to cooling tower
- Lecture 31 - Differential Equations of Equilibrium in Cylindrical shell using membrane hypothesis

[Lecture 32 - Membrane Analysis of Cylindrical Shell roof subjected to self weight and snow load](#)

[Lecture 33 - Circular Cylindrical Shell for Fourier Loading in a membrane state of stress](#)

[Lecture 34 - Simplified Bending Theory of Cylindrical Shell-Beam and Arch theories](#)

[Lecture 35 - General bending theory of cylindrical shell](#)

[Lecture 36 - Some applications of symmetrical bending of circular cylindrical shell](#)

- Lecture 1 - Introduction to Optimization
- Lecture 2 - Classical Optimization
- Lecture 3 - Introduction to Linear Problem
- Lecture 4 - General system of equations
- Lecture 5 - Simplex Method
- Lecture 6 - Solution of Linear Problem using Excel Solver
- Lecture 7 - Bracketing Method
- Lecture 8 - Region Elimination Methods
- Lecture 9 - Gradient Based Method and Examples
- Lecture 10 - Convex Function
- Lecture 11 - Line Search Methods for Multi-Variable Problems
- Lecture 12 - Quadratic Approximation Method
- Lecture 13 - Constrained Optimization I: Equality constraints
- Lecture 14 - Constrained Optimization II: Inequality constraints
- Lecture 15 - Constrained Optimization III: Penalty function methods
- Lecture 16 - Introduction to Metaheuristic Optimization
- Lecture 17 - Genetic Algorithms - Part I
- Lecture 18 - Genetic Algorithms - Part II
- Lecture 19 - Genetic Algorithms - Part III
- Lecture 20 - Real Coded Genetic Algorithms
- Lecture 21 - Multi-modal optimization
- Lecture 22 - Introduction to R
- Lecture 23 - GA using R (Unconstrained problem)
- Lecture 24 - GA using R (Constrained problem)
- Lecture 25 - Constraint Handling in GAs
- Lecture 26 - Evolution Strategies (ESs)
- Lecture 27 - Particle swarm optimization
- Lecture 28 - Introduction to R - Part II
- Lecture 29 - Multi-objective Genetic Algorithms
- Lecture 30 - Introduction to Differential Evolution
- Lecture 31 - Introduction to Matlab

[Lecture 32 - Optimization using Matlab \(Classical methods\)](#)

[Lecture 33 - A tutorial on Differential Evolution](#)

[Lecture 34 - NSGA II Using R](#)

[Lecture 35 - Optimization using MATLAB](#)

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Lecture 4 - Derivation of Reynolds Transport Theorem - Part I

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Lecture 10 - Water Vapor Dynamics

Lecture 11 - Precipitable Water in the Static Atmospheric Column

Lecture 12 - Numerical Examples on Basic Atmospheric Parameters

Lecture 13 - Precipitation-Types and Formation

Lecture 14 - Terminal Velocity

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Lecture 16 - Numerical Examples on Terminal Velocity and Thunderstorm Cell

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Lecture 25 - Evaporation-Aerodynamic Method

Lecture 26 - Evaporation-Combined Method

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Lecture 28 - Evaporation-Empirical method

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Lecture 30 - Evapotranspiration-Numerical Example

Lecture 31 - Summary of Module - II

Lecture 32 - Subsurface Water

Lecture 33 - 1-D Unsteady Unsaturated Flow Equation

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Lecture 36 - Estimation of Infiltration-Empirical Equations

Lecture 37 - Numerical examples - Infiltration estimation using empirical equations

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Lecture 45 - Numerical Examples on Direct Runoff

Lecture 46 - Overland flow

Lecture 47 - Streamflow Measurement - I

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Lecture 49 - Representation of Streamflow

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Lecture 52 - Hydrologic Analysis - Introduction

Lecture 53 - Linear System Theory

Lecture 54 - Hydrograph Analysis-UH

Lecture 55 - Hydrograph Analysis-DRH

Lecture 56 - Numerical examples on UH and DRH

Lecture 57 - S-Hydrograph

Lecture 58 - Unit Hydrograph of Different Duration

Lecture 59 - Numerical examples UH of Different Duration

Lecture 60 - Instantaneous Unit Hydrograph

Lecture 61 - Instantaneous Unit Hydrograph-Nash's Model

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Lecture 63 - Synthetic Unit Hydrograph

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NPTEL : NOC:Expansive Soil (Civil Engineering)

Co-ordinators : Prof. Anil Kumar Mishra

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Lecture 2 - Index properties and classification of soil

Lecture 3 - Engineering properties of soil - I

Lecture 4 - Engineering properties of soil - II

Lecture 5 - Clay mineralogy

Lecture 6 - Properties of clay particles

Lecture 7 - Definition, type and behaviour

Lecture 8 - Mechanism of soil-water interaction

Lecture 9 - Swelling of expansive soil

Lecture 10 - Factors controlling DDL thickness

Lecture 11 - Determination of swelling properties

Lecture 12 - Classification and prediction

Lecture 13 - Factors controlling swelling of soil

Lecture 14 - Shrinkage behaviour of soil

Lecture 15 - Factors controlling shrinkage behavior of soils

Lecture 16 - Measurement of various shrinkage characteristics of soil

Lecture 17 - Cyclic Swelling-Shrinkage Behaviour of Soil

Lecture 18 - Thermo-Mechanical-Hydraulic-Chemical Behaviour - I

Lecture 19 - Thermo-Mechanical-Hydraulic-Chemical Behaviour - II

Lecture 20 - Thermo-Mechanical-Hydraulic-Chemical Behaviour - III

Lecture 21 - Mechanical Methods

Lecture 22 - Hydraulic methods

Lecture 23 - Chemical methods - 1

Lecture 24 - Chemical methods - 2

Lecture 25 - By inclusion or confinement

Lecture 26 - Foundation on expansive soil

Lecture 27 - Use of expansive soil for various geotechnical engineering applications

Lecture 28 - Closure lecture

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- Lecture 2 - Time Domain Analysis of Linear System - Harmonic input
- Lecture 3 - Time Domain Analysis of Linear System - Arbitrary Input
- Lecture 4 - Transformed technique in vibration of linear system
- Lecture 5 - Formulation of problem: Equilibrium Approach
- Lecture 6 - Formulation of problem by Energy Principle
- Lecture 7 - Hamilton's principles for formulating vibration problems
- Lecture 8 - Lagrange's equation for formulating vibration problems
- Lecture 9 - One Dimensional Wave Equation
- Lecture 10 - D'Alembert's Solution of the Wave Equation
- Lecture 11 - Transverse Vibration of String
- Lecture 12 - Forced Transverse Vibration of String
- Lecture 13 - Axial Vibration of Bar
- Lecture 14 - Torsional Vibration of Bar
- Lecture 15 - Some typical problems in axial and torsional vibrations
- Lecture 16 - Transverse vibration of beams
- Lecture 17 - Natural frequencies and mode shapes of beams with various end conditions
- Lecture 18 - Free damped transverse vibration analysis of beam
- Lecture 19 - Forced damped vibration analysis of Euler Bernoulli beam
- Lecture 20 - Vibration of beams subjected to moving load
- Lecture 21 - Some special topics on the transverse vibration of beam
- Lecture 22 - Combination of continuous and lumped parameter system
- Lecture 23 - State space solutions in vibration problems
- Lecture 24 - Beam with moving oscillator, pulsating force and rolling mass
- Lecture 25 - Vibration of membrane
- Lecture 26 - Vibration of Circular membrane
- Lecture 27 - Vibration of Rectangular plate
- Lecture 28 - Free vibration of rectangular plates
- Lecture 29 - Forced vibration of rectangular plates
- Lecture 30 - Approximate method for vibration analysis
- Lecture 31 - Rayleigh-Ritz method for vibration analysis

[Lecture 32 - Gallerkin's method and Finite difference method](#)

[Lecture 33 - System subjected to support excitation](#)

[Lecture 34 - Response of continuous systems to transient excitations](#)

[Lecture 35 - Shock spectrum due to half sine pulse](#)

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Lecture 3 - Functions of Random Variables

Lecture 4 - Joint Distributions

Lecture 5 - Mt. Gen. Func. and CLT

Lecture 6 - Theory of Estimation

Lecture 7 - Goodness of Fit

Lecture 8 - MVFOSM

Lecture 9 - MVFOSM (Continued...)

Lecture 10 - Hasofer-Lind Rel. Index

Lecture 11 - Rackwitz's Algorithm (Continued...)

Lecture 12 - HL-RF for Non-Normal Problems

Lecture 13 - HL-RF for Correlated Problems

Lecture 14 - FORM using MATLAB

Lecture 15 - FORM using MATLAB (Continued...)

Lecture 16 - FORM Using FEM

Lecture 17 - Morgenstern Model

Lecture 18 - Nataf Model

Lecture 19 - Rosenblatt Transformation

Lecture 20 - Brietung's Model

Lecture 21 - Tvedt's Model

Lecture 22 - Monte-Carlo Simulation

Lecture 23 - Importance Sampling

Lecture 24 - Least Square Curve Fitting

Lecture 25 - Orthogonal Polinomials

Lecture 26 - RSM

Lecture 27 - Stochastic Response Surface Method

Lecture 28 - Moving Least Square Method

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Lecture 31 - Optimal Partial Safety Factors

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[Lecture 33 - Subset Simulation](#)

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[Lecture 35 - Applications \(Continued...\)](#)

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- Lecture 2 - Fault Plane Solution - Part 1
- Lecture 3 - Fault Plane Solution - Part 2
- Lecture 4 - Fault Plane Solution (Stereonets)
- Lecture 5 - Seismic gaps
- Lecture 6 - Analogy of active and inactive fault
- Lecture 7 - Seismic waves and their use in locating EQ epicentre
- Lecture 8 - EQ Intensity, magnitude and wave attenuation
- Lecture 9 - Seismic source characterization and seismic activity
- Lecture 10 - Earthquake catalogue preparation and seismic activity parameters
- Lecture 11 - Ground motion simulation models and GMPEs
- Lecture 12 - Deterministic seismic hazard analysis (DSHA)
- Lecture 13 - Probabilistic seismic hazard analysis (PSHA)
- Lecture 14 - One Dimensional equation of motion: P wave
- Lecture 15 - One Dimensional equation of motion: S wave
- Lecture 16 - Solution to 1D equation of motion: S wave
- Lecture 17 - Local Site Effect (LSE) and Ground Response Analysis - Part I
- Lecture 18 - Local Site Effect (LSE) and Ground Response Analysis - Part II
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- Lecture 22 - State Criteria for Liquefaction - Part 2
- Lecture 23 - Initiation of Liquefaction
- Lecture 24 - Assessment of Liquefaction Potential
- Lecture 25 - Paleoliquefaction
- Lecture 26 - Seismic Microzonation
- Lecture 27 - Landslides: Introduction and classification
- Lecture 28 - Seismic vulnerability and risk - Part 1
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- Lecture 4 - Undamped Free Vibration
- Lecture 5 - Damped free vibration
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- Lecture 7 - Structural Damping
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- Lecture 9 - Response due to Harmonic Excitation
- Lecture 10 - Response due to Harmonic Excitation (Continued...)
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- Lecture 12 - Transmissibility and Support Motion Problem
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- Lecture 14 - Impulse Response function
- Lecture 15 - Duhamel's Integral
- Lecture 16 - Response in Frequency Domain
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- Lecture 18 - Nigam and Jennings and Central Difference method
- Lecture 19 - Wilson Theta and Newmark Method
- Lecture 20 - MATLAB Examples
- Lecture 21 - Response Spectrum
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- Lecture 24 - Rayleigh's Method and Calculus of Variation
- Lecture 25 - Hamilton's Principle to Lagrange Equation
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- Lecture 27 - Hamilton's Canonical Form
- Lecture 28 - Natural Frequencies and Mode shapes of MDOF system
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NPTEL : Advanced Hydrology (Civil Engineering)

Co-ordinators : Dr. Ashu Jain

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- Lecture 7 - Proportioning of concrete mixes - Part 1 of 3
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- Lecture 12 - Principles of quality control in concrete construction
- Lecture 13 - Quality control and acceptance criteria for concrete based on compressive strength
- Lecture 14 - Fibre reinforced concrete
- Lecture 15 - High strength concrete
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- Lecture 21 - Self-compacting concrete
- Lecture 22 - Testing self-compacting concrete
- Lecture 23 - Shotcrete and underwater concrete
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- Lecture 25 - Alkali – aggregate reaction - Part 2 of 2
- Lecture 26 - Reinforcement corrosion in concrete
- Lecture 27 - Chloride penetration in concrete
- Lecture 28 - Using epoxy-coated bars in concrete structures
- Lecture 29 - Using FRP as reinforcement in concrete structures - Part 1 of 2
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- Lecture 5 - Measurement Units and Particulate classification
- Lecture 6 - Interpretation and Particle size Distribution
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- Lecture 11 - Internal Combustion Engine and Air Pollution - I
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- Lecture 13 - Air Pollution and Health - I
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NPTEL : Application of Soil Mechanics (Civil Engineering)

Co-ordinators : Dr. Nihar Ranjan Patra

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- Lecture 29 - Improving the Quality of Cover Concrete
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Lecture 29 - Reinforced Earth

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NPTEL : Ground Water Hydrology (Civil Engineering)

Co-ordinators : Dr. Anirban Dhar, Dr. V.R. Desai

- Lecture 1 - Introduction : Ground Water (GW) Utilization and Historical Background, GW in hydrologic Cycle
- Lecture 2 - Ground Water in & % Hydrologic Cycle (Continued...), Ground Water Budget, Ground Water Level Fluctuations and Environmental Influence
- Lecture 3 - Ground water Level Fluctuations and Environmental Influence (Continued...) Literature/Data/Internet Resources
- Lecture 4 - Ground water Level Fluctuations and Environmental Influence (Continued...) Literature/Data/Internet Resources
- Lecture 5 - Occurrence and Movement of Ground Water : Origin and Age of Ground Water, Rock Properties Affecting Ground Water, Ground Water Column
- Lecture 6 - Zones of Aeration and Saturation; Aquifers and their characteristics/classification
- Lecture 7 - Aquifer Classification (Continued...), Ground water Basins and Springs; Darcy's Law; Permeability
- Lecture 8 - Determination of Permeability : Heterogeneity and Anisotropy
- Lecture 9 - Ground Water (GW) flowrates and flow directions; general flow equations through porous media
- Lecture 10 - General Flow Equations Through Porous Media (Continued...), Dupuit's Assumptions
- Lecture 11 - 1-D Unconfined Ground water Flows; Steady Flow into Wells
- Lecture 12 - Steady Flow into Wells (Continued...); Unsteady Flow into Wells
- Lecture 13 - Unsteady Flow into Wells (Continued...)
- Lecture 14 - Unsteady Radial Flow in Confined and Unconfined Aquifers
- Lecture 15 - Unsteady Radial Flow in Leaky Aquifers (Continued...); Well Flow Near Aquifer Boundaries
- Lecture 16 - Well Flow for Special Conditions; Partially Penetrating Wells; Horizontal Wells and Collector Wells; Multiple Well Systems
- Lecture 17 - Well Completion; Well Development; Well Protection; Well Rehabilitation; Well testing for Yields
- Lecture 18 - Well Protection/Rehabilitation/Testing for yield (Continued...); Artificial Ground Water Recharge : Concept and Methods
- Lecture 19 - Concept and methods of Artificial Ground Water Recharge (Continued...); Recharge Mounds and Induced Recharge
- Lecture 20 - Induced Recharge (Continued...); Wastewater recharge for reuse; Water spreading
- Lecture 21 - Pollution and Quality Analysis of Ground Water : Sources of Pollution of GW-Municipal, Industrial, Agricultural and Miscellaneous
- Lecture 22 - Ground Water Pollution from Industrial, Agricultural and Miscellaneous Sources (Continued...)
- Lecture 23 - Ground Water Pollution from Miscellaneous Sources (Continued...), Attenuation and Underground Distribution of Pollutants
- Lecture 24 - Potential Evaluation of Ground water Pollution; Physical/Chemical/Biological analysis of Ground Water quality; Criteria and measures of Ground water quality
- Lecture 25 - Ground water salinity and samples ; Graphical representations of ground water quality
- Lecture 26 - Graphical representations of ground water quality (Continued...), Surface/Sub-Surface Investigation Of Ground Water: Geological/geophysical exploration; Remote sensing/electrical resistivity methods
- Lecture 27 - Surface Investigation of ground water (Continued...): Electrical resistivity seismic refraction/gravity/magnetic methods

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Lecture 28 - Seismic refraction/gravity/magnetic methods (Continued...);Sub-surface investigation of ground water: Geographical/resistivity methods

Lecture 29 - Sub-surface investigation of ground water (Continued...): Geographical/resistivity/spontaneous potential/radiation of methods of logging

Lecture 30 - Radiation method of logging (Continued...); Temperature/caliper/fluid conductivity/fluid velocity/miscellaneous logging methods

Lecture 31 - Saline Water Intrusion in Aquifers:Occurence, Features affecting aquifers,Bodon - Ghyben - Hergberg Principle

Lecture 32 - Saline Water Intrusion in Aquifers : Bodon - Ghyben - Hergberg principle (Continued...), Analytical Solution of Saline Water Intrusion in Coastal Aquifer

Lecture 33 - Saline Water Intrusion in Aquifers : Analytical Solution of Saline Water Intrusion in Coastal Aquifer (Continued...), Density dependent salt water intrusion model

Lecture 34 - Saline Water Intrusion in Aquifers : Geochemical Investigations, Control of salt water intrusion, Practical Modeling of salt water intrusion

Lecture 35 - Modeling and Management of Ground Water : Ground Water Simulation Models, Ground Water Management Model : Confined Aquifer

Lecture 36 - Modeling and Management of Ground Water : Ground Water Management Model : Confined and Unconfined Aquifer, Linked Simulation - Optimization, Meta Model Based Approach

Lecture 37 - Modeling and Management of Ground Water : Contaminant Source Identification , Monitoring Network Design

Lecture 38 - Modeling and Management of Ground Water : Aquifer Yield and Ground Water Availability, Effects of Ground Water Development, Regional Scale Development of Ground Water

Lecture 39 - Modeling and Management of Ground Water : Conjunctive Surface - Subsurface Modeling of Overland Flow including flow through Vadose zone

Lecture 40 - Modeling and Management of Ground Water : Ground Water - Surface Water Interaction

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Lecture 2 - Error Analysis

Lecture 3 - Introduction to Linear Systems - I

Lecture 4 - Linear Systems - II

Lecture 5 - Linear Systems - III

Lecture 6 - Linear Systems - Error Bounds

Lecture 7 - Error Bounds and Iterative Methods for Solving Linear Systems

Lecture 8 - Iterative Methods for Solving Linear Systems - I

Lecture 9 - Iterative Methods - II

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Lecture 11 - Iterative Methods for Eigen Value Extraction

Lecture 12 - Solving Nonlinear Equations - I

Lecture 13 - Solving Nonlinear Equations - II

Lecture 14 - Solving Multi Dimensional Nonlinear Equations - I

Lecture 15 - Solving Multi Dimensional Nonlinear Equations - II

Lecture 16 - ARC Length and Gradient Based Methods

Lecture 17 - Gradient Based Methods

Lecture 18 - Conjugate Gradient Method - I

Lecture 19 - Conjugate Gradient Method - II

Lecture 20 - Nonlinear Conjugate Gradient and Introduction to PDEs

Lecture 21 - Eigenfunction Solutions for the Wave Equation

Lecture 22 - Analytical Methods for Solving the Wave Equation

Lecture 23 - Analytical Methods for Hyperbolic and Parabolic PDEs

Lecture 24 - Analytical Methods for Parabolic and Elliptic PDEs

Lecture 25 - Analytical Methods for Elliptic PDE's

Lecture 26 - Series Solutions for Elliptic PDE's and Introduction to Differential Operators

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[Lecture 36 - Orthogonal Basis Functions for Solving PDE's - I](#)

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Lecture 1 - Introduction - Role of Probability in Civil Engineering

Lecture 2 - Random Events and Probability Concept

Lecture 3 - Set Theory and Set Operations

Lecture 4 - Axioms of Probability

Lecture 5 - Probability of Events

Lecture 6 - Concept and Definition of Random Variables

Lecture 7 - Probability Distribution of Random Variables

Lecture 8 - CDF and Descriptors of Random Variables

Lecture 9 - Further Descriptors of Random Variables

Lecture 10 - Discrete Probability Distribution

Lecture 11 - Probability Distribution of Continuous RVs

Lecture 12 - Probability Distribution of Continuous RVs (Continued...1)

Lecture 13 - Probability Distribution of Continuous RVs (Continued...2)

Lecture 14 - Functions of Single Random Variables

Lecture 15 - Functions of Random Variables - Different Methods

Lecture 16 - Functions of Random Variables - Different Methods (Continued...)

Lecture 17 - Expectation and Moments of Functions of RV

Lecture 18 - Expectation and Moments of Functions of RV (Continued...)

Lecture 19 - Joint Probability Distribution

Lecture 20 - Marginal Probability Distribution

Lecture 21 - Conditional Probability Distribution

Lecture 22 - Conditional Probability Distribution (Continued...)

Lecture 23 - Properties of Multiple Random Variables

Lecture 24 - Properties of Multiple Random Variables (Continued...)

Lecture 25 - MGF of Multivariate RVs and Multivariate Probability Distributions

Lecture 26 - Multivariate Distribution and Functions of Multiple Random Variables

Lecture 27 - Functions of Multiple Random Variables (Continued...1)

Lecture 28 - Functions of Multiple Random Variables (Continued...2)

Lecture 29 - Introduction to Copulas

Lecture 30 - Introduction to Copulas (Continued...)

Lecture 31 - Probability Models using Normal Distribution

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Lecture 3 - Different Methods of Design of Reinforced Concrete Structures

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Lecture 8 - Design of Doubly Reinforced Beam Flexure - I

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Lecture 10 - Design of Doubly Reinforced Beam Flexure

Lecture 11 - Limit State of Collapse Shear

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Lecture 24 - Design of Footings - Part I

Lecture 25 - Design of Footings - Part II

Lecture 26 - Design of Staircases

Lecture 27 - Design for Torsion - Part I

Lecture 28 - Design for Torsion - Part II

Lecture 29 - Design of RC Slender Columns

Lecture 30 - Deflection of RC Beams

- Lecture 1 - Introduction to Engineering Geology
- Lecture 2 - Geologic Structures
- Lecture 3 - Geologic Maps and Stratigraphic Sections
- Lecture 4 - Remote Sensing in Engineering Geology
- Lecture 5 - Physical Properties of Minerals
- Lecture 6 - Crystallography and Optical Properties
- Lecture 7 - Chemical Characteristics of Minerals
- Lecture 8 - Origin And Types of Rocks
- Lecture 9 - Origin And Types of Soils
- Lecture 10 - Igneous Rocks
- Lecture 11 - Sedimentary Rocks
- Lecture 12 - Metamorphic Rocks
- Lecture 13 - Weathering
- Lecture 14 - Sediment Transport and Deposition
- Lecture 15 - Introduction to Subsurface Exploration
- Lecture 16 - Introduction to Subsurface Exploration
- Lecture 17 - Sampling and Non - Intrusive Methods
- Lecture 18 - Index Properties and Classification of Soils
- Lecture 19 - Index Properties of Rock and Rock Mass
- Lecture 20 - Stress-Strain Behavior of Soil and Rock - I
- Lecture 21 - Stress-Strain Behavior of Soil and Rock - II
- Lecture 22 - In-situ State of Stress
- Lecture 23 - Geologic Considerations in Tunneling
- Lecture 24 - Geologic Considerations in Dam Construction
- Lecture 25 - Groundwater - Preliminaries
- Lecture 26 - Groundwater Flow - I
- Lecture 27 - Groundwater Flow - II
- Lecture 28 - Groundwater Related Engineering Issues
- Lecture 29 - Groundwater Over Utilization
- Lecture 30 - Plate Tectonics
- Lecture 31 - Plate Tectonics - 2 and Earthquake

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NPTEL : Introduction to Transportation Engineering (Civil Engineering)

Co-ordinators : Dr. K.S. Reddy, Dr. Bhargab Maitra

- Lecture 1 - Transportation Engineering
- Lecture 2 - Elements of Concern and Components
- Lecture 3 - Traffic Stream Characteristics
- Lecture 4 - Traffic Studies : Part - I
- Lecture 5 - Traffic Studies : Part - II
- Lecture 6 - Highway Capacity and Level of Service
- Lecture 7 - Intersection Control and Signalization
- Lecture 8 - Functional Classification, Design Elements
- Lecture 9 - Cross Section Elements
- Lecture 10 - Stopping Sight Distance And Decision Sight
- Lecture 11 - Overtaking, Intermediate and Headlight Sight
- Lecture 12 - Intersection Sight Distance - I
- Lecture 13 - Intersection Sight Distance - II
- Lecture 14 - Horizontal Alignment - I
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- Lecture 16 - Horizontal Alignment - III
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- Lecture 18 - Horizontal Alignment - V
- Lecture 19 - Horizontal Alignment - VI
- Lecture 20 - Vertical Alignment - I
- Lecture 21 - Vertical Alignment - II
- Lecture 22 - Vertical Alignment - III
- Lecture 23 - Highway Alignment
- Lecture 24 - Principles of Pavement Design
- Lecture 25 - Traffic Loading - I
- Lecture 26 - Traffic Loading - II
- Lecture 27 - Pavement Materials - I
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[Lecture 35 - Analysis of Concrete Pavements](#)

[Lecture 36 - Flexible Pavement Design Indian Roads Congress](#)

[Lecture 37 - Flexible Pavement Design AASHTO Method - 1993](#)

[Lecture 38 - Concrete Pavement Design Indian Congress Method](#)

[Lecture 39 - Concrete Pavement Design PCA and AASHTO Methods](#)

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Lecture 5 - Analysis of Stress - IV

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Lecture 7 - Analysis of Strain - I

Lecture 8 - Analysis of Strain - II

Lecture 9 - Analysis of Strain - III

Lecture 10 - Analysis of Strain - IV

Lecture 11 - Analysis of Strain - V

Lecture 12 - Analysis of Strain - VI

Lecture 13 - Analysis of Strain - VII

Lecture 14 - Analysis of Strain - VIII

Lecture 15 - Application of Stress/Strain

Lecture 16 - Application of Stress / Strain

Lecture 17 - Application of Stress / Strain

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Lecture 21 - Torsion - IV

Lecture 22 - Bending of Beams - I

Lecture 23 - Bending of Beams - II

Lecture 24 - Bending of Beams - III

Lecture 25 - Bending of Beams - IV

Lecture 26 - Stresses in Beams - I

Lecture 27 - Stresses in Beams - II

Lecture 28 - Stresses in Beams - III

Lecture 29 - Stresses in Beams - IV

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Lecture 31 - Deflection of Beams - II

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[Lecture 1 - Life Cycle Assessment - Introduction](#)

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Co-ordinators : Dr. B.N. Rao

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- Lecture 3 - An overview of recycled concrete aggregates (RCA): sources and types - Part 1
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- Lecture 5 - Recycled Concrete Aggregate (RCA): Availability, Collection, and Processing Methods - Part 1
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- Lecture 7 - Recycled Concrete Aggregates: Properties and Performance - Part 1
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- Lecture 3 - GPS Positioning Methods
- Lecture 4 - GPS Solutions and Errors
- Lecture 5 - GPS Application
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- Lecture 7 - Electromagnetic Spectrum
- Lecture 8 - Sensors and Platform
- Lecture 9 - Sensors and Platform
- Lecture 10 - Image Interpretation
- Lecture 11 - Statistical Evaluation of RS Data
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- Lecture 15 - Orthogonal Transformation
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- Lecture 20 - Photogramatic-Basic concepts of a single photography
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- Lecture 27 - GIS-Introductory Concepts
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- Lecture 2 - Gauges and Permanent Way
- Lecture 3 - Wheel and Axles, Coning of Wheels
- Lecture 4 - Track Resistances, Hauling Capacity
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- Lecture 6 - Stresses in Components of Track
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- Lecture 10 - Jointed or Welded rails
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- Lecture 14 - Geometric Design - Alignment of Track
- Lecture 15 - Horizontal Curve and Super elevation
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- Lecture 2 - Different components of GIS
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- Lecture 4 - Raster data models and comparisons with vector
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- Lecture 6 - Non-spatial data (attributes) and their type
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- Lecture 8 - Spatial database systems and their types
- Lecture 9 - Pre-processing of spatial datasets
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- Lecture 14 - Quality assessment of freely available DEMS
- Lecture 15 - GIS analysis - Part 1
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- Lecture 18 - Classification Methods
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Lecture 7 - GPS Positioning (Principle and Methods)

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Lecture 9 - GPS Observables (Types, Errors and Quality)

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Lecture 7 - GPS Positioning of Control Point

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Lecture 2 - Different Techniques of Image Acquisition

Lecture 3 - Why is Digital Image processing Important ?

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[Lecture 42 - Drinking Water Microbiology - II](#)

[Lecture 43 - Drinking Water Microbiology - III](#)

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[Lecture 46 - Solid Waste Microbiology - I](#)

[Lecture 47 - Solid Waste Microbiology - II](#)

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[Lecture 49 - Antimicrobial Resistance - I](#)

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[Lecture 51 - Epidemiology - I](#)

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[Lecture 53 - Biosensors - I](#)

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[Lecture 56 - Bioinformatics - I](#)

[Lecture 57 - Bioinformatics - II](#)

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- Lecture 1 - Concept of Digital Elevation Model and How It Is Represented
- Lecture 2 - Various Techniques to Generate Digital Elevation Model - 1
- Lecture 3 - Various Techniques to Generate Digital Elevation Model - 2
- Lecture 4 - Various Techniques to Generate Digital Elevation Model - 3
- Lecture 5 - Importance of Spatial Resolution With DEMs
- Lecture 6 - How To Assess Quality of DEM?
- Lecture 7 - Integration of DEMs With Satellite Data
- Lecture 8 - Common Derivatives of DEMs- Slope and Aspect
- Lecture 9 - Triangulated Irregular Network (TIN) and Its Derivatives
- Lecture 10 - Shaded Relief Models and Their Applications
- Lecture 11 - DEMs Derivatives - 1
- Lecture 12 - DEMs Derivatives - 2
- Lecture 13 - DEMs Derivatives - 3
- Lecture 14 - DEMs Derivatives - 4
- Lecture 15 - DEM Based Surface Hydrologic Modelling - 1
- Lecture 16 - DEM Based Surface Hydrologic Modelling - 2
- Lecture 17 - DEM and DAM Simulation and Its Application In Ground Water Hydrology
- Lecture 18 - Applications of DEMs In Solar and Wind Energy Potential Estimations
- Lecture 19 - Applications of DEMs in Viewshed and Flood Hazard Mapping
- Lecture 20 - DEMs Sources, Limitations and Future of Digital Elevation Models

- Lecture 1 - Introduction, Fundamentals of Equilibrium and Kinetics
- Lecture 2 - Equilibrium-Process Feasibility, Gibbs Energy-Standard Condition
- Lecture 3 - Gibbs Free Energy-Non Standard Conditions - I
- Lecture 4 - Gibbs Free Energy-Non Standard Conditions - II
- Lecture 5 - Phase Equilibrium
- Lecture 6 - Component Balance
- Lecture 7 - Reaction Kinetics
- Lecture 8 - Rate of Reaction - I
- Lecture 9 - Rate of Reaction - II, Types of Reactors
- Lecture 10 - Mass Balance on different types of Reactors
- Lecture 11 - Material Balance for Complex Reactions
- Lecture 12 - Material Balance for Reversible Reactions
- Lecture 13 - Determination of Kinetic Equations
- Lecture 14 - Acid-Base Reactions
- Lecture 15 - Acid Dissociation Constant, Strength of Acid
- Lecture 16 - Ionization Fractions
- Lecture 17 - Introduction to VMINTEQ
- Lecture 18 - Estimation of pH using VMINTEQ
- Lecture 19 - Mixing Problems
- Lecture 20 - Inverse Dose Problems
- Lecture 21 - logC-pH Diagram
- Lecture 22 - Carbonate System: Closed System
- Lecture 23 - Carbonate System: Open System
- Lecture 24 - VMINTEQ: Application of Gases, Acid-Base Titration
- Lecture 25 - VMINTEQ: Titration and Multisweep, Buffer: Introduction
- Lecture 26 - VMINTEQ: Buffer System, Buffer Intensity: Introduction
- Lecture 27 - Buffer Intensity: Monoprotic and Diprotic Acids
- Lecture 28 - Alkalinity: Introduction
- Lecture 29 - Alkalinity: Theoretical and Practical Definition
- Lecture 30 - Acidity and its Applications
- Lecture 31 - Alkalinity and Acidity: Applications

- Lecture 32 - Mixing of Two Solutions and Conservative Quantities - I
- Lecture 33 - Mixing of Two Solutions and Conservative Quantities - II
- Lecture 34 - Carbonate and Non-Carbonate Alkalinity
- Lecture 35 - Anaerobic Digester: Acid Formation and Neutralization
- Lecture 36 - Aqueous Complexes: Applications in Toxicity Reduction
- Lecture 37 - Aqueous Complexes: Solubility, Rate Constants and Strength of Ligands
- Lecture 38 - Aqueous Complexes of Aluminium (Al)
- Lecture 39 - Aqueous Complexes of Mercury (Hg)
- Lecture 40 - Precipitation and Dissolution: Introduction and Applications
- Lecture 41 - Applications of Precipitation and Dissolution
- Lecture 42 - Different Stages in Precipitation, Equilibrium of Precipitation - I
- Lecture 43 - Equilibrium of Precipitation - II
- Lecture 44 - Examples Related to Equilibrium of Precipitation
- Lecture 45 - Other Examples of Equilibrium of Precipitation
- Lecture 46 - Solubility and Competitive Precipitation
- Lecture 47 - Predominance Area Diagram and Introduction to Redox Processes
- Lecture 48 - Redox Reactions and its Applications
- Lecture 49 - Balancing of Redox and Development of Half Reaction
- Lecture 50 - Kinetics of Redox Processes
- Lecture 51 - Equilibrium of Redox - I
- Lecture 52 - Equilibrium of Redox - II and Reaction Feasibility
- Lecture 53 - Reaction Feasibility Based on P_e - I
- Lecture 54 - Reaction Feasibility Based on P_e - II
- Lecture 55 - Effect of Complexation on Redox
- Lecture 56 - Effect of Complexation and Solid Phase on Redox
- Lecture 57 - Reaction Feasibility based on E_h
- Lecture 58 - Introduction to Electrochemical cell (Ecell)
- Lecture 59 - Applications of Ecell
- Lecture 60 - $\log C$ - P_e and pH - P_e Diagram

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Course Outline

Lecture 4 - Introduction to hazardous waste laws and risk assessment

Lecture 5 - The major aspects of Risk Assessment

Lecture 6 - Risk Characterization

Lecture 7 - Risk Assessment - Deterministic approach

Lecture 8 - Risk Assessment - Stochastic Approach

Lecture 9 - Hazardous Waste laws - The TCLP Test

Lecture 10 - Hazardous rules and regulations

Lecture 11 - Remediation of contaminated GW-Plume Containment

Lecture 12 - Remediation of contaminated GW-Javandel et al's approach

Lecture 13 - Remediation of contaminated GW by Pump and Treat - I

Lecture 14 - Remediation of contaminated GW by Pump and Treat - II

Lecture 15 - Remediation of contaminated GW- Calculation of remediation time and introduction to source control

Lecture 16 - Permeable Reactive Barriers - I

Lecture 17 - Permeable Reactive Barriers - II

Lecture 18 - Permeable Reactive Barriers - III

Lecture 19 - Design of Permeable Reactive Barriers

Lecture 20 - Case Study on Permeable Reactive Barriers - I

Lecture 21 - Case Study on Permeable Reactive Barriers - II

Lecture 22 - Case Study- PRB (Utah)

Lecture 23 - Case Study (Utah) (Continued...)

Lecture 24 - Mechanism of natural attenuation and the affecting factors

Lecture 25 - Introduction to natural attenuation and its types

Lecture 26 - Pathways of Contaminant Transport and Rate of Degradation of Contaminant

Lecture 27 - Rate of Degradation of Contaminant when advection is considered

Lecture 28 - Rate of Degradation of Contaminant when both diffusion and advection are considered

Lecture 29 - Example of Rate of Degradation in natural attenuation

Lecture 30 - Case study: Natural Attenuation

Lecture 31 - Results of Case Study: Natural Attenuation

- Lecture 32 - Introduction of Soil/Sediments contamination with some examples
- Lecture 33 - Case Study: Soil/Sediments Contamination and remediation by Excavation and Disposal
- Lecture 34 - Hazardous waste disposal site/TSDF
- Lecture 35 - Different type of fluxes through containment barrier
- Lecture 36 - Introduction to Solidification and Stabilisation and Case Study
- Lecture 37 - Different contaminant reactions during solidification and stabilisation
- Lecture 38 - Diffusion of contaminant through solidified form
- Lecture 39 - Calculations for fractions of binders, admixtures, waste and water used in solidification
- Lecture 40 - Discussion of TCLP approach in solidification and its examples
- Lecture 41 - Discussion of TCLP approach (contd.) and Cost estimation of Solidification
- Lecture 42 - Case Study: Solidification and Stabilization
- Lecture 43 - Chemical Treatment
- Lecture 44 - Case Study: In-Situ Chemical Oxidation - Part I
- Lecture 45 - Case Study: In-Situ Chemical Oxidation - Part II
- Lecture 46 - Case Study: In-Situ Chemical Oxidation - Part III
- Lecture 47 - Surfactant Extraction - Part I
- Lecture 48 - Surfactant Extraction - Part II
- Lecture 49 - Case Study: Surfactant Extraction - Part I
- Lecture 50 - Case Study: Surfactant Extraction - Part II
- Lecture 51 - Soil Vapor Extraction - Part I
- Lecture 52 - Soil Vapor Extraction - Part II
- Lecture 53 - Bioremediation - Part I
- Lecture 54 - Bioremediation - Part II
- Lecture 55 - Case Study: Bioremediation
- Lecture 56 - Case Study: Soil Vapor Extraction - Part I
- Lecture 57 - Case Study: Soil Vapor Extraction - Part II
- Lecture 58 - Phyto-remediation
- Lecture 59 - Conceptual Site Model
- Lecture 60 - Adaptive Design in Remediation Engineering
- Lecture 61 - Solubilization Theory - Part I
- Lecture 62 - Solubilization Theory - Part II
- Lecture 63 - Enhanced Aquifer Flushing Technologies

Lecture 1 - Introduction to Global Navigation Satellite System (GNSS)

Lecture 2 - How position is determined by the GNSS? - Part I

Lecture 3 - How position is determined by the GNSS? - Part II

Lecture 4 - How position is determined by the GNSS? - Part III

Lecture 5 - NAVSTAR - Global Positioning System

Lecture 6 - Global Navigation Satellite System (GLONASS)

Lecture 7 - BeiDou Navigation Satellite System (BDS)

Lecture 8 - Indian Regional Navigation Satellite System (IRNSS)

Lecture 9 - GALILEO

Lecture 10 - Quasi-Zenith Satellite System (QZSS)

Lecture 11 - Differential Global Navigation Satellite System (DGNSS)

Lecture 12 - Real-Time Kinematic (RTK)

Lecture 13 - Satellite Based Augmentation System (SBAS)

Lecture 14 - GNSS Errors

Lecture 15 - GNSS Correction Methods

Lecture 16 - Why altitude estimated by GNSS receivers is not very accurate

Lecture 17 - Global Navigation Satellite Systems (GNSS) Applications - I

Lecture 18 - Global Navigation Satellite Systems (GNSS) Applications - II

Lecture 19 - GNSS: Current Trends and Future

Lecture 20 - GNSS: Opportunities in India

Lecture 1 - Introduction to Geomorphology and Concept of Time Scale in a Geomorphic System

Lecture 2 - Process of Landform Development

Lecture 3 - Energy Flow in Geomorphic System and Role of Uniformitarianism Vs Catastrophism

Lecture 4 - Landform Development - Equilibrium and Evolution

Lecture 5 - Process Geomorphology - I

Lecture 6 - Process Geomorphology - II

Lecture 7 - Weathering and soil Formation Introduction - I

Lecture 8 - Weathering and soil Formation Introduction - II

Lecture 9 - Weathering and Soil Formation (Types of Weathering)

Lecture 10 - Weathering and Soil Formation (Mechanical Weathering)

Lecture 11 - Weathering and Soil Formation (Mechanical and Chemical Weathering)

Lecture 12 - Weathering and Soil Formation (Chemical and Biological Weathering)

Lecture 13 - Weathering of Silicate rocks and Weathering Products

Lecture 14 - Factors of Weathering

Lecture 15 - Soil Formation

Lecture 16 - Soil Formation Processes

Lecture 17 - Soil Classification

Lecture 18 - Mass Wasting

Lecture 19 - Classification of Mass Wasting - I

Lecture 20 - Classification of Mass Wasting - II

Lecture 21 - Hill Slope Evolution - I

Lecture 22 - Hill Slope Evolution - II

Lecture 23 - Arid Zone Geomorphology

Lecture 24 - Landforms in Dry Region

Lecture 25 - Pediment Evolution

Lecture 26 - Aeolian Processes and Landforms - I

Lecture 27 - Aeolian Processes and Landforms - II

Lecture 28 - Wind Erosional Landforms - I

Lecture 29 - Wind Erosional Landforms - II

Lecture 30 - Dune Classification - I

Lecture 31 - Dune Classification - II

- Lecture 32 - Coastal Geomorphology - I
- Lecture 33 - Coastal Geomorphology and Landforms
- Lecture 34 - Coastal Geomorphology - II
- Lecture 35 - Coastal Geomorphology - III
- Lecture 36 - Shoreline Platform
- Lecture 37 - Coastal Geomorphology - IV
- Lecture 38 - Coastal Geomorphology - V
- Lecture 39 - Coastal Geomorphology - VI
- Lecture 40 - Coastal Geomorphology - VII
- Lecture 41 - Coastal Geomorphology - VIII
- Lecture 42 - Coastal Geomorphology - IX
- Lecture 43 - Tectonic Geomorphology
- Lecture 44 - Fluvial Process
- Lecture 45 - Fluvial Process - I
- Lecture 46 - Fluvial Process - II
- Lecture 47 - Fluvial Process - III
- Lecture 48 - Fluvial Process - IV
- Lecture 49 - Fluvial Process - V and Drainage Analysis
- Lecture 50 - Fluvial Process - VI and Drainage Analysis
- Lecture 51 - Fluvial Geomorphology River System - I
- Lecture 52 - Fluvial Geomorphology River System - II
- Lecture 53 - Glacial Geomorphology - I
- Lecture 54 - Glacial Geomorphology - II (Valley Glacier)
- Lecture 55 - Glacial Geomorphology - III
- Lecture 56 - Glacial Geomorphology - IV (Geomorphologic Changes by Glacier)
- Lecture 57 - Exploration Geomorphology in Oil field Sandbody Geometry - I
- Lecture 58 - Exploration Geomorphology in Oil Field Sandbody Geometry - II
- Lecture 59 - Seismic Geomorphology - I
- Lecture 60 - Seismic Geomorphology - II

Lecture 1 - Rudiments of Remote Sensing and Advantages

Lecture 2 - Historical Perspective of development of remote sensing technology

Lecture 3 - EM spectrum, solar reflection and thermal emission

Lecture 4 - Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission

Lecture 5 - Interaction mechanisms of EM radiation with ground, spectral response curves

Lecture 6 - Laws of Radiation and their relevance in Remote Sensing

Lecture 7 - Basis of remote sensing image representation

Lecture 8 - Various Remote Sensing Platforms

Lecture 9 - Multi-spectral scanners and imaging devices

Lecture 10 - Significant characteristics of LANDSAT, SPOT, Sentinel sensors

Lecture 11 - Prominent characteristics of IRS, Cartosat, ResourceSat sensors

Lecture 12 - Unmanned Aerial Vehicle/Drone

Lecture 13 - Passive Microwave Remote Sensing

Lecture 14 - Image characteristics and different resolutions in Remote Sensing

Lecture 15 - Different techniques of Image acquisition

Lecture 16 - Importance of digital image processing

Lecture 17 - Digital Image Processing Software

Lecture 18 - Basic image enhancement techniques

Lecture 19 - Colour representations and transformtions

Lecture 20 - Image Histograms and statistics

Lecture 21 - Atmospheric errors and corrections

Lecture 22 - Geometric transformations/Geo-referencing Technique

Lecture 23 - Digital Image Processing Software Demonstration - 1

Lecture 24 - Image enhancement techniques - 1

Lecture 25 - Image enhancement techniques - 2

Lecture 26 - Digital Image Processing Software Demonstration - 2

Lecture 27 - Spatial Filtering Techniques, Band rationing and PCA

Lecture 28 - Frequency Doman Fourier Transformation

Lecture 29 - Digital Image Processing Software Demonstration - 3

Lecture 30 - Unsupervised image classification and density slicing techniques

Lecture 31 - Supervised image classification techniques and limitations

- Lecture 32 - Digital Image Processing Software Demonstration - 4
- Lecture 33 - LiDAR Technique and applications
- Lecture 34 - Mosaicking, subsets, sub-sampling techniques and applications
- Lecture 35 - False Topographic Phenomena and correction techniques - 1
- Lecture 36 - False Topographic Phenomena and correction techniques - 2
- Lecture 37 - High Spatial Resolution Satellite Images and limitations
- Lecture 38 - Basic Image Compression techniques and different image file formats
- Lecture 39 - Hyperspectral Remote Sensing
- Lecture 40 - Digital Image vs Digital Photograph
- Lecture 41 - NDVI and other indices
- Lecture 42 - Active Microwave Remote Sensing - 1
- Lecture 43 - Active Microwave Remote Sensing - 2
- Lecture 44 - Radar Images interpretation and applications
- Lecture 45 - SAR Interferometry (InSAR) Technique - 1
- Lecture 46 - SAR Interferometry (InSAR) Technique - 2
- Lecture 47 - Principles of image interpretation
- Lecture 48 - Image interpretation of different geological landforms, rock types and structures
- Lecture 49 - Remote Sensing of Moon and Mars
- Lecture 50 - Google Earth and its Applications
- Lecture 51 - Integrated applications of RS and GIS in groundwater studies - 1
- Lecture 52 - Integrated applications of RS and GIS in groundwater studies - 2
- Lecture 53 - Applications of Remote Sensing in Earthquake Studies - 1
- Lecture 54 - Applications of Remote Sensing in Earthquake Studies - 2
- Lecture 55 - Different sources of free satellite images
- Lecture 56 - Limitations of Remote Sensing Techniques

Lecture 1 - Introduction

Lecture 2 - Shallow Foundations: General Requirements

Lecture 3 - Shallow Foundations: Bearing Capacity

Lecture 4 - Shallow Foundations: Settlement

Lecture 5 - Shallow Foundations: Numerical Examples

Lecture 6 - Combined Footings

Lecture 7 - Raft Foundations: General Requirements

Lecture 8 - Raft Foundations: Methods of Analysis

Lecture 9 - Footings under Dynamic Loads: Eccentric and Inclined Loads, A New Method

Lecture 10 - Footings under Dynamic Loads: Design Procedure and Example on a New Method

Lecture 11 - Footings under Dynamic Loads: Analytical Approaches

Lecture 12 - Footings under Dynamic Loads: Numerical on Analytical Approaches

Lecture 13 - Pile Foundations subjected to Static Vertical Load

Lecture 14 - Pile Foundations: Group Action of Piles and Numerical

Lecture 15 - Pile Foundations under Lateral Loads: Conventional and Elastic Methods

Lecture 16 - Pile Foundations under Lateral Loads: Elastic Method for Cohesionless Soils

Lecture 17 - Pile Foundations under Lateral Loads: Elastic Method for Cohesive Soils including degradation of modulus of subgrade reaction (k)

Lecture 18 - Pile Foundations under Lateral Loads: Numerical Examples

Lecture 19 - Dynamic Analysis of Piles under Vertical and Horizontal Vibrations

Lecture 20 - Dynamic Analysis of Piles under Horizontal Vibration: Continue with Numerical Example

Lecture 21 - Seismic Response of Pile Foundations - 1

Lecture 22 - Seismic Response of Pile Foundations - 2

Lecture 23 - Combined Pile-Raft Foundations (CPRF) - General

Lecture 24 - Geotechnical and Seismic Analyses of CPRF

Lecture 25 - Design of Piles in Liquefiable Soils - 1

Lecture 26 - Design of Piles in Liquefiable Soils - 2

Lecture 27 - Introduction to Well Foundations

Lecture 28 - Lateral Stability of Well Foundations

Lecture 29 - Lateral Stability, Construction and Sinking of Well Foundation

Lecture 30 - Tiltling and Shifting of Wells, Numerical Problems

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[Lecture 33 - SGM and Wave Propagation](#)

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[Lecture 35 - Ground Response Analysis \(GRA\)](#)

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[Lecture 37 - Raft Foundations – Numerical Examples](#)

[Lecture 38 - Foundations on Slopes - 1](#)

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Lecture 2 - Essential Components of GIS

Lecture 3 - Different types of vector data

Lecture 4 - Concept of topology

Lecture 5 - Demonstration through GIS software

Lecture 6 - Raster data model and comparisons with vector

Lecture 7 - TIN data model and comparisons with raster

Lecture 8 - Non-spatial data (attributes) and their types

Lecture 9 - Vector data compression techniques

Lecture 10 - Demonstration through GIS software

Lecture 11 - Raster data compression techniques - 1

Lecture 12 - Raster data compression techniques - 2

Lecture 13 - Georeferencing

Lecture 14 - Pre-processing of spatial datasets - 1

Lecture 15 - Demonstration through GIS software

Lecture 16 - Pre-processing of spatial datasets - 2

Lecture 17 - Pre-processing of spatial datasets - 3

Lecture 18 - Spatial Interpolation Techniques - 1

Lecture 19 - Spatial Interpolation Techniques - 2

Lecture 20 - GIS ANALYSIS - 1

Lecture 21 - GIS Analysis - 2

Lecture 22 - GIS Analysis - 3

Lecture 23 - GIS Analysis - 4

Lecture 24 - GIS Analysis - 5

Lecture 25 - Demonstration through GIS software

Lecture 26 - GIS Analysis - 6

Lecture 27 - GIS Analysis - 7

Lecture 28 - Attributes Classification Methods

Lecture 29 - Special database systems and their types - 1

Lecture 30 - Demonstration through GIS software

Lecture 31 - Spatial database systems and their types - 2

[Lecture 32 - Concept of NoData in Raster](#)

[Lecture 33 - Different map projections](#)

[Lecture 34 - Concept of digital elevation model \(DEM\) and how it is represented](#)

[Lecture 35 - Demonstration through GIS software](#)

[Lecture 36 - Various techniques to generate digital elevation model - 1](#)

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[Lecture 39 - Digital Elevation Models and different types of resolutions](#)

[Lecture 40 - Demonstration through GIS software](#)

[Lecture 41 - How to assess quality of a DEM?](#)

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[Lecture 47 - Demonstration through GIS software](#)

[Lecture 48 - DEMs derivatives - 1](#)

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[Lecture 53 - DEM based Surface Hydrologic Modelling - 1](#)

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[Lecture 55 - DEMs and Dam Simulation and its application in groundwater hydrology](#)

[Lecture 56 - Applications of DEMs in Viewshed and Flood Hazard Mapping](#)

[Lecture 57 - Applications of DEMs in solar and wind energy potential estimations](#)

[Lecture 58 - DEMs Sources, limitations and future of Digital Elevation Models](#)

[Lecture 59 - Errors in GIS and key elements of maps](#)

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- Lecture 2 - Life expectancy and real-world scenario
- Lecture 3 - Course outline
- Lecture 4 - Review of fundamentals
- Lecture 5 - Mass balance
- Lecture 6 - Mass Balance: Batch reactor, CSTR, and Plug flow reactors
- Lecture 7 - Mass balance: Comparison of CSTR and Plug flow reactor
- Lecture 8 - Mass Balance: Non ideal system and Water quality parameters
- Lecture 9 - Water quality: DO and ways to measure it
- Lecture 10 - Water quality: Nutrients in water
- Lecture 11 - Water quality: Total suspended solids and Pathogens
- Lecture 12 - Wastewater treatment plant: basic principals
- Lecture 13 - Wastewater treatment plant: Preliminary treatment
- Lecture 14 - Wastewater treatment plant: Sedimentation and basics
- Lecture 15 - Sedimentation: Discrete and Flocculant settling
- Lecture 16 - Design of primary settling tank
- Lecture 17 - Biological treatment: BOD and Nutrient removal
- Lecture 18 - Analysis of biological removal process(ASP)
- Lecture 19 - Activated sludge process: Material balance for aeration basin
- Lecture 20 - Oxygen transfer: types and basic principals
- Lecture 21 - Relevance of F/M ratio and Design Parameters of Activated Sludge Process
- Lecture 22 - Sludge Bulking and Activated Sludge Variations
- Lecture 23 - Sequencing Batch Reactor
- Lecture 24 - Nitrogen Removal - I
- Lecture 25 - Nitrogen Removal - II and Phosphorus Removal - I
- Lecture 26 - Phosphorus Removal - II
- Lecture 27 - Secondary Clarifiers and Attached Growth System
- Lecture 28 - Disinfection
- Lecture 29 - Chlorination Disinfection
- Lecture 30 - Disinfection By-products (DBPs) and Disinfectant Removal
- Lecture 31 - Water demand

- Lecture 32 - Water Quality Parameters
- Lecture 33 - Overview of Water Treatment
- Lecture 34 - Physico-Chemical treatment
- Lecture 35 - Coagulation - I
- Lecture 36 - Coagulation - II
- Lecture 37 - Rapid Mixing
- Lecture 38 - Flocculation - I
- Lecture 39 - Flocculation - II
- Lecture 40 - Flocculent settling
- Lecture 41 - Filtration
- Lecture 42 - Depth filtration
- Lecture 43 - Design of Sand filter and Surface filtration
- Lecture 44 - Disinfection
- Lecture 45 - Hardness - I
- Lecture 46 - Hardness - II
- Lecture 47 - Lime-Soda softening - I
- Lecture 48 - Lime-Soda softening - II
- Lecture 49 - Recarbonation
- Lecture 50 - Types of Softening Basin and Adsorption
- Lecture 51 - Adsorption
- Lecture 52 - Adsorption Isotherms
- Lecture 53 - Ion Exchange
- Lecture 54 - Nanofiltration and RO
- Lecture 55 - Aeration: Removal of Fe and Mn
- Lecture 56 - Residual Management
- Lecture 57 - Sludge Thickening
- Lecture 58 - Stabilization of Sludge
- Lecture 59 - Anaerobic and Aerobic digestion of sludge
- Lecture 60 - Conditioning, Dewatering and Disposal of Sludge

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Lecture 2 - Minerals and Rock Classes

Lecture 3 - Mineral Identification Procedure

Lecture 4 - Rock Identification Procedure

Lecture 5 - Geological Structures and Discontinuities

Lecture 6 - Spherical Representation of Geological Data - 1

Lecture 7 - Spherical Representation of Geological Data - 2

Lecture 8 - Spherical Representation of Geological Data - 3

Lecture 9 - Application of Graphical Representation of Geological Data

Lecture 10 - Laboratory Testing of Rocks - Sampling

Lecture 11 - Laboratory testing of Rocks - Preparations and UCS

Lecture 12 - Factors Influencing UCS and Modes of Failure in Compression

Lecture 13 - Failure Mechanism and Post-Failure Behaviour in Compression, Indirect Method for UCS

Lecture 14 - Indirect Method for UCS, Brazilian Test, Schmidt Rebound Hardness Test

Lecture 15 - Sound Velocity Test, Slake Durability Test, Swelling Pressure and Free Swell Test and Void Index Test

Lecture 16 - Shear Tests - 1

Lecture 17 - Shear Tests - 2

Lecture 18 - Engineering Classification of Intact Rocks, Concept of Rock Mass, RQD

Lecture 19 - Concept of Rock Mass, Factors Affecting Discontinuities

Lecture 20 - Factors Affecting Discontinuities

Lecture 21 - Classification of Rock Mass: Rock Mass Rating (RMR) - 1

Lecture 22 - Classification of Rock Mass: Rock Mass Rating (RMR) - 2

Lecture 23 - Classification of Rock Mass: Rock Mass Quality (Q-system) - 1

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Lecture 25 - Classification of Rock Mass: Geological Strength Index (GSI)

Lecture 26 - Strength Criteria for Isotropic and Anisotropic Rock - 1

Lecture 27 - Strength Criteria for Isotropic and Anisotropic Rocks -2, Mohr's Failure Theory

Lecture 28 - Mohr-Coulomb Failure Criterion

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Lecture 30 - Concept of Instantaneous c and ϕ : Balmer Approach

Lecture 31 - Empirical Failure Criteria: Basics of Regression Analysis

Lecture 32 - Hoek and Brown Criterion (1980)

Lecture 33 - Parameters of Failure Criteria

Lecture 34 - Failure Criteria for Rock Mass

Lecture 35 - Tunneling: Underground Excavations

Lecture 36 - Tunneling: Ground Conditions

Lecture 37 - Elastic Stress Distribution Around Circular Tunnels - 1

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Lecture 39 - Elastic Analysis of Circular Tunnels - Displacements

Lecture 40 - Thick Wall Cylinder in Biaxial Stress Field

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Lecture 42 - Underground Excavation Failure Mechanisms

Lecture 43 - Structurally Controlled Failure: Roof Failure

Lecture 44 - Structurally Controlled Failure: Sidewall Failures - 1

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Lecture 46 - Rock Mass Support Interaction Analysis - 1

Lecture 47 - Rock Mass Support Interaction Analysis - 2

Lecture 48 - Rock Slope Stability

Lecture 49 - Rock Slope Stability - Plane Failure

Lecture 50 - Rock Slope Stability - Wedge Failure

Lecture 51 - Rock Slope Stability - Circular Failure

Lecture 52 - Rock Slope Stability - Toppling Failure - 1

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Lecture 55 - Rock Slope Stabilization

Lecture 56 - Foundations on Weak Rocks

Lecture 57 - Ultimate Bearing Capacity Using Bell's Approach

Lecture 58 - Bearing Capacity from Classification Approaches and Based on UCS

Lecture 59 - Bearing Capacity Based on Plate Load test; Treatment of Foundations

Lecture 60 - Dam Foundation Problems

- Lecture 1 - Introduction to Scientific Computations - I
- Lecture 2 - Introduction to Scientific Computations - II
- Lecture 3 - Basic Concepts of Linear Algebra
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Lecture 7 - FE modelling of planar structures (Continued...)

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Lecture 15 - Second order implicit methods

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Lecture 30 - FEM for stability analysis. Euler-Bernoulli beam and general formulations

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Lecture 21 - Time Domain Parameters (Continued...)

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Lecture 26 - Time history; response Spectra (design); Stochastic models

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Lecture 6 - Noisy Channel: Argmax Based Computation

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Lecture 12 - Part of Speech Tagging counted ... and Indian Language in Focus; Morphology Analysis

Lecture 13 - PoS Tagging contd... , Indian Language Consideration; Accuracy Measure

Lecture 14 - PoS Tagging; Fundamental Principle; Why Challenging; accuracy

Lecture 15 - PoS Tagging; Accuracy Measurement; Word categories

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Lecture 17 - HMM

Lecture 18 - HMM, Viterbi, Forward Backward Algorithm

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Lecture 20 - HMM, Forward Backward Algorithms, Baum Welch Algorithm

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Lecture 28 - PCA; SVD; Towards Latent Semantic Indexing (LSI)

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Design and Analysis of Algorithms (Computer Science and Engineering)

Co-ordinators : Prof. Sundar Viswanathan, Prof. Ajit A Diwan, Prof. Abhiram G Ranade

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Lecture 3 - Algorithms Analysis Framework - II

Lecture 4 - Asymptotic Notations

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Lecture 7 - Divide And Conquer - II Median Finding

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Software Engineering (Computer Science and Engineering)

Co-ordinators : Prof. N.L. Sarda, Prof. Umesh Bellur, Prof. Rushikesh K Joshi

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- Lecture 2 - Introduction to Software Engineering
- Lecture 3 - Overview of Phases
- Lecture 4 - Overview of Phases
- Lecture 5 - Requirements Engineering / Specification
- Lecture 6 - Formal Specification
- Lecture 7 - Algebraic Specification Methods
- Lecture 8 - Systems Modeling Overview
- Lecture 9 - Process Modeling - DFD , Function Decomp
- Lecture 10 - Process Modeling - DFD, Function Decomp
- Lecture 11 - Data Modeling - ER Diagrams, Mapping
- Lecture 12 - Data Modeling - ER Diagrams, Mapping
- Lecture 13 - Production Quality Software - Introduction
- Lecture 14 - Software Design - Primary Consideration
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- Lecture 16 - Class and Component Level Design
- Lecture 17 - Architectural Design
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- Lecture 27 - Software Reuse CBSE
- Lecture 28 - Reuse Continued
- Lecture 29 - Introduction to Project Management
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Lecture 23 - Coverage Criteria, (Continued...)

Lecture 24 - Logic Coverage Criteria

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Lecture 31 - Functional Testing

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- [Lecture 41 - Mutation testing](#)
- [Lecture 42 - Mutation Testing : Mutation for integration](#)
- [Lecture 43 - Mutation testing : Grammars and inputs](#)
- [Lecture 44 - Software Testing Course: Summary after Week 9](#)
- [Lecture 45 - Testing of web Applications and Web Services](#)
- [Lecture 46 - Testing of web Applications and Web Services](#)
- [Lecture 47 - Testing of web Applications and Web Services](#)
- [Lecture 48 - Testing of Object-Oriented Applications](#)
- [Lecture 49 - Testing of Object-Oriented Applications](#)
- [Lecture 50 - Symbolic Testing - 1](#)
- [Lecture 51 - Symbolic Testing - 2](#)
- [Lecture 52 - DART: Directed Automated Random Testing - 1](#)
- [Lecture 53 - DART: Directed Automated Random Testing - 2](#)
- [Lecture 54 - DART: Directed Automated Random Testing - 3](#)
- [Lecture 55 - Testing of Object-Oriented Applications](#)
- [Lecture 56 - Testing of Mobile Applications](#)
- [Lecture 57 - Non-Functional System Testing](#)
- [Lecture 58 - Regression Testing](#)
- [Lecture 59 - Assignment: Week 11 Solving](#)
- [Lecture 60 - Software Testing: Summary at the End of the Course](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Design and Pedagogy of the Introductory Programming Course (Computer Science and Engineering)

Co-ordinators : Prof. Abhiram G Ranade

Lecture 1 - Course Overview

Lecture 2 - Introduction and Survey.0: The standard approach to introductory programming

Lecture 3 - Introduction and Survey.1: Experience with the standard approach

Lecture 4 - Introduction and Survey.2: Alternative approaches, Summary, and Conclusion

Lecture 5 - Basic Ideas in Our Approach.0: Introduction

Lecture 6 - Basic Ideas in Our Approach.1: Examples of translating manual algorithms to computer programs

Lecture 7 - Basic Ideas in Our Approach.2: More examples

Lecture 8 - Basic Ideas in Our Approach.3: Should we teach students (manual) problem solving strategies?

Lecture 9 - Basic Ideas in Our Approach.4: The design of the course

Lecture 10 - Basic Ideas in Our Approach.5: Remarks on individual topics - 1

Lecture 11 - Basic Ideas in Our Approach.6: Remarks on individual topics - 2, Conclusion

Lecture 12 - Pedagogy.0: Introduction and basic principles

Lecture 13 - Pedagogy.1: Scaffolding, Lesson Plan

Lecture 14 - Pedagogy.2: A quick tour of the course - 1

Lecture 15 - Pedagogy.3: Tour-2

Lecture 16 - Pedagogy.4: Tour-3, Conclusion

Lecture 17 - Advanced Programming Topics.0: Introduction, Organization of medium sized programs

Lecture 18 - Advanced Programming Topics.1: Advanced memory management, Standard Library

Lecture 19 - Advanced Programming topics.2: Object Oriented Programming, Concluding remarks

Lecture 20 - In class questions, Assignments, Examinations.0: In class questions and lab assignments

Lecture 21 - In class questions, Assignments, Examinations.1: Examinations

Lecture 22 - Summing up

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Introduction - Part 3

Lecture 4 - Introduction - Part 4

Lecture 5 - Problem Solving using Computer - Part 1

Lecture 6 - Problem Solving using Computer - Part 2

Lecture 7 - Problem Solving using Computer - Part 3

Lecture 8 - Problem Solving using Computer - Part 4

Lecture 9 - Problem Solving using Computer - Part 5

Lecture 10 - Basic Elements of Program - Part 1

Lecture 11 - Basic Elements of Program - Part 2

Lecture 12 - Basic Elements of Program - Part 3

Lecture 13 - Basic Elements of Program - Part 4

Lecture 14 - Program Design - Part 1

Lecture 15 - Program Design - Part 2

Lecture 16 - Program Design - Part 3

Lecture 17 - Simple cpp Graphics

Lecture 18 - Conditional Execution - Part 1

Lecture 19 - Most general form of if - Part 2

Lecture 20 - More general form of conditions - Part 3

Lecture 21 - A somewhat large program example - Part 4

Lecture 22 - Switch statement and logical data - Part 5

Lecture 23 - Loops - Part 1

Lecture 24 - Mark averaging - Part 2

Lecture 25 - The break and continue statements - Part 3

Lecture 26 - The for statement - Part 4

Lecture 27 - Euclid's algorithm for GCD - Part 5

Lecture 28 - Correctness proof for GCD - Part 6

Lecture 29 - Computing Mathematical Functions - Part 1 : Taylor series

Lecture 30 - Computing Mathematical Functions - Part 2 : Numerical integration

Lecture 31 - Computing Mathematical Functions - Part 3 : Bisection Method

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- Lecture 32 - Computing Mathematical Functions - Part 4 : Newton Raphson Method
- Lecture 33 - Loops in various applications - Part 1 : Loops in various applications brute force algorithms
- Lecture 34 - Loops in various applications - Part 2 : Finding Pythagorean Triples
- Lecture 35 - Loops in various applications - Part 3 : Modelling a system: bargaining
- Lecture 36 - Loops in various applications - Part 4 : Simulating a water tank
- Lecture 37 - Loops in various applications - Part 5 : Arithmetic on very large numbers
- Lecture 38 - Functions - Part 1 : Basics
- Lecture 39 - Functions - Part 2 : Examples
- Lecture 40 - Functions - Part 3 : Reference parameters
- Lecture 41 - Functions - Part 4 : Pointers
- Lecture 43 - Recursion - Part 1 : Introduction
- Lecture 44 - Recursion - Part 2 : Recursive objects, Tree drawing
- Lecture 45 - Recursion - Part 3 : How to think about recursion
- Lecture 46 - Virahanka Numbers - Part 1 : Introduction
- Lecture 47 - Virahanka Numbers - Part 2 : Recursive Program
- Lecture 48 - Virahanka Numbers - Part 3 : Iterative Program and Conclusion
- Lecture 49 - Program Organization and Functions - Part 1 : Introduction
- Lecture 50 - Program Organization and Functions - Part 2 : Splitting into files
- Lecture 51 - Program Organization and Functions - Part 3 : Namespaces
- Lecture 52 - Program Organization and Functions - Part 4 : How to use C++ without simplecpp
- Lecture 53 - Advanced Features of Functions - Part 1 : Introduction and passing one function to another
- Lecture 54 - Advanced Features of Functions - Part 2 : Lambda expressions
- Lecture 55 - Advanced Features of Functions - Part 3 : Default values to parameters
- Lecture 56 - Advanced Features of Functions - Part 4 : Function overloading and lecture conclusion
- Lecture 57 - Array Part-1 - Part 1 : Introduction
- Lecture 58 - Array Part-1 - Part 2 : Marks averaging problem
- Lecture 59 - Array Part-1 - Part 3 : Histogram computation
- Lecture 60 - Array Part-1 - Part 4 : Marks display variation
- Lecture 61 - Array Part-1 - Part 5 : Polynomial multiplication
- Lecture 62 - Array Part-1 - Part 6 : Queues in dispatching taxis
- Lecture 63 - Array Part-1 - Part 7 : More efficient Queues in dispatching taxis
- Lecture 64 - Array Part-1 - Part 8 : Disk intersection
- Lecture 65 - Array Part-1 - Part 9 : Arrays of graphical objects and conclusion

[Lecture 66 - Array Part-2 - Part 1 : Introduction](#)

[Lecture 67 - Array Part-2 - Part 2 : Interpretation of a name\[index\]](#)

[Lecture 68 - Array Part-2 - Part 3 : Arrays and function calls](#)

[Lecture 69 - Array Part-2 - Part 4 : A function to sort an array](#)

[Lecture 70 - More on Arrays - Part 1 : Textual data](#)

[Lecture 71 - More on Arrays - Part 2 : Functions on character strings](#)

[Lecture 72 - More on Arrays - Part 3 : Two dimensional arrays](#)

[Lecture 73 - More on Arrays - Part 4 : Command Line Arguments](#)

[Lecture 74 - Arrays and recursion - Part 1 : Binary Search Introduction](#)

[Lecture 75 - Arrays and recursion - Part 2 : Binary search analysis](#)

[Lecture 76 - Arrays and recursion - Part 3 : Mergesort overview](#)

[Lecture 77 - Arrays and recursion - Part 4 : Merge function](#)

[Lecture 78 - Arrays and recursion - Part 5 : Mergesort conclusion](#)

[Lecture 79 - Structures - Part 1 : Definition and instantiation](#)

[Lecture 80 - Structures - Part 2 : Operations on structures](#)

[Lecture 81 - Structures - Part 3 : An example program](#)

[Lecture 82 - Structures - Part 4 : Pointers and lecture conclusion](#)

[Lecture 83 - Structures Part 2 - Part 1 : Introduction to Member functions](#)

[Lecture 84 - Structures Part 2 - Part 2 : Vectors from Physics](#)

[Lecture 85 - Structures Part 2 - Part 3 : Taxi dispatch](#)

[Lecture 86 - Classes - Part 1 : Introduction](#)

[Lecture 87 - Classes - Part 2 : Constructors](#)

[Lecture 88 - Classes - Part 3 : Operator overloading](#)

[Lecture 89 - Classes - Part 4 : Access control](#)

[Lecture 90 - Classes - Part 5 : Classes for graphics and input output](#)

[Lecture 91 - Classes - Part 6 : General remarks](#)

[Lecture 92 - Representing variable length entities - Part 1 : Introduction](#)

[Lecture 93 - Representing variable length entities - Part 2 : Heap memory basics](#)

[Lecture 94 - Representing variable length entities - Part 3 : Pitfalls of using heap memory](#)

[Lecture 95 - Representing variable length entities - Part 4 : Automating memory management](#)

[Lecture 96 - Representing variable length entities - Part 5 : Implementing a class with automated memory management - 1](#)

[Lecture 97 - Representing variable length entities - Part 6 : Implementing a class with automated memory management - 2](#)

[Lecture 98 - Representing variable length entities - Part 7 : Using the implemented class and conclusion](#)

[Lecture 99 - The Standard Library - Part 1 : Class string](#)

[Lecture 100 - The Standard Library - Part 2 : Class vector](#)

[Lecture 101 - The Standard Library - Part 3 : Sorting vectors and arrays](#)

[Lecture 102 - The Standard Library - Part 4 : Classes map and unordered_map](#)

[Lecture 103 - The Standard Library - Part 5 : Iterators](#)

[Lecture 104 - Data structure based programming - Part 1 : Introduction](#)

[Lecture 105 - Data structure based programming - Part 2 : Set and pair classes](#)

[Lecture 106 - Data structure based programming - Part 3 : Implementation of standard library data structures](#)

[Lecture 107 - Data structure based programming - Part 4 : Composing data structures](#)

[Lecture 108 - Data structure based programming - Part 5 : typedef and lecture conclusion](#)

[Lecture 109 - Medium size programs - Part 1 : The new marks display program](#)

[Lecture 110 - Medium size programs - Part 2 : Manual algorithm for new marks display](#)

[Lecture 111 - Medium size programs - Part 3 : RSMTAB and rest of the program](#)

[Lecture 112 - Medium size programs - Part 4 : Sophisticated solutions to marks display](#)

[Lecture 113 - A graphical editor and solver for circuits - Part 1 : Outline](#)

[Lecture 114 - A graphical editor and solver for circuits - Part 2 : Main program and organization](#)

[Lecture 115 - A graphical editor and solver for circuits - Part 3 : Mathematical representation of the circuit](#)

[Lecture 116 - A graphical editor and solver for circuits - Part 4 : Extensions and concluding remarks](#)

[Lecture 117 - Cosmological simulation - Part 1 : Introduction and First order Euler method](#)

[Lecture 118 - Cosmological simulation - Part 2 : Second order Euler method](#)

[Lecture 119 - Cosmological simulation - Part 3 : The program](#)

[Lecture 120 - Cosmological simulation - Part 4 : Concluding remarks](#)

Lecture 1 - Introduction

Lecture 2 - Analogy for CEO's Problem

Lecture 3 - Discussing the CEO's Problem

Lecture 4 - From the CEO's Company to Layers in a Network

Lecture 5 - Layers in Detail

Lecture 6 - Layered Nature of a Network

Lecture 7 - Introduction to Internet Data Capturing using Wireshark

Lecture 8 - Network data captured while requesting a website

Lecture 9 - What is Cisco Packet Tracer

Lecture 10 - Modes of Cisco Packet Tracer

Lecture 11 - Getting Cisco Packet Tracer

Lecture 12 - Logical and Physical Typologies in Cisco Packet Tracer

Lecture 13 - Devices on Cisco Packet Tracer

Lecture 14 - Introduction to the Cisco Packet Tracer Activity for Week 1

Lecture 15 - Introduction to the campus network on Cisco Packet Tracer

Lecture 16 - Loading the page in Simulation Mode

Lecture 17 - Inspecting the packets in Simulation Mode

Lecture 18 - Editing the dummy website on Cisco Packet Tracer

Lecture 19 - Summary of the Cisco Packet Tracer Activity

Lecture 20 - Introduction to Anupam's Adventure

Lecture 21 - Anupam's adventure brings us to IP Addressing

Lecture 22 - Addressing at various layers

Lecture 23 - IP Addresses

Lecture 24 - Address Translation

Lecture 25 - Introduction to IP Addressing

Lecture 26 - Creating a network with Sub-net mask

Lecture 27 - Nomenclature of a sub-net mask

Lecture 28 - Network addresses and Private networks

Lecture 29 - Introduction to the Addressing Topology

Lecture 30 - Addressing a local network and DHCP

Lecture 31 - Addressing a local network manually

Lecture 32 - Addressing in Public and Private Networks

Lecture 33 - Verifying Connectivity using Ping

Lecture 34 - Using network address translation to communicate on internet

Lecture 35 - Using Sub nets and Summary of addressing

Lecture 36 - Summary of the week

Lecture 37 - Analogy for the week 2

Lecture 38 - Discussion on dabbawala analogy

Lecture 39 - From dabbawalas to routers and switches

Lecture 40 - What is routing ?

Lecture 41 - Static routing in a router in CPT

Lecture 42 - How does a switch forwards packets CPT

Lecture 43 - How to add static route in a router? (CPT)

Lecture 44 - Traveler's dilemma

Lecture 45 - Discussing the Traveler's dilemma

Lecture 46 - From Traveler's dilemma to Dynamic Routing

Lecture 47 - Dynamic Routing with Distance Vector

Lecture 48 - Distance Vector Routing in Detail

Lecture 49 - Dynamic Routing with Link State

Lecture 50 - Setting up dynamic routing in Packet Tracer

Lecture 51 - Summary of the week

Lecture 52 - Introduction to analogy for week 3

Lecture 53 - Analogy for week 3

Lecture 54 - Questions on analogy for week 3

Lecture 55 - Understanding the new order requirements

Lecture 56 - Introduction to Transport Layer

Lecture 57 - Introduction to TCP

Lecture 58 - Introduction to UDP

Lecture 59 - Exploring UDP on Cisco Packet Tracer

Lecture 60 - TCP Connection Establishment

Lecture 61 - TCP Connection Closure

Lecture 62 - Summary of TCP and UDP on Cisco Packet Tracer

Lecture 63 - The story of the delivery fiasco

Lecture 64 - From delivery fiasco to Port Numbers

- Lecture 65 - Application Layer in depth
- Lecture 66 - Port number in Wireshark
- Lecture 67 - Summary of port number and PAT
- Lecture 68 - Summary of the entire TCP IP stack
- Lecture 69 - Introducing the analogy for week 4
- Lecture 70 - The secret box
- Lecture 71 - Questions on analogy for week 4
- Lecture 72 - Secret of the secret box
- Lecture 73 - From secret box to encryption
- Lecture 74 - Introduction to security and CIA
- Lecture 75 - Information Security and Defence in Depth
- Lecture 76 - Information Classification and Access Control
- Lecture 77 - Process Management
- Lecture 78 - Introduction to Network Security
- Lecture 79 - Network Breach and Countermeasures
- Lecture 80 - Internet Security
- Lecture 81 - Securing the Internet Usage
- Lecture 82 - Internet Security Products
- Lecture 83 - Personal Computing Device Recommendations
- Lecture 84 - Responsible Behavior on the Internet
- Lecture 85 - Best practices for home Network and Media Devices
- Lecture 86 - Closing thoughts on security
- Lecture 87 - The story of a family trip
- Lecture 88 - The troubleshooting approach
- Lecture 89 - Troubleshooting Physical and Data Link Layers
- Lecture 90 - Troubleshooting Network Layer
- Lecture 91 - Troubleshooting Transport and Application Layers
- Lecture 92 - Troubleshooting Summary
- Lecture 93 - Troubleshooting Heuristics
- Lecture 94 - Troubleshooting Challenge - 1
- Lecture 95 - Troubleshooting challenge - 2
- Lecture 96 - Troubleshooting Challenge - 3
- Lecture 97 - Thats How we Troubleshoot

[Lecture 98 - Week Summary](#)

[Lecture 99 - Course Closure](#)

[Lecture 100 - Course Credits](#)

Lecture 1 - Intro to Data Analytics. What is Learning Analytics?

Lecture 2 - Academic Analytics, and Educational Data Mining

Lecture 3 - Four Levels of Analytics

Lecture 4 - Four Levels of Learning Analytics Overview - II

Lecture 5 - Data Collection from Different learning environment

Lecture 6 - Data collection in TELE

Lecture 7 - Data Preprocessing

Lecture 8 - Ethics in Learning Analytics, Student Privacy

Lecture 9 - Demo of Weka

Lecture 10 - Introduction to Machine Learning - Part 1

Lecture 11 - Introduction to Machine Learning - Part 2

Lecture 12 - Training and testing data

Lecture 13 - Performance Metrics - I

Lecture 14 - Performance Metrics - II

Lecture 15 - Performance Metrics - III

Lecture 16 - Demo of Orange

Lecture 17 - Descriptive Analytics - I

Lecture 18 - Descriptive Analytics - II

Lecture 19 - Charts - I

Lecture 20 - Charts - II

Lecture 21 - Charts - III

Lecture 22 - Comparing Charts

Lecture 23 - Descriptive Analytics “ Example I

Lecture 24 - Descriptive Analytics “ Example II

Lecture 25 - Excel tool

Lecture 26 - Diagnostics Analytics

Lecture 27 - Correlation

Lecture 28 - Correlation Matrix

Lecture 29 - Spearman’s Rank Correlation

Lecture 30 - Data Mining

Lecture 31 - iSAT

- [Lecture 32 - Diagnostic Analytics - SPM](#)
- [Lecture 33 - Sequential pattern mining \(SPM-II\)](#)
- [Lecture 34 - Differential Sequence Mining \(DSM\)](#)
- [Lecture 35 - Process Mining](#)
- [Lecture 36 - Diagnostic Analytics - Clustering](#)
- [Lecture 37 - K-means Clustering](#)
- [Lecture 38 - Hierarchical Clustering](#)
- [Lecture 39 - Clustering - Examples](#)
- [Lecture 40 - Predictive Analytics](#)
- [Lecture 41 - Linear Regression](#)
- [Lecture 42 - Multiple Regression](#)
- [Lecture 43 - Logistic Regression](#)
- [Lecture 44 - Linear Regression - Example](#)
- [Lecture 45 - Predictive Analytics - II](#)
- [Lecture 46 - Naive Bayes Classifier](#)
- [Lecture 47 - Decision Tree](#)
- [Lecture 48 - Decision Tree Classifier](#)
- [Lecture 49 - DT, NB - Examples](#)
- [Lecture 50 - Text Analytics](#)
- [Lecture 51 - Introduction to NLP](#)
- [Lecture 52 - NLP-II](#)
- [Lecture 53 - NLP-Tools](#)
- [Lecture 54 - NLP-Examples](#)
- [Lecture 55 - Intro Multimodal Learning Analytics](#)
- [Lecture 56 - Affective Computing - 1](#)
- [Lecture 57 - Affective Computing - 2](#)
- [Lecture 58 - Eye Tracking](#)
- [Lecture 59 - Revision of Learning Analytics tools course](#)
- [Lecture 60 - Source of Data collection and Research Community](#)
- [Lecture 61 - Machine Learning tools used in industry](#)

Lecture 1 - Introduction to Computer Systems

Lecture 2 - Principles of Computer Systems Design

Lecture 3 - Overview of CPU hardware

Lecture 4 - Overview of memory and I/O hardware

Lecture 5 - Introduction to Operating Systems

Lecture 6 - Week 1: Tutorial 1

Lecture 7 - Week 1: Tutorial 2

Lecture 8 - Processes

Lecture 9 - Kernel mode execution

Lecture 10 - Threads

Lecture 11 - CPU scheduling policies

Lecture 12 - Virtual machines and containers

Lecture 13 - Week 2: Tutorial 1

Lecture 14 - Week 2: Tutorial 2

Lecture 15 - Week 2: Tutorial 3

Lecture 16 - Memory management in OS

Lecture 17 - Paging

Lecture 18 - Demand paging

Lecture 19 - File system and memory

Lecture 20 - Optimizing memory access

Lecture 21 - Week 3: Tutorial 1

Lecture 22 - Week 3: Tutorial 2

Lecture 23 - Week 3: Tutorial 3

Lecture 24 - Filesystem Datastructures

Lecture 25 - Filesystem Implementation

Lecture 26 - Network I/O via Sockets

Lecture 27 - Network I/O Implementation

Lecture 28 - Memory and I/O virtualization

Lecture 29 - Week 4: Tutorial 1

Lecture 30 - Week 4: Tutorial 2

Lecture 31 - Introduction to computer networking

[Lecture 32 - Internet Routing and Forwarding](#)

[Lecture 33 - Transport protocols](#)

[Lecture 34 - Application layer protocols](#)

[Lecture 35 - Network Security](#)

[Lecture 36 - Week 5: Tutorial 1](#)

[Lecture 37 - Week 5: Tutorial 2](#)

[Lecture 38 - Multithreaded application design](#)

[Lecture 39 - Inter-process communication](#)

[Lecture 40 - Multi-tier application design](#)

[Lecture 41 - Examples of end-to-end systems design](#)

[Lecture 42 - Deployment of computer systems](#)

[Lecture 43 - Week 6: Tutorial 1](#)

[Lecture 44 - Week 6: Tutorial 2](#)

[Lecture 45 - Performance measurement](#)

[Lecture 46 - Performance analysis](#)

[Lecture 47 - Performance profiling and optimization](#)

[Lecture 48 - Caching](#)

[Lecture 49 - Performance scalability](#)

[Lecture 50 - Week 7: Tutorial 1](#)

[Lecture 51 - Fault tolerance and reliability](#)

[Lecture 52 - Replication and consistency](#)

[Lecture 53 - Atomicity](#)

[Lecture 54 - Distributed transactions](#)

[Lecture 55 - Case studies of distributed systems design](#)

[Lecture 1](#)

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Lecture 1 - Introduction: Game Theory

Lecture 2 - Introduction: Mechanism Design

Lecture 3 - The game of chess

Lecture 4 - Proof of the chess theorem

Lecture 5 - Normal form games

Lecture 6 - Dominance

Lecture 7 - Nash equilibrium

Lecture 8 - Maxmin strategies

Lecture 9 - Elimination of dominated strategies

Lecture 10 - Preservation of PSNE

Lecture 11 - Matrix games

Lecture 12 - Relation between Maxmin and PSNE in matrix

Lecture 13 - Mixed strategies

Lecture 14 - Mixed strategy Nash equilibrium (MSNE)

Lecture 15 - Find MSNE

Lecture 16 - MSNE characterization theorem proof

Lecture 17 - Algorithm to find MSNE

Lecture 18 - Correlated equilibrium (CE)

Lecture 19 - Computing correlated equilibrium

Lecture 20 - Extensive form games

Lecture 21 - Subgame perfection

Lecture 22 - Limitations of SPNE

Lecture 23 - Imperfect Information Extensive Form Games (IIEFG)

Lecture 24 - Strategies in IIEFGs

Lecture 25 - Equivalence of Strategies in IIEFGs

Lecture 26 - Perfect Recall

Lecture 27 - Equilibrium in IIEFG

Lecture 28 - Game Theory in Practice: P2P file sharing

Lecture 29 - Bayesian Games

Lecture 30 - Strategy, Utility in Bayesian Games

Lecture 31 - Equilibrium in Bayesian Games

[Lecture 32 - Examples of Bayesian Equilibrium](#)

[Lecture 33 - Introduction to Mechanism Design](#)

[Lecture 34 - Revelation Principle](#)

[Lecture 35 - Introduction to Arrow's Impossibility Result](#)

[Lecture 36 - Proof of Arrow's Result](#)

[Lecture 37 - Introduction to the Social Choice Setup](#)

[Lecture 38 - Introduction to Gibbard-Satterthwaite Theorem](#)

[Lecture 39 - Proof of Gibbard-Satterthwaite Theorem](#)

[Lecture 40 - Domain Restriction](#)

[Lecture 41 - Median Voting Rule](#)

[Lecture 42 - Median Voter Theorem - Part 1](#)

[Lecture 43 - Median Voter Theorem - Part 2](#)

[Lecture 44 - The Task Sharing Domain](#)

[Lecture 45 - The Uniform Rule](#)

[Lecture 46 - Mechanism Design with Transfers](#)

[Lecture 47 - Examples of Quasi-linear Preferences](#)

[Lecture 48 - Pareto Optimality and Groves Payments](#)

[Lecture 49 - Introduction to VCG Mechanism](#)

[Lecture 50 - VCG in Combinatorial Allocations](#)

[Lecture 51 - Applications to Internet Advertising](#)

[Lecture 52 - Slot Allocation and Payments in Position](#)

[Lecture 53 - Pros and Cons of VCG Mechanism](#)

[Lecture 54 - Affine Maximizers](#)

[Lecture 55 - Single Object Allocation](#)

[Lecture 56 - Myerson's Lemma](#)

[Lecture 57 - Illustration of Myerson's Lemma](#)

[Lecture 58 - Optimal Mechanism Design](#)

[Lecture 59 - Single Agent Optimal Mechanism Design](#)

[Lecture 60 - Multiple Agent Optimal Mechanism Design](#)

[Lecture 61 - Examples of Optimal Mechanisms](#)

[Lecture 62 - Endnotes and Summary](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Introduction to Computer and Network Performance Analysis using Queuing Systems (Computer Science and Engineering)

Co-ordinators : Prof. Varsha Apte

- Lecture 1 - Introduction, why do delays happen, contention for resources
- Lecture 2 - Performance metrics and parameters
- Lecture 3 - Introducing Queuing Systems
- Lecture 4 - Memoryless Distributions
- Lecture 5 - Operational Laws
- Lecture 6 - Asymptotic Analysis of G/G/1, G/G/1/K queues
- Lecture 7 - Asymptotic Analysis of G/G/c/K queues
- Lecture 8 - Little's Law
- Lecture 9 - Little's Law examples and A Case Study of Open Load test on a Web server
- Lecture 10 - Some results for M/G/1 queue and Memoryless Arrivals
- Lecture 11 - Continuing the Case Study of Open Load test on a web server (Response Time)
- Lecture 12 - Open queuing networks - tandem queuing network
- Lecture 13 - Open queuing networks - general (Jackson) queuing networks
- Lecture 14 - Open queuing networks - examples
- Lecture 15 - Closed Queuing Systems
- Lecture 16 - Closed Queuing System (Continued...)
- Lecture 17 - Case study of Closed Load Test on a Web Server
- Lecture 18 - General formulation of Jacksonian Closed Queuing Networks
- Lecture 19 - Mean Value Analysis for Closed Queuing Networks
- Lecture 20 - Mean Value Analysis examples, Case Study of a Load test on a web server, Closing Remarks

- Lecture 1 - Introduction, why do delays happen, contention for resources
- Lecture 2 - Performance metrics and parameters
- Lecture 3 - Introducing Queuing Systems
- Lecture 4 - Memoryless Distributions
- Lecture 5 - Operational Laws
- Lecture 6 - Aumann model of incomplete information: Definition and Examples
- Lecture 7 - Knowledge operator: Definition and Examples
- Lecture 8 - Common knowledge: Definition and Examples
- Lecture 9 - The structural theorem of common knowledge
- Lecture 10 - Proof of the structural theorem (forward direction)
- Lecture 11 - Proof of the structural theorem (backward direction)
- Lecture 12 - Aumann model of incomplete information with belief: Definition and Examples
- Lecture 13 - Aumann's agreement theorem
- Lecture 14 - Zero-sum game definition and Security strategies
- Lecture 15 - Saddle point strategies
- Lecture 16 - Further properties of saddle point strategies
- Lecture 17 - Mixed strategies
- Lecture 18 - Weirstrass lemma and existence of a mixed saddle point strategy
- Lecture 19 - Von Nuenmann minmax theorem
- Lecture 20 - Computing mixed saddle point startegy: Holmes and Moriarty
- Lecture 21 - Computing mixed strategy saddle point: 2X2 matrix game
- Lecture 22 - Computing mixed strategy saddle point: 2X3 matrix game
- Lecture 23 - Nash equilibrium of a non zero-sum game and its relation with Kakutani fixed
- Lecture 24 - Proof: Existence of Nash equilibrium (Condition 1 of Kakutani fixed point)
- Lecture 25 - Proof: Existence of Nash equilibrium (Condition 2 of Kakutani fixed point)
- Lecture 26 - Existence of Nash equilibrium for infinite strategy space (Using Brower's)
- Lecture 27 - Quantal Response: Motivation
- Lecture 28 - Quantal Response: Formal model
- Lecture 29 - Dynamic games definiton
- Lecture 30 - Solution concept in dynamic games
- Lecture 31 - Relation of the heuristic solution with the Nash equilibrium of the standard

- Lecture 32 - Example of a Threat equilibrium
- Lecture 33 - Interpreting the threat equilibrium in standard normal form of the dynamic game
- Lecture 34 - Extensive form games - I
- Lecture 35 - Extensive form games - II
- Lecture 36 - Single Act Games
- Lecture 37 - Informationally inferior games
- Lecture 38 - Information Structure in Single Act Games
- Lecture 39 - Nested and Ladder Nested Extensive form games
- Lecture 40 - Equilibrium Algorithm
- Lecture 41 - Stage-wise multi act games
- Lecture 42 - Feedback equilibrium
- Lecture 43 - Mixed and Behavioral Strategies
- Lecture 44 - Conditions for equivalence for mixed and behavioral strategies
- Lecture 45 - Kuhn's Theorem - I
- Lecture 46 - Kuhn's Theorem - II
- Lecture 47 - Kuhn's Theorem - III
- Lecture 48 - Games of incomplete information
- Lecture 49 - Bayesian Nash equilibrium - I
- Lecture 50 - Bayesian Nash equilibrium - II
- Lecture 51 - Self-enforcement of Nash equilibrium
- Lecture 52 - Stackelberg game
- Lecture 53 - Principal-Agent Models - I
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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Embedded Systems-Design Verification and Test (Computer Science and Engineering)

Co-ordinators : Prof.Jatindra Kumar Deka, Dr. Santosh Biswas, Prof.Arnab Sarkar

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Artificial Intelligence (Prof. Anupam Basu) (Computer Science and Engineering)

Co-ordinators : Prof. Sudeshna Sarkar, Prof. Anupam Basu

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Problem Solving through Programming in C (Computer Science and Engineering)

Co-ordinators : Prof.Arnab sarkar, Prof.Jatindra Kumar Deka, Dr. Santosh Biswas

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[Lecture 49 - Equivalence Class Testing - II](#)

[Lecture 50 - Special Value Testing](#)

[Lecture 51 - Combinatorial Testing](#)

[Lecture 52 - Decision Table Testing](#)

[Lecture 53 - Cause effect graphing](#)

[Lecture 54 - Pairwise Testing](#)

[Lecture 55 - White box Testing](#)

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[Lecture 58 - MC/DC Testing](#)

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NPTEL : NOC:Computer Networks and Internet Protocol (Computer Science and Engineering)

Co-ordinators : Prof. Sandip Chakraborty, Prof. Soumya Kanti Ghosh

- Lecture 1 - Introduction to Computer Networks - A brief history
- Lecture 2 - Data Networks - from Circuit Switching Network to Packet Switching Network
- Lecture 3 - Network Protocol Stack
- Lecture 4 - Services at the Different Layers of the Protocol Stack
- Lecture 5 - Application Layer I - Different Protocols at the Application Layer
- Lecture 6 - Application Layer II - Domain Name Systems
- Lecture 7 - Application Layer III - The Web
- Lecture 8 - Application Layer III - Hypertext Transfer Protocol
- Lecture 9 - Application Layer III - Internet Mail Transfer
- Lecture 10 - Application Layer IV - File Transfer (FTP)
- Lecture 11 - Transport Layer I - Services
- Lecture 12 - Transport Layer II - Connection
- Lecture 13 - Transport Layer II - Connection (Continued...)
- Lecture 14 - Transport Layer IV - Reliability
- Lecture 15 - Transport Layer V - Sliding Window Protocols
- Lecture 16 - Transport Layer Performance
- Lecture 17 - Buffer Management and Congestion Control
- Lecture 18 - Transport Layer Primitives
- Lecture 19 - Transmission Control Protocol I - Basics
- Lecture 20 - Transmission Control Protocol II - Connections
- Lecture 21 - Transmission Control Protocol III - Flow Control
- Lecture 22 - Transmission Control Protocol IV - Congestion Control
- Lecture 23 - User Datagram Protocol
- Lecture 24 - Socket Programming - I
- Lecture 25 - Socket Programming - II
- Lecture 26 - Network Layer I - Introduction
- Lecture 27 - IP Addressing (IPv4) I - Classful addressing
- Lecture 28 - IP Addressing (IPv4) II - CIDR
- Lecture 29 - IP Addressing (IPv4) III - Network Address Translation (NAT)
- Lecture 30 - IPv6 Addressing
- Lecture 31 - Internet QoS - I (What is QoS)

- [Lecture 32 - Internet QoS - II \(Basic QoS Architecture\)](#)
- [Lecture 33 - Internet QoS - III \(Traffic Policing and Traffic Shaping\)](#)
- [Lecture 34 - Internet QoS - IV \(Traffic Scheduling\)](#)
- [Lecture 35 - Internet QoS - V \(Integrated and Differentiated Service Architecture\)](#)
- [Lecture 36 - IP Routing Table](#)
- [Lecture 37 - Routing in the Internet I - Intra-domain routing](#)
- [Lecture 38 - Routing in the Internet II - Routing protocols](#)
- [Lecture 39 - Routing in the Internet III - Inter-domain Routing](#)
- [Lecture 40 - Routing in the Internet IV - Border Gateway Protocol](#)
- [Lecture 41 - IP Routers](#)
- [Lecture 42 - IP Routers Demo](#)
- [Lecture 43 - Software Defined Networking - I \(Basics\)](#)
- [Lecture 44 - Software Defined Networking - II \(Open Flow\)](#)
- [Lecture 45 - Software Defined Networking - III \(Demo\)](#)
- [Lecture 46 - Data Link Layer - Overview](#)
- [Lecture 47 - Data Link Layer - Basic Concepts](#)
- [Lecture 48 - Data Link Layer - Ethernet](#)
- [Lecture 49 - Data Link Layer - Ethernet \(Continued...\)](#)
- [Lecture 50 - Data Link Layer - Flow and Error Control](#)
- [Lecture 51 - ARP-RAPP-BOOTP-DHCP](#)
- [Lecture 52 - ARP-RAPP-BOOTP-DHCP \(Continued...\)](#)
- [Lecture 53](#)
- [Lecture 54 - Wireless LANs](#)
- [Lecture 55 - Layer 1: Physical Layer](#)
- [Lecture 56 - Layer 1: Physical Layer - II](#)
- [Lecture 57 - Layer 1: Physical Layer - III](#)
- [Lecture 58 - Network Security - Overview](#)
- [Lecture 59 - Network Security - II](#)
- [Lecture 60 - Network Security - III \[TCP/IP Security\]](#)

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NPTEL : NOC:Blockchain Architecture Design and Use Cases (Computer Science and Engineering)

Co-ordinators : Praveen Jayachandran, Prof. Sandip Chakraborty

- Lecture 1 - Introduction to Blockchain - I (Basics)
- Lecture 2 - Introduction to Blockchain - II (History)
- Lecture 3 - Introduction to Blockchain - III (Architecture)
- Lecture 4 - Introduction to Blockchain - IV (Conceptualization)
- Lecture 5 - Basic Crypto Primitives - I
- Lecture 6 - Basic Crypto Primitives - II
- Lecture 7 - Bitcoin Basics - I
- Lecture 8 - Bitcoin Basics - II
- Lecture 9 - Bitcoin Basics - III
- Lecture 10 - Distributed Consensus
- Lecture 11 - Consensus in Bitcoin - I (The Basics)
- Lecture 12 - Consensus in Bitcoin - II (PoW and Beyond)
- Lecture 13 - Consensus in Bitcoin - III (The Miners)
- Lecture 14 - Permissioned Blockchain - I (Basics)
- Lecture 15 - Permissioned Blockchain - II (Consensus)
- Lecture 16 - Permissioned Blockchain - III (RAFT Consensus)
- Lecture 17 - Permissioned Blockchain - IV (Byzantine General Problem)
- Lecture 18 - Permissioned Blockchain - V (Practical Byzantine Fault Tolerance)
- Lecture 19 - Blockchain for Enterprise - Overview
- Lecture 20 - Blockchain Components and Concepts
- Lecture 21 - Hyperledger Fabric - Transaction Flow
- Lecture 22 - Hyperledger Fabric Details
- Lecture 23 - Fabric - Membership and Identity Management
- Lecture 24 - Hyperledger Fabric Network Setup
- Lecture 25 - Fabric Demo on IBM Blockchain Cloud - I
- Lecture 26 - Fabric Demo on IBM Blockchain Cloud - II
- Lecture 27 - Fabric Demo, deploy from scratch - III
- Lecture 28 - Hyperledger Composer - Application Development
- Lecture 29 - Hyperledger Composer - Network Administration
- Lecture 30 - Blockchain Use Cases
- Lecture 31 - Blockchain in Financial Service - I (Payments and Secure Trading)

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- Lecture 32 - Blockchain in Financial Service - II (Compliance and Mortgage)
- Lecture 33 - Blockchain in Financial Service - III (Financial Trade)
- Lecture 34 - Revolutionizing Global Trade
- Lecture 35 - Blockchain in Supply Chain - I
- Lecture 36 - Blockchain in Supply Chain - II
- Lecture 37 - Blockchain in Other Industries
- Lecture 38 - Blockchain in Government - I (Advantages)
- Lecture 39 - Blockchain in Government - II (Use Cases)
- Lecture 40 - Blockchain in Government - III (Digital Identity)
- Lecture 41 - Blockchain in Government - IV (Hyperledger Indy)
- Lecture 42 - Blockchain in Government - V (Tax Payments and Land Registry Records)
- Lecture 43 - Blockchain Security - I (Overview)
- Lecture 44 - Blockchain Security - II (Membership and Access control in Fabric)
- Lecture 45 - Blockchain Security - III (Privacy in Fabric)
- Lecture 46 - Blockchain Security - III (Fabric SideDB)
- Lecture 47 - Research Aspects - I (Consensus Scalability)
- Lecture 48 - Research Aspects - II (Bitcoin-NG)
- Lecture 49 - Research Aspects - III (Collective Signing)
- Lecture 50 - Research Aspects - IV (Byzcoin)
- Lecture 51 - Research Aspects - V (Algorand)
- Lecture 52 - Research Aspects - VI (Cross Fault Tolerance)
- Lecture 53 - Research Aspects - VII (Secured Multi-Party Computation)
- Lecture 54 - Blockchain for Science - I (Blockchain for Big Data)
- Lecture 55 - Blockchain for Science - II (Blockchain and AI)
- Lecture 56 - Comparing Ecosystems - Ethereum
- Lecture 57 - Comparing Ecosystems - Ethereum development tools and Quorum
- Lecture 58 - Comparing Ecosystems - Corda Part 1
- Lecture 59 - Comparing Ecosystems - Corda Part 2
- Lecture 60 - Concluding the course

Lecture 1 - Introduction

Lecture 2 - Octal and Hexadecimal Number Systems

Lecture 3 - Signed and Unsigned Binary Number Representation

Lecture 4 - Binary Addition and Subtraction

Lecture 5 - BCD and Gray Code Representations

Lecture 6 - Error Detection and Correction

Lecture 7 - Logic Gates

Lecture 8 - Logic Families to Implement Gates

Lecture 9 - Emerging Technologies - Part I

Lecture 10 - Emerging Technologies - Part II

Lecture 11 - Switching Algebra

Lecture 12 - Algebraic Manipulation

Lecture 13 - Properties of Switching Functions

Lecture 14 - Obtaining Canonical Representations of Functions

Lecture 15 - Functional Completeness

Lecture 16 - Minimization Using Karnaugh Maps - Part I

Lecture 17 - Minimization Using Karnaugh Maps - Part II

Lecture 18 - Minimization Using Karnaugh Maps - Part III

Lecture 19 - Minimization using Tabular Method - Part I

Lecture 20 - Minimization using Tabular Method - Part II

Lecture 21 - Design of Adders - Part I

Lecture 22 - Design of Adders - Part II

Lecture 23 - Design of Adders - Part III

Lecture 24 - Logic Design - Part I

Lecture 25 - Logic Design - Part II

Lecture 26 - Logic Design - Part III

Lecture 27 - Binary Decision Diagrams - Part I

Lecture 28 - Binary Decision Diagrams - Part II

Lecture 29 - Logic Design using AND-EXOR Network

Lecture 30 - Threshold Logic and Threshold Gates

Lecture 31 - Latches and Flip-Flops - Part I

- Lecture 32 - Latches and Flip-Flops - Part II
- Lecture 33 - Latches and Flip-Flops - Part III
- Lecture 34 - Clocking and Timing - Part I
- Lecture 35 - Clocking and Timing - Part II
- Lecture 36 - Synthesis of Synchronous Sequential Circuits - Part I
- Lecture 37 - Synthesis of Synchronous Sequential Circuits - Part II
- Lecture 38 - Synthesis of Synchronous Sequential Circuits - Part III
- Lecture 39 - Synthesis of Synchronous Sequential Circuits - Part IV
- Lecture 40 - Minimization of Finite State Machines - Part I
- Lecture 41 - Minimization of Finite State Machines - Part II
- Lecture 42 - Design of Registers - Part I
- Lecture 43 - Design of Registers - Part II
- Lecture 44 - Design of Registers - Part III
- Lecture 45 - Design of Counters - Part I
- Lecture 46 - Design of Counters - Part II
- Lecture 47 - Digital-to-Analog Converter - Part I
- Lecture 48 - Digital-to-Analog Converter - Part II
- Lecture 49 - Analog-to-Digital Converter - Part I
- Lecture 50 - Analog-to-Digital Converter - Part II
- Lecture 51 - Analog-to-Digital Converter - Part III
- Lecture 52 - Asynchronous Sequential Circuits - Part I
- Lecture 53 - Asynchronous Sequential Circuits - Part II
- Lecture 54 - Algorithmic State Machine (ASM Chart
- Lecture 55 - Testing of Digital Circuits
- Lecture 56 - Fault Modeling
- Lecture 57 - Test Pattern Generation
- Lecture 58 - Design for Testability
- Lecture 59 - Built-in Self-Test - Part I
- Lecture 60 - Built-in Self-Test - Part II

Lecture 1 - Background: Introduction

Lecture 2 - Probability: Concentration inequalities

Lecture 3 - Linear algebra: PCA, SVD

Lecture 4 - Optimization: Basics, Convex, GD

Lecture 5 - Machine Learning: Supervised, generalization, feature learning, clustering.

Lecture 6 - Memory-efficient data structures: Hash functions, universal / perfect hash families

Lecture 7 - Bloom filters

Lecture 8 - Sketches for distinct count

Lecture 9 - Sketches for distinct count (Continued...)

Lecture 10 - Misra-Gries sketch

Lecture 11 - Frequent Element: Space Saving and Count Min

Lecture 12 - Frequent Element: Count Sketch

Lecture 13 - Near Neighbors

Lecture 14 - Locality Sensitive Hashing

Lecture 15 - Building LSH Tables

Lecture 16 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants

Lecture 17 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants (Continued...)

Lecture 18 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants (Continued...)

Lecture 19 - Randomized Numerical Linear Algebra: Random projection

Lecture 20 - Randomized Numerical Linear Algebra: Random projection (Continued...)

Lecture 21 - Randomized Numerical Linear Algebra: a) Matrix multiplication + QB decomposition

Lecture 22 - Randomized Numerical Linear Algebra: b) CUR+CX

Lecture 23 - Randomized Numerical Linear Algebra: a) L2 regression using RP

Lecture 24 - Randomized Numerical Linear Algebra: b) Leverage scores

Lecture 25 - Randomized Numerical Linear Algebra: c) Hash Kernels + Kitchen Sink

Lecture 26 - Map-reduce and Hadoop

Lecture 27 - Hadoop System

Lecture 28 - Hadoop System (Continued...)

Lecture 29 - Hadoop System (Continued...)

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Lecture 31 - Spark (Continued...)

[Lecture 32 - Spark \(Continued...\)](#)

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[Lecture 36 - Distributed Machine Learning and Optimization:ADMM + applications](#)

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[Lecture 39 - Clustering \(Continued...\)](#)

[Lecture 40 - Conclusion](#)

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[Lecture 5 - Introduction \(Continued...\)](#)

[Lecture 6 - Introduction \(Continued...\)](#)

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[Lecture 8 - Lexical Analysis \(Continued...\)](#)

[Lecture 9 - Lexical Analysis \(Continued...\)](#)

[Lecture 10 - Lexical Analysis \(Continued...\)](#)

[Lecture 11 - Lexical Analysis \(Continued...\)](#)

[Lecture 12 - Lexical Analysis \(Continued...\)](#)

[Lecture 13 - Lexical Analysis \(Continued...\)](#)

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[Lecture 18 - Parser \(Continued...\)](#)

[Lecture 19 - Parser \(Continued...\)](#)

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- [Lecture 33 - Edge-Triggered Flip-Flop](#)
- [Lecture 34 - Representations of Flip-Flops](#)
- [Lecture 35 - Analysis of Sequential Logic Circuit](#)
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- [Lecture 37 - Register and Shift Register: PIPO and SISO](#)
- [Lecture 38 - Shift Register: SIPO, PISO and Universal Shift Register](#)
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- [Lecture 40 - Linear Feedback Shift Register](#)
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Lecture 3 - Java Tools and Resources

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Lecture 5 - Java Applet Programming

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Lecture 7 - Encapsulation

Lecture 8 - Demonstration - III

Lecture 9 - Java Programming Insights

Lecture 10 - Demonstration - IV

Lecture 11 - Java Static Scope Rule

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- Lecture 2 - Design Considerations of Embedded Systems
- Lecture 3 - Microprocessors and Microcontrollers
- Lecture 4 - Architecture of ARM Microcontroller - Part 1
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- Lecture 7 - ARM Instruction Set - Part 1
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- Lecture 10 - About the STM32F401 Nucleo Board
- Lecture 11 - PWM and Interrupt on STM32F401
- Lecture 12 - Digital to Analog Conversion
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- Lecture 15 - Output Devices, Sensors and Actuators - Part 1
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- Lecture 18 - Microcontroller Development Boards
- Lecture 19 - Mbed C Programming Environment
- Lecture 20 - Interfacing With STM32F401 Board
- Lecture 21 - Interfacing With Arduino Uno
- Lecture 22 - Interfacing 7-Segment Led And LCD Displays - Part 1
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- Lecture 24 - Serial Port Terminal Application (Coolterm)
- Lecture 25 - Experiment With Temperature Sensor
- Lecture 26 - Experiment With Ldr Light Sensor - Part 1
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- Lecture 28 - Experiment With Speaker
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Lecture 4 - Finite Field Architectures - 1

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Lecture 8 - Background on Cryptography, Cryptanalysis and Advanced Encryption Standard (AES)

Lecture 9 - Advanced Encryption Standard (AES) and Side Channel Analysis

Lecture 10 - Field Isomorphisms

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Google Cloud Computing Foundation Course (Computer Science and Engineering)

Co-ordinators : Prof. Soumya Kanti Ghosh

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Introduction to Human Computer Interaction (Computer Science and Engineering)

Co-ordinators : Prof. Ponnurangam Kumaraguru

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NPTEL : NOC:Machine Learning for Engineering and Science Applications (Computer Science and Engineering)

Co-ordinators : Prof. Ganapathy, Prof. Balaji Srinivasan

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Co-ordinators : Prof. Henrik Bostrom, Prof. Fredrik Kilander, Prof. Carl Gustaf Jansson

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Applied Accelerated Artificial Intelligence (Computer Science and Engineering)

Co-ordinators : Prof. Satyadhyan Chickerur, Prof. Bharatkumar Sharma, Prof. Adesuyi Tosin, Prof. Satyajit Das

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Lecture 9 - Fundamentals of Digital Modulation

Lecture 10 - Linear Modulation Methods: Amplitude Shift Keying (ASK)

Lecture 11 - Linear Modulation Methods: Phase Shift Keying (PSK)

Lecture 12 - Linear Modulation Methods: Quadrature Amplitude Modulation (QAM) and Frequency Shift Keying (FSK)

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Lecture 14 - ASK using Raised Cosine (RC) and Root-Raised Cosine (RRC) Pulse Shaping

Lecture 15 - Basics of Detection: Properties of Gaussian Random Variables

Lecture 16 - Basics of Detection: Gaussian Random Vectors and Hypothesis Testing

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- Lecture 6 - 2nd Order Circuits:Magnetically Coupled Circuits
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- Lecture 11 - Amplitude and Phase of Network Functions
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NPTEL : Advanced Electric Drives (Electrical Engineering)

Co-ordinators : Dr. S.P. Das

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Lecture 3 - Vector analysis-I and Introduction to coordinate system

Lecture 4 - Rectangular coordinate system

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Lecture 10 - Electric Potential-I

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Lecture 21 - Polarization - II (Continued...)

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Lecture 23 - Continuity equation and Conductors - III

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- Lecture 33 - Introduction of magnetic field
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- Lecture 38 - Magnetic force, torque and dipole (Continued...)
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- Lecture 40 - Magnetic materials-I (Continued...) and Magnetic moment
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- Lecture 43 - Inductor and calculation of inductance for different shapes (Continued...)
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- Lecture 54 - Skin depth/effect
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- Lecture 56 - Oblique incidence of waves (Continued...)
- Lecture 57 - Transmission line
- Lecture 58 - Transmission line model
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- [Lecture 77 - Dielectric Waveguide \(Continued...\)](#)
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Lecture 2 - Frequency Domain Representation and Introduction to Discrete Fourier Series

Lecture 3 - Discrete Fourier Series Example and Parseval's Theorem for Periodic Signals

Lecture 4 - Fourier Transform (FT), Inverse Fourier Transform (IFT) of Continuous Signals, Example of FT of Pulse and Sinc Function

Lecture 5 - Modulation Property of Fourier Transform, Dirac Delta or Unit Impulse Function - Definition and Fourier Transform

Lecture 6 - Duality Property of Fourier Transform and Introduction to Linear Time Invariant (LTI) Systems

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Lecture 11 - Spectrum of Amplitude Modulated(AM) Signals and Introduction to Envelope Detection

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Lecture 14 - Double Sideband (DSB) Suppressed Carrier (SC) Modulation, Spectrum of DSB-SC Signals and Coherent Demodulation

Lecture 15 - Double Sideband(DSB) Suppressed Carrier (SC) Demodulation, Non-coherent demodulation, Impact of Carrier Phase Offset

Lecture 16 - Carrier Phase Offset Example for Double Sideband (DSB) Suppressed Carrier (SC) Demodulation- Wireless Cellular Communication with User Mobility

Lecture 17 - Phase Synchronization using Costas Receiver for Double Sideband (DSB) Suppressed Carrier (SC) Demodulation

Lecture 18 - Introduction to Quadrature Carrier Multiplexing (QCM) and Demodulation of QCM Signals.

Lecture 19 - Introduction to Single Sideband (SSB) Modulation

Lecture 20 - Generation of Single Sideband (SSB) Modulation Signals through Frequency Discrimination

Lecture 21 - Frequency Domain Description of Hilbert Transform \hat{A} – Fourier Spectrum of the Hilbert Transformer

Lecture 22 - Time Domain Description of Hilbert Transform \hat{A} – Impulse Response of the Hilbert Transformer

Lecture 23 - Phase Shifting Method for Generation of Single Sideband (SSB) Modulated Signals based on Hilbert Transform

Lecture 24 - Complex Pre-Envelope and Complex Envelope of Passband Signals

Lecture 25 - Complex Pre- Envelope and Complex Envelope of QCM (Quadrature Carrier Modulated) Signals

Lecture 26 - Introduction to Vestigial Side Band(VSB) Modulation and Non- Ideal Filtering, Spectral Efficiency

Lecture 27 - Properties of Vestigial Side Band Filter for Reconstruction of Message Signal without Distortion

Lecture 28 - Introduction to Angle Modulation, Description of Phase Modulation (PM) and Frequency Modulation (FM)

Lecture 29 - Frequency Modulation (FM) with Sinusoidal Modulation Signal and Pictorial Examples, Insights of PM and FM signals

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- Lecture 31 - Indirect Method for Generation of FM Signals - Generation of Wideband FM Signal through Frequency Multiplication
- Lecture 32 - Spectrum of Frequency Modulated (FM) Signals
- Lecture 33 - Bandwidth of Frequency Modulated (FM) Signals - Carson's Rule
- Lecture 34 - Demodulation of Frequency Modulated (FM) Signals, Condition of Envelope Detection
- Lecture 35 - Analog to Digital Conversion of Signals and Introduction to Sampling
- Lecture 36 - Spectrum of Sampled Signal, Aliasing and Nyquist Sampling Theorem
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- Lecture 38 - Introduction to Pulse Amplitude Modulation (PAM), Sample and Hold, Flat Top Sampling
- Lecture 39 - Pulse Amplitude Modulation (PAM), Spectrum of PAM Signal, Reconstruction of Original Signal from PAM Signal, Equalization
- Lecture 40 - Introduction to Quantization, Uniform Quantizer, Mid-Tread Quantizer
- Lecture 41 - Quantization, Mid-Rise Quantizer, PDF and Power of Quantization Noise, Quantization Noise Power versus Quantizer Resolution
- Lecture 42 - Introduction to Lloyd-Max Quantization Algorithm, Optimal Quantizer Design
- Lecture 43 - Lloyd-Max Quantization Algorithm, Iterative Computation of Optimal Quantization Levels and Intervals
- Lecture 44 - Companding for Non-Uniform Quantization, Mu-law Compressor, A-law Compressor
- Lecture 45 - Introduction to Delta Modulation, One-bit Quantizer
- Lecture 46 - Signal Reconstruction in Delta Modulation, Schematic Diagrams, Slope Overload Distortion and Granular Noise
- Lecture 47 - Differential Pulse Coded Modulation (DPCM), DPCM Signal Reconstruction and Schematic Diagram
- Lecture 48 - Frequency Mixing and Translation in Communication Systems, Heterodyne and Super Heterodyne Receivers
- Lecture 49 - Frequency Translation and Super Heterodyne Receivers, Problem of Image Frequency
- Lecture 50 - Frequency Division Multiplexing (FDM), Carrier Spacing in FDM
- Lecture 51 - Time Division Multiplexing (TDM), Operation of TDM, Sample Spacing in TDM
- Lecture 52 - Bandwidth Requirements for Time Division Multiplexing (TDM), The T1 TDM System : A Case Study

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- Lecture 2 - Introduction to Error Control Coding - II
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- Lecture 4 - Introduction to Linear Block Codes, Generator Matrix and Parity Check Matrix
- Lecture 5 - Syndrome, Error Correction and Error Detection
- Lecture 6 - Problem Solving Session - I
- Lecture 7 - Decoding of Linear Block Codes
- Lecture 8 - Distance Properties of Linear Block Codes - I
- Lecture 9 - Distance Properties of Linear Block Codes - II
- Lecture 10 - Problem Solving Session - II
- Lecture 11 - Some Simple Linear Block Codes - I
- Lecture 12 - Some Simple Linear Block Codes - II: Reed Muller Codes
- Lecture 13 - Bounds on the Size of a Code
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- Lecture 15 - Introduction to Convolutional Codes - I: Encoding
- Lecture 16 - Introduction to Convolutional Codes - II: State Diagram, Trellis Diagram
- Lecture 17 - Convolutional Codes: Classification, Realization
- Lecture 18 - Convolutional Codes:Distance Properties
- Lecture 19 - Decoding of Convolutional Codes - I: Viterbi Algorithm
- Lecture 20 - Decoding of Convolutional Codes - II: BCJR Algorithm
- Lecture 21 - Problem solving session - IV
- Lecture 22 - Problem solving session - V
- Lecture 23 - Performance Bounds for Convolutional Codes
- Lecture 24 - Low Density Parity Check Codes
- Lecture 25 - Decoding of Low Density Parity Check Codes - I
- Lecture 26 - Decoding of Low Density Parity Check Codes - II: Belief Propagation Algorithm
- Lecture 27 - Turbo Codes
- Lecture 28 - Turbo Decoding
- Lecture 29 - Problem Solving Sessions - VI
- Lecture 30 - Distance Properties of Turbo Codes
- Lecture 31 - Convergence of Turbo Codes

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Lecture 2 - Spectrum of Transmitted Digital Communication Signal and Wide Sense Stationarity

Lecture 3 - Spectrum of Transmitted Digital Communication Signal, Autocorrelation Function and Power Spectral Density

Lecture 4 - Spectrum of Transmitted Digital Communication Signal, Relation to Energy Spectral Density and Introduction to AWGN Channel

Lecture 5 - Additive White Gaussian Noise (AWGN) Properties, Gaussian Noise and White Noise

Lecture 6 - Structure of Digital Communication Receiver, Receiver Filter and Signal-to-Noise Power Ratio (SNR)

Lecture 7 - Digital Communication Receiver, Noise Properties and Output Noise Power

Lecture 8 - Digital Communication Receiver, Optimal SNR and Matched Filter

Lecture 9 - Probability of Error in Digital Communication and Probability Density Functions of Output

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Lecture 11 - Introduction to Binary Phase Shift Keying (BPSK) Modulation, Optimal Decision Rule and Probability of Bit-Error or Bit-Error Rate (BER)

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Lecture 13 - Optimal Decision Rule for Amplitude Shift Keying (ASK), Bit Error Rate (BER) and Comparison with Binary Phase Shift Keying (BPSK) Modulation

Lecture 14 - Introduction to Signal Space Concept and Orthonormal Basis Signals

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Lecture 16 - Optimal Decision Rule for FSK, Bit Error Rate (BER) and Comparison with BPSK, ASK

Lecture 17 - Introduction to Quadrature Phase Shift Keying (QPSK)

Lecture 18 - Waveforms of Quadrature Phase Shift Keying (QPSK)

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Lecture 20 - Introduction to M-ary PAM (Pulse Amplitude Modulation), Average Symbol Power and Decision rules

Lecture 21 - M-ary PAM (Pulse Amplitude Modulation) -Part-II, Optimal Decision Rule and Probability of Error

Lecture 22 - M-ary QAM (Quadrature Amplitude Modulation) Part-I, Introduction, Transmitted Waveform and Average Symbol Energy

Lecture 23 - M-ary QAM (Quadrature Amplitude Modulation) - Part-II, Optimal Decision Rule, Probability of Error and Constellation Diagram

Lecture 24 - M-ary PSK (Phase Shift Keying) Part-I, Introduction , Transmitted Waveform and Constellation Diagram

Lecture 25 - M-ary PSK (Phase Shift Keying) - Part-II, Optimal Decision Rule, Nearest Neighbor Criterion and Approximate Probability of Error

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Lecture 27 - Definition of Entropy, Average of Information / Uncertainty of source and Properties of Entropy

Lecture 28 - Entropy Example- Binary Source Maximum and Minimum Entropy of Binary Source

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- Lecture 29 - Maximum Entropy of Source with M-ary Alphabet, Concave/Convex Functions and Jensens Inequality
- Lecture 30 - Joint Entropy , Definition of Joint Entropy of Two Sources and Simple Examples for Joint Entropy Computation
- Lecture 31 - Properties of Joint Entropy and Relation between Joint Entropy and Marginal Entropies
- Lecture 32 - Conditional Entropy, Example of Conditional Entropy and Properties of Conditional Entropy
- Lecture 33 - Mutual Information, Diagrammatic Representation and Properties of Mutual Information
- Lecture 34 - Simple Example of Mutual Information and Practical Example of Mutual Information-Binary Symmetric Channel
- Lecture 35 - Channel Capacity, Implications of Channel Capacity, Claude E. Shannon- Father of Information Theory and Example of Capacity of Binary Symmetric Channel
- Lecture 36 - Differential Entropy and Example for Uniform Probability Density function
- Lecture 37 - Differential Entropy of Gaussian Source and Insights
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- Lecture 39 - Capacity of Gaussian channel - Part I
- Lecture 40 - Capacity of Gaussian Channel - Part-II, Practical Implications and Maximum rate in bits/sec
- Lecture 41 - Introduction to Source Coding and Data Compression, Variable Length codes and Unique Decodability
- Lecture 42 - Uniquely Decodable Codes, Prefix-free code, Instantaneous Code and Average Code length
- Lecture 43 - Binary Tree Representation of Code, Example and Kraft Inequality
- Lecture 44 - Lower Bound on Average Code Length and Kullback-Leibler Divergence
- Lecture 45 - Optimal Code length, Constrained Optimization and Morse Code Example
- Lecture 46 - Approaching Lower Bound on Average code length and Block Coding
- Lecture 47 - Huffman Code, Algorithm, Example and Average Code Length
- Lecture 48 - Introduction to channel coding, Rate of Code, Repetition Code and Hamming Distance
- Lecture 49 - Introduction to Convolutional Codes, Binary Field Arithmetic and Linear Codes
- Lecture 50 - Example of Convolutional Code Output and Convolution Operation for Code generation
- Lecture 51 - Matrix Representation of Convolutional Codes, Generator Matrix, Transform Domain Representation and Shift Register Architecture
- Lecture 52 - State Diagram Representation of Convolutional Code, State transitions and Example of Code Generation using State transitions
- Lecture 53 - Trellis Representation of Convolutional Code and Valid Code Words
- Lecture 54 - Decoding of the Convolutional Code, Minimum Hamming distance and Maximum Likelihood Codeword Estimate
- Lecture 55 - Principle of Decoding of Convolutional code
- Lecture 56 - Viterbi Decoder for Maximum Likelihood Decoding of Convolutional Code Using Trellis Representation, Branch Metric Calculation, State Metric Calculation and Example

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- Lecture 2 - Introduction to Transmission lines
- Lecture 3 - Sinusoidal waves on Transmission lines
- Lecture 4 - Terminating T-lines: Reflection and Transmission coefficient
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- Lecture 6 - Lossy Transmission lines and primary constants
- Lecture 7 - When to apply T-line Theory?
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- Lecture 10 - Impedance transformation and power flow on T-lines
- Lecture 11 - Graphical aid: Smith Chart Derivation
- Lecture 12 - Smith chart applications
- Lecture 13 - Further applications of Smith chart - Part 1
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- Lecture 19 - Further examples of use of lattice diagrams
- Lecture 20 - High-speed digital signal propagation on T-lines
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- Lecture 26 - Review of vector fields and Gradient
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- Lecture 32 - Boundary conditions for Electromagnetic fields
- Lecture 33 - Electrostatics-I: Laplace and Poissons equations
- Lecture 34 - Electrostatics-II: Solving Laplaces equation in 1D
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- Lecture 48 - Application: Reflection from multiple media and anti-reflection coating.
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- Lecture 52 - Application: Fabry-Perot cavity and Multi-layer films
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- Lecture 56 - Planar optical waveguides
- Lecture 57 - Application: Optical Fibers
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- Lecture 59 - Mach-Zehnder Modulator
- Lecture 60 - Wave Propagation in Anisotropic Medium
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- Lecture 64 - Fields of a Dipole Antenna

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Lecture 3 - Energy and Power Signals

Lecture 4 - Real Exponential Signals

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Lecture 51 - Fourier Transform Problems: Unit Step Response of RC Circuit, Sampling of Continuous Signal

Lecture 52 - Sampling: Spectrum of Sampled Signal, Nyquist Criterion

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Lecture 54 - Fourier Analysis of Discrete Time Signals and Systems - Introduction

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Lecture 56 - Discrete Time Fourier Transform: Definition, Inverse DTFT, Convergence, Relation between DTFT and z-Transform, DTFT of Common Signals

Lecture 57 - Discrete Time Fourier Transform: Properties of DTFT - Linearity, Time Shifting, Frequency Shifting, Conjugation, Time-Reversal, Duality

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Lecture 59 - DTFT: Discrete Time LTI Systems - LTI Systems Characterized by Difference Equations

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NPTEL : NOC:Applied Optimization for Wireless, Machine Learning, Big Data (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

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Lecture 2 - Eigenvectors and Eigenvalues of Matrices and their Properties

Lecture 3 - Positive Semidefinite (PSD) and Positive Definite (PD) Matrices and their Properties

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Lecture 5 - Inner Product Space and its Properties: Cauchy Schwarz Inequality

Lecture 6 - Properties of Norm, Gaussian Elimination and Echelon form of matrix

Lecture 7 - Gram Schmidt Orthogonalization Procedure

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Lecture 51 - Practical Application: Multiple Input Multiple Output (MIMO) Beamformer Design

Lecture 52 - Practical Application: Co-operative Communication, Overview and various Protocols used

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Lecture 56 - Practical Application

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[Lecture 73 - Examples on Duality: Dual Norm, Dual of Linear Program \(LP\)](#)

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- Lecture 1 - Overview of fiber-optic communication systems
- Lecture 2 - Review of Maxwell's equations
- Lecture 3 - Uniform plane waves (UWPs) in free-space
- Lecture 4 - Properties of UWPs (propagation constant, polarization, and Poynting vector)
- Lecture 5 - Boundary conditions and reflection from a PEC
- Lecture 6 - Obliquely incident waves-I (TE and TM waves, Snell's laws)
- Lecture 7 - Obliquely incident waves-II (Reflection and transmission coefficients, Brewster angle)
- Lecture 8 - Total internal reflection
- Lecture 9 - Ray theory of dielectric slab waveguides
- Lecture 10 - Transverse resonance condition for slab waveguides
- Lecture 11 - Introduction to optical fibers
- Lecture 12 - Ray theory of light propagation in optical fibers
- Lecture 13 - Concept of waveguide modes
- Lecture 14 - Systematic procedure to obtain modes of a waveguide
- Lecture 15 - Systematic analysis of parallel plate metallic waveguide
- Lecture 16 - Systematic analysis of dielectric slab waveguides
- Lecture 17 - Further discussion on slab waveguides
- Lecture 18 - Modal analysis of step index optical fiber
- Lecture 19 - Properties of modes of step-index optical fiber - I
- Lecture 20 - Properties of modes of step-index optical fiber - II
- Lecture 21 - Linearly polarized modes
- Lecture 22 - Attenuation and power loss in fibers
- Lecture 23 - Introduction to dispersion in fibers
- Lecture 24 - Mathematical modelling of dispersion: Transfer function approach
- Lecture 25 - Pulse propagation equation and its solution
- Lecture 26 - Pre-chirped pulses and Inter and Intra-modal dispersion in optical fibers
- Lecture 27 - Beam Propagation Method
- Lecture 28 - Polarization Effects on Pulse Propagation
- Lecture 29 - Modes in Optical Fibres and Pulse Propagation in Optical Fibres
- Lecture 30 - Graded Index Fibers
- Lecture 31 - Light Sources, Detectors and Amplifiers

- Lecture 32 - Basics of Lasers-I (Structure of Lasers, Process of Photon Emission)
- Lecture 33 - Basics of Lasers-II (Einstein's Theory of Radiation)
- Lecture 34 - Basics of Lasers-III (Population Inversion and Rate Equation for Lasers)
- Lecture 35 - Basic Properties of Semiconductor Laser-I (Energy Gap, Intrinsic and Extrinsic Semiconductors)
- Lecture 36 - Basic Properties of Semiconductor Laser-II (Fermi Level)
- Lecture 37 - Optical Properties of Semiconductors-I (Direct Bandgap and Indirect Bandgap, Density of States)
- Lecture 38 - Optical Properties of Semiconductors-II (Gain, Absorption, Recombination rate) Homojunction Lasers
- Lecture 39 - Double Heterostructure Lasers, Introduction to Quantum Well Lasers
- Lecture 40 - Semiconductor Optical Amplifier
- Lecture 41 - Erbium-doped fiber amplifier
- Lecture 42 - Photodetectors
- Lecture 43 - Noise in Photodetectors
- Lecture 44 - Introduction to WDM components
- Lecture 45 - Couplers, Circulators, FRM and Filters
- Lecture 46 - Filter, MUX/DEMUX, Diffraction grating (FBG and Long period grating)
- Lecture 47 - Optical Modulators-I (Current modulation)
- Lecture 48 - Optical Modulators-II (Electro-optic modulators)
- Lecture 49 - Review of Communication Concepts-I (Deterministic and Random Signals, Baseband and Passband Signals)
- Lecture 50 - Review of Communication Concepts-II (Signal and vectors, Signal energy, Orthonormal basis functions)
- Lecture 51 - Intensity modulation/ Direct Detection
- Lecture 52 - BER discussion for OOK systems
- Lecture 53 - Higher order modulation and Coherent Receiver
- Lecture 54 - Coherent receiver for BPSK systems and BER calculation
- Lecture 55 - Recovering Polarization
- Lecture 56 - DSP algorithms for Chromatic dispersion mitigation
- Lecture 57 - DSP algorithms for Carrier phase estimation - I
- Lecture 58 - DSP algorithms for Carrier phase estimation - II
- Lecture 59 - Nonlinear effects in fiber
- Lecture 60 - Four wave mixing, Loss measurement, Dispersion measurement
- Lecture 61 - Lab Demonstration (Laser diode characteristics, Loss measurement, Optical Intensity Modulation)

Lecture 1 - Introduction and Types of Transmission Lines

Lecture 2 - Distributed Circuit Model of Uniform Transmission Line

Lecture 3 - Voltage and Current Equation of the Transmission line

Lecture 4 - Sinusoidal Excitation of Transmission Line (Propagation constant, Characteristic Impedance)

Lecture 5 - Properties of Transmission Line (Reflection Coefficient, Input Impedance, Standing Wave Ratio)

Lecture 6 - Power Calculations and Introduction to Smith Chart

Lecture 7 - Smith Chart

Lecture 8 - Additional Applications of Smith Chart

Lecture 9 - Time domain Analysis of Transmission Line - I

Lecture 10 - Time domain Analysis of Transmission Line - II

Lecture 11 - Usage of Lattice Diagrams

Lecture 12 - TDR analysis of Transmission Lines

Lecture 13 - Introduction to Propagation of Electromagnetic Waves

Lecture 14 - Uniform Plane Waves - I

Lecture 15 - Uniform Plane Waves - II

Lecture 16 - Poynting Vector, Average Power, Polarization

Lecture 17 - Uniform Plane Waves in Lossy Medium

Lecture 18 - Normal Incidence of Plane Waves

Lecture 19 - Oblique Incidence of Plane Waves - I

Lecture 20 - Oblique Incidence of Plane Waves - II

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Lecture 23 - Optical Fibers

Lecture 24 - Parallel Plate Waveguides

Lecture 25 - Rectangular Waveguides

Lecture 26 - Modes of Rectangular Waveguides

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Lecture 28 - Solution to Electric Scalar Potential and Magnetic Vector Potential Equations

Lecture 29 - Further discussion on Magnetic Vector Potential and Elementary Hertzian Dipole

Lecture 30 - Near field and Far-field Antenna and Properties of Antennas

Lecture 31 - Linear antenna - I

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Lecture 2 - Sinusoids and Phasors

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Lecture 5 - AC Power Analysis

Lecture 6 - RMS Voltage and Current

Lecture 7 - Topology

Lecture 8 - Star-Delta Transformation and Mesh Analysis

Lecture 9 - Mesh Analysis.

Lecture 10 - Nodal Analysis

Lecture 11 - Linearity Property and Superposition Theorem

Lecture 12 - Source Transformation

Lecture 13 - Duality

Lecture 14 - Thevenin's Theorem - 1

Lecture 15 - Thevenin's Theorem - 2

Lecture 16 - Norton's Theorem - 1

Lecture 17 - Norton's Theorem - 2

Lecture 18 - Maximum Power Transfer Theorem - 1

Lecture 19 - Maximum Power Transfer Theorem - 2

Lecture 20 - Reciprocity and Compensation Theorem

Lecture 21 - First Order RC Circuits

Lecture 22 - First Order RL Circuits

Lecture 23 - Singularity Functions

Lecture 24 - Step Response of RC and RL Circuits

Lecture 25 - Second Order Response

Lecture 26 - Step Response of Second Order Circuits-First Order and Second Order Circuits (Continued...)

Lecture 27 - Step Response of Parallel RLC Circuit-First Order and Second Order Circuits (Continued...)

Lecture 28 - Definition of the Laplace Transform

Lecture 29 - Properties of the Laplace Transform

Lecture 30 - Inverse Laplace Transform

Lecture 31 - Laplace Transform of Circuit Elements

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Lecture 1 - Introduction to Electric Drives

Lecture 2 - Dynamics of Electric Drives, Four Quadrant Operation, Equivalent Drive Parameters

Lecture 3 - Equivalent Drive Parameters, Friction Components, Nature of Load Torque

Lecture 4 - Steady State Stability, Load Equalization

Lecture 5 - Load Equalization, Characteristics of DC Motor

Lecture 6 - Speed Torque Characteristics of Separately Excited DC Motor and Series DC Motor

Lecture 7 - Field Control of Series Motor, Motoring and Braking of Separately Excited and Series DC motors

Lecture 8 - Speed Control of Separately Excited DC Motor Using Controlled Rectifiers

Lecture 9 - Analysis of Single Phase Full Controlled Converter-fed Separately Excited DC Motor

Lecture 10 - Speed Torque Characteristics of Full Controlled Converter-fed Separately Excited DC Motor, Analysis of Single Phase Half Controlled Converter-fed Separately Excited DC Motor

Lecture 11 - Analysis of Single Phase Half Controlled Converter-fed Separately Excited DC Motor.

Lecture 12 - Three Phase Full Controlled Converter-fed Separately Excited DC Motor, Multi-quadrant Operation of DC Motor

Lecture 13 - Dual Converter-fed DC Motor, Multi-quadrant Operation Using Field Current Reversal

Lecture 14 - DC Chopper-fed Separately Excited DC Motor for Motoring and Braking

Lecture 15 - Two-quadrant DC Chopper, Four-quadrant DC Chopper

Lecture 16 - Dynamic Braking of DC Motor by Chopper Controlled Resistor, Closed-loop Operation of DC Drives, Induction Motor Drives

Lecture 17 - Speed Torque Characteristics of Induction Motor, Operation of Induction Motor from Non-sinusoidal Supply

Lecture 18 - Operation of Induction Motor from Non-sinusoidal Supply

Lecture 19 - Stator Current of Induction Motor with Non-sinusoidal Supply, Operation of Induction Motor with Unbalanced Voltage Supply

Lecture 20 - Single Phasing of Induction Motor, Braking of Induction Motor

Lecture 21 - Dynamic braking of induction motor, AC dynamic braking, DC dynamic braking

Lecture 22 - Analysis of DC dynamic braking of induction motor

Lecture 23 - Self-excited dynamic braking of induction motor, Speed control of induction motor using stator voltage regulator, Variable voltage variable frequency control

Lecture 24 - Variable voltage variable frequency control of induction motor, Open loop V/F control

Lecture 25 - Slip speed control of induction motor, Constant Volt/Hz control with slip speed regulation

Lecture 26 - Closed-loop Volt/Hz control of induction motor with slip speed regulation, Multi-quadrant operation of induction motor drive

Lecture 27 - Current Source Inverter (CSI) fed induction motor drive

Lecture 28 - Closed-loop operation of current source inverter (CSI) fed induction motor drive, Control of slip ring induction motor - Static rotor resistance control

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Lecture 29 - Closed-loop operation of slip ring induction motor with static rotor resistance control, Slip power recovery in slip ring induction motor - Static Kramer drive

Lecture 30 - Static Kramer drive and its closed-loop control, Introduction to synchronous motor

Lecture 31 - Various types of synchronous motors, Equivalent circuit and phasor diagram of cylindrical synchronous motor, Speed-torque characteristics of cylindrical synchronous motor

Lecture 32 - Phasor diagram of salient pole synchronous motor, Expression of power and torque for a salient pole synchronous motor, Synchronous reluctance motor, Open-loop V/f control of synchronous motor

Lecture 33 - Open-loop V/f control, Torque-speed characteristics, Self controlled synchronous motor drive employing load commutated thyristor inverter

Lecture 34 - Detailed analysis of commutation of load commutated thyristor inverter, Derivation of overlap angle and margin angle, Closed-loop speed control scheme for load commutated inverter-fed synchronous motor drive

Lecture 35 - Low cost brushless DC motor (BLDCM), Trapezoidal permanent magnet AC motor

Lecture 36 - Trapezoidal permanent magnet AC motor, Derivation of power and torque, Closed-loop control of trapezoidal BLDC motor, Introduction to switched reluctance motor

Lecture 37 - Construction and operating principle of switched reluctance motor

Lecture 38 - Current/ voltage control for switched reluctance motor, operating modes of switched reluctance motor, Introduction to traction drives

Lecture 39 - Current collector for mainline trains, Nature of traction load, Duty cycle of traction drives

Lecture 40 - Duty cycle of traction drives, Distance between two stops, Calculation of total tractive effort and drive rating

Lecture 1 - Introduction: Fuzzy Sets, Logic and Systems and Applications

Lecture 2 - Introduction: Real Life Applications of Fuzzy Systems

Lecture 3 - Fuzzy Sets and Fuzzy Logic Toolbox in MATLAB - I

Lecture 4 - Fuzzy Sets and Fuzzy Logic Toolbox in MATLAB - II

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Lecture 1 - Introduction to Peer to Peer Networks

Lecture 2 - Peer to Peer Network in Telephony:Voice over Internet Telephony (VoIP) and Distributed Hash Table (DHT)

Lecture 3 - Building DHT Networks

Lecture 4 - Logarithmic Partitioning of Node ID Space and Index Entry Authenticity

Lecture 5 - Implementation of Voice over Internet Telephony in P2P Way

Lecture 6 - Leaf Nodes, Core Nodes and Type of Messages in DHT Networks

Lecture 7 - Static and Dynamic Partitioning of Node ID Space: Fixed and Floating Partitioning

Lecture 8 - PASTRY Protocol: The Efficient Use of Internet Infrastructure

Lecture 9 - Understanding the PASTRY Protocol through Example

Lecture 10 - Kademia: A DHT Routing Protocol

Lecture 11 - Tapestry: An Evolution of Kademia

Lecture 12 - Understanding the Tapestry Protocol through Example

Lecture 13 - Multi-dimensional Distributed Hash Table: Mapping of Peers into Multidimensional Space

Lecture 14 - Multi-Layer DHT: A Design for Multiple Services

Lecture 15 - Keeping Pairs at Correct Root Nodes

Lecture 16 - Abrupt and Graceful Exit of Root Node: Maintaining Pairs Alive

Lecture 17 - Resilience of Pairs

Lecture 18 - A P2P Distributed File System

Lecture 19 - Storage Space Problem and Incentives to Share Storage

Lecture 20 - P2P Nodes Communications Challenges in Heterogeneous Network Environments

Lecture 21 - P2P Overlaid Multicast: Basic Design

Lecture 22 - P2P Overlaid Multicast: Alternate Design

Lecture 23 - A Design of P2P Email System

Lecture 24 - P2P Mailing List Services: A Basic Design

Lecture 25 - P2P Mailing List Services: An Alternate Design

Lecture 26 - P2P Web: A Basic Design

Lecture 27 - P2P Web Search Engine: A Basic Design

Lecture 28 - P2P Internet: On Being Anonymous

Lecture 29 - P2P in Blockchain

Lecture 30 - P2P Anonymous Communication

Lecture 31 - The Anonymous Communication on the Internet through TOR Network

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NPTEL : NOC:Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

- Lecture 1 - Vector Properties: Addition, Linear Combination, Inner Product, Orthogonality, Norm
- Lecture 2 - Vectors: Unit Norm Vector, Cauchy-Schwarz inequality, Radar Application
- Lecture 3 - Inner Product Application: Beamforming in Wireless Communication Systems
- Lecture 4 - Matrices, Definition, Addition and Multiplication of Matrices
- Lecture 5 - Matrix: Column Space, Linear Independence, Rank of Matrix, Gaussian Elimination
- Lecture 6 - Matrix: Determinant, Inverse Computation, Adjoint, Cofactor Concepts
- Lecture 7 - Applications of Matrices: Solution of System of Linear equations, MIMO Wireless Technology
- Lecture 8 - Applications of Matrices: Electric Circuits, Traffic flows
- Lecture 9 - Applications of Matrices: Graph Theory, Social Networks, Dominance Directed Graph, Influential Node
- Lecture 10 - Null Space of Matrix: Definition, Rank-Nullity Theorem, Application in Electric Circuits
- Lecture 11 - Gram-Schmidt Orthogonalization
- Lecture 12 - Gaussian Random Variable: Definition, Mean, Variance, Multivariate Gaussian, Covariance Matrix
- Lecture 13 - Linear Transformation of Gaussian Random Vectors
- Lecture 14 - Machine Learning Application: Gaussian Classification
- Lecture 15 - Eigenvalue: Definition, Characteristic Equation, Eigenvalue Decomposition
- Lecture 16 - Special Matrices: Rotation and Unitary Matrices, Application: Alamouti Code
- Lecture 17 - Positive Semi-definite (PSD) Matrices: Definition, Properties, Eigenvalue Decomposition
- Lecture 18 - Positive Semidefinite Matrix: Example and Illustration of Eigenvalue Decomposition
- Lecture 19 - Machine Learning Application: Principle Component Analysis (PCA)
- Lecture 20 - Computer Vision Application: Face Recognition, Eigenfaces
- Lecture 21 - Least Squares (LS) Solution, Pseudo-Inverse Concept
- Lecture 22 - Least Squares (LS) via Principle of Orthogonality, Projection Matrix, Properties
- Lecture 23 - Application: Pseudo-Inverse and MIMO Zero Forcing (ZF) Receiver
- Lecture 24 - Wireless Application: Multi-Antenna Channel Estimation
- Lecture 25 - Machine Learning Application: Linear Regression
- Lecture 26 - Computation Mathematics Application: Polynomial Fitting
- Lecture 27 - Least Norm Solution
- Lecture 28 - Wireless Application: Multi-user Beamforming
- Lecture 29 - Singular Value Decomposition (SVD): Definition, Properties, Example
- Lecture 30 - SVD Application in MIMO Wireless Technology: Spatial-Multiplexing and High Data Rates
- Lecture 31 - SVD for MIMO wireless optimization, water-filling algorithm, optimal power allocation

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Lecture 32 - SVD application for Machine Learning: Principal component analysis (PCA)

Lecture 33 - Multiple signal classification (MUSIC) algorithm: system model

Lecture 34 - MUSIC algorithm for Direction of Arrival (DoA) estimation

Lecture 35 - Linear minimum mean square error (LMMSE) principle

Lecture 36 - LMMSE estimate and error covariance matrix

Lecture 37 - LMMSE estimation in linear systems

Lecture 38 - LMMSE application: Wireless channel estimation and example

Lecture 39 - Time-series prediction via auto-regressive (AR) model

Lecture 40 - Recommender system: design and rating prediction

Lecture 41 - Recommender system: Illustration via movie rating prediction example

Lecture 42 - Fast Fourier transform (FFT) and Inverse fast Fourier transform (IFFT)

Lecture 43 - IFFT/ FFT application in Orthogonal Frequency Division Multiplexing (OFDM) wireless technology

Lecture 44 - OFDM system: Circulant matrices and properties

Lecture 45 - OFDM system model: Transmitter and receiver processing

Lecture 46 - Single-carrier frequency division for multiple access (SC-FDMA) technology

Lecture 47 - Linear dynamical systems: definition and solution via matrix exponential

Lecture 48 - Linear dynamical systems: matrix exponential via SVD

Lecture 49 - Machine Learning application: Support Vector Machines (SVM)

Lecture 50 - Support Vector Machines (SVM): Problem formulation via maximum hyperplane separation

Lecture 51 - Sparse regression: problem formulation and relation to Compressive Sensing (CS)

Lecture 52 - Sparse regression: solution via the Orthogonal Matching Pursuit (OMP) algorithm

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Fundamentals of Electric Vehicles: Technology and Economics (Electrical Engineering)

Co-ordinators : Prof. Ashok Jhunjunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan

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- Lecture 104 - Negative resistance
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- Lecture 106 - Opamp supply voltages and saturation
- Lecture 107 - KCL with an opamp and supply currents
- Lecture 108 - Circuits with storage elements (capacitors and inductors)
- Lecture 109 - First order circuit with zero input-natural response
- Lecture 110 - First order RC circuit with zero input-Example
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- Lecture 112 - General form of the first order circuit response
- Lecture 113 - First order RC circuit with a constant input-Example
- Lecture 114 - First order circuit with piecewise constant input
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- Lecture 116 - First order circuit-Response of arbitrary circuit variables
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- Lecture 124 - First order RC circuit with an exponential input
- Lecture 125 - First order RC response to its own natural response
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Lecture 23 - Phase modulated Sensors - 3

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- Lecture 8 - Inter-reciprocity in linear time-invariant networks (Continued...)
- Lecture 9 - Inter-reciprocity in networks with ideal operational amplifiers
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- Lecture 15 - MNA stamp of an ideal opamp
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- Lecture 56 - Reciprocity and Inter-reciprocity in LPTV networks : Part 2, the transfer-function theorem
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- Lecture 59 - The frequency-reversal theorem for inter-reciprocal (adjoint) LPTV networks : derivation
- Lecture 60 - Why is the frequency-reversal theorem important?
- Lecture 61 - Inter-reciprocity in signal-flow graphs
- Lecture 62 - Applications of inter-reciprocity: analysis of chopped amplifiers
- Lecture 63 - Applications of inter-reciprocity: analysis of chopped amplifiers (Continued...)
- Lecture 64 - Applications of inter-reciprocity: chopping with square-wave modulation

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- Lecture 9 - Distribution of arrival epoch S_n and $N(t)$ for a Poisson Process
- Lecture 10 - Alternate definitions of a Poisson Process
- Lecture 11 - Merging of Poisson Processes - Part 1
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- Lecture 18 - Non Homogeneous Poisson Process
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- Lecture 23 - Strong law for renewal processes
- Lecture 24 - Strong law for renewal processes - Proof
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- Lecture 2 - Moore's Law and Interconnect Bottleneck
- Lecture 3 - Progress in Optical Interconnect Technology and Beyond
- Lecture 4 - Evolution of Silicon Photonics Platform
- Lecture 5 - Fundamentals of Lightwaves: EM Waves: Maxwell Equations and Plane Wave Solutions
- Lecture 6 - Fundamentals of Lightwaves: EM Waves: Wave Propagation in Lossy Dielectric Medium
- Lecture 7 - Fundamentals of Lightwaves: EM Waves in Metals and Semiconductors
- Lecture 8 - Fundamentals of Lightwaves: EM Waves: Plasma Dispersion
- Lecture 9 - Fundamentals of Lightwaves: EM Waves Principle of Optical Waveguiding
- Lecture 10 - Fundamentals of Lightwaves: 1-D Optical Waveguide: Ray Optics Model
- Lecture 11 - Optical Waveguides: Theory and Design: TIR Based Eigen Mode Solutions for Slab Waveguides
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- Lecture 20 - Optical Waveguides: Theory and Design: Coupled Mode Theory (Continued...)
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- Lecture 22 - Integrated Optical Components: Y-Junction Power Splitter/Combiner and Mach-Zehnder Interferometer
- Lecture 23 - Integrated Optical Components: Directional Coupler: Coupled Waveguides
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- Lecture 25 - Integrated Optical Components: Directional Coupler: Design and Modelling
- Lecture 26 - Integrated Optical Components: DC based MZI and Microring Resonator (MRR)
- Lecture 27 - Integrated Optical Components: Microring Resonator (MRR): Passive Characteristics
- Lecture 28 - Integrated Optical Components: Distributed Bragg Reflector (DBR)
- Lecture 29 - Integrated Optical Components: Distributed Bragg Reflector (DBR): Device Design - Part 1
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- Lecture 31 - Tunable Devices and Reconfigurable Circuits: Phase Error Interference

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- Lecture 2 - Classical Vs Quantum Mechanics
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- Lecture 4 - 3D potential well model of atom and Bohr's model
- Lecture 5 - Covalent bonds and inter-atomic interactions in Silicon
- Lecture 6 - Energy band formation
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- Lecture 10 - Effective mass in Semiconductors
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- Lecture 13 - Fermi level in extrinsic semiconductors
- Lecture 14 - Temperature dependence of Fermi level
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- Lecture 16 - Charge neutrality relationship
- Lecture 17 - Drift current and energy band representation of kinetic energy of carriers
- Lecture 18 - Semiconductor bands in a electric field
- Lecture 19 - Diffusion current
- Lecture 20 - Non-uniform doping
- Lecture 21 - Equilibrium Vs Nonequilibrium carrier response
- Lecture 22 - Minority carrier diffusion equation (MCDE) - Example problems
- Lecture 23 - Quasi Fermi level in nonequilibrium conditions
- Lecture 24 - Quasi Fermi level and minority carrier diffusion length
- Lecture 25 - Semiconductor device fabrication
- Lecture 26 - PN Junctions - An introduction
- Lecture 27 - PN Junction electrostatics
- Lecture 28 - Energy band diagram of PN junction
- Lecture 29 - Depletion width and peak electric field
- Lecture 30 - PN junction electrostatics - examples
- Lecture 31 - Demo of PN Junction Lab on Nanohub

- Lecture 32 - Forward and reverse biased PN junctions
- Lecture 33 - Minority carrier injection in PN junctions
- Lecture 34 - Current in forward biased PN junction
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- Lecture 38 - Nanohub Demo - PN Junction with applied bias
- Lecture 39 - Schottky barrier in metal-semiconductor junction
- Lecture 40 - Current flow across a Schottky barrier
- Lecture 41 - Ohmic vs rectifying contacts
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- Lecture 44 - Simplified band diagrams of accumulation and depletion in MOSCAP
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- Lecture 49 - Exact solution vs delta-depletion approximation
- Lecture 50 - Threshold voltage in a MOSCAP
- Lecture 51 - Nanohub Demo - MOSCAP tool
- Lecture 52 - Non-ideal MOS Capacitor
- Lecture 53 - MOSCAP Capacitance-Voltage (CV) Characteristics
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- Lecture 55 - Impact of doping, oxide thickness and temperature on CV
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- Lecture 57 - Introduction to MOSFET
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- Lecture 59 - IV Characteristics of a long channel MOSFET
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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Electric Vehicles and Renewable Energy (Electrical Engineering)

Co-ordinators : Prof. Ashok Jhunjunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan

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Lecture 2 - The drive Torque, Power, Speed and Energy

Lecture 3 - Energy Source

Lecture 4 - Vehicle Auxillary, Petrol pumps and Charging stations

Lecture 5 - Introduction to Electric Vehicles in India

Lecture 6 - Can India Drive its EV program Innovatively and Differently and scale

Lecture 7 - Battery Cost reduction strategy

Lecture 8 - A bit about Batteries, Charging and Swapping Infrastructure

Lecture 9 - Where will we get Lithium for batteries and EV Subsystems

Lecture 10 - Forces acting when a vehicle move

Lecture 11 - Aerodynamic drag, Rolling Resistance and Uphill Resistance

Lecture 12 - Power and torque to accelerate

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Lecture 15 - Concept of drive cycle - 1

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Lecture 17 - Drive Cycles and Energy used per km - Part 1

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Lecture 21 - Introduction to Battery Parameters - Part 1

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Lecture 25 - Batteries in Future

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- Lecture 33 - Charging Batteries
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- Lecture 35 - Electrical Design of Battery Pack - Part 1
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- Lecture 57 - Power and Efficiency
- Lecture 58 - Torque Production - Part 1
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- Lecture 61 - Speed and Back EMF
- Lecture 62 - The d-q Equivalent circuit - Part 1
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- Lecture 65 - Three phase AC - Part 1
- Lecture 66 - Three phase AC - Part 2
- Lecture 67 - Thermal Design - Part 1
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Co-ordinators : Dr. Saurabh Saxena

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NPTEL : NOC:DC Microgrid (Electrical Engineering)

Co-ordinators : Prof. Avik Bhattacharya

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Lecture 19 - Microgrid Operation Modes and Standards - Part II

Lecture 20 - Microgrid Control Architectures

Lecture 21 - Microgrid Control Architectures (Continued...)

Lecture 22 - Intelligent Microgrid Operation and Control

Lecture 23 - Intelligent Microgrid Operation and Control (Continued...)

Lecture 24 - Intelligent Microgrid Operation and Control (Continued...)

Lecture 25 - Energy Management in Microgrid System (Continued...)

Lecture 26 - DC Microgrid System Architecture and AC Interface

Lecture 27 - DC Microgrid System Architecture and AC Interface (Continued...)

Lecture 28 - DC Microgrid System Architecture and AC Interface (Continued...)

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[Lecture 37 - DC Microgrid stabilization strategies \(Passive damping method\)](#)

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[Lecture 39 - DC microgrid stabilization using nonlinear Techniques](#)

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- Lecture 4 - Overview - III
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- Lecture 6 - Source of Poor Power Quality - II
- Lecture 7 - AC Power Quality Standard
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- Lecture 11 - Passive Filter Design - I
- Lecture 12 - Passive Filter Design - II
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- Lecture 14 - PWM Rectifier - II
- Lecture 15 - PWM Rectifier - III
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- Lecture 17 - Three Phase Converters - II and multi pulse Converters
- Lecture 18 - Three Phase Converters - III and multi-pulse Converters
- Lecture 19 - VSI and CSI
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- Lecture 21 - Multilevel Inverter - II
- Lecture 22 - Multilevel Inverter - III
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- Lecture 24 - PWM for Voltage Source Inverter - II
- Lecture 25 - PWM for Voltage Source inverter - III
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- Lecture 27 - Operation and Control of Grid-Connected VSC
- Lecture 28 - Grid Connected VSC with inner Current Control
- Lecture 29 - Shunt Active Power Filter - I
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- Lecture 14 - Protection of Transmission Lines using Distance Relays - I
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- Lecture 1 - Introduction to VLSI Design
- Lecture 2 - Introduction to VLSI Physical Design
- Lecture 3 - Complexity Analysis for Algorithms
- Lecture 4 - Graphs for Physical Design
- Lecture 5 - Graph searching Algorithms
- Lecture 6 - Spanning Tree and Shortest Path Algorithms
- Lecture 7 - Overview of Timing Analysis
- Lecture 8 - Timing Arcs and Unateness
- Lecture 9 - Delay Parameters of a Combinational Circuit
- Lecture 10 - Delay Parameters of a Sequential Circuit
- Lecture 11 - Timing Analysis in a Sequential Circuit
- Lecture 12 - STA in Sequential Circuit with Clock Skew - I
- Lecture 13 - STA in Sequential Circuit with Clock Skew - II
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- Lecture 15 - STA considering OCV and CRPR (Setup check)
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- Lecture 17 - STA for Combinational Circuits - I
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- Lecture 19 - Introduction to Partitioning - I
- Lecture 20 - Introduction to Partitioning - II
- Lecture 21 - Partitioning Algorithms
- Lecture 22 - Kernighan-Lin (KL) Algorithm
- Lecture 23 - Fiduccia-Mattheyses (FM) Algorithm
- Lecture 24 - Introduction to Floorplanning
- Lecture 25 - Floorplanning Representations
- Lecture 26 - Floorplanning Algorithms - 1
- Lecture 27 - Floorplanning Algorithms - 2
- Lecture 28 - Pin Assignment and Power - Ground Routing
- Lecture 29 - Introduction to Placement
- Lecture 30 - Wirelength estimation techniques
- Lecture 31 - Min-cut placement

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- [Lecture 33 - Placement algorithms and legalization](#)
- [Lecture 34 - Introduction to Clock Tree Synthesis](#)
- [Lecture 35 - Clock Routing Algorithms - I](#)
- [Lecture 36 - Clock Routing Algorithms - II](#)
- [Lecture 37 - Clock Routing Algorithms - III](#)
- [Lecture 38 - Introduction and Optimization Goals - Global Routing](#)
- [Lecture 39 - Single net routing \(Rectilinear routing\)](#)
- [Lecture 40 - Global Routing in the connectivity graph](#)
- [Lecture 41 - Finding Shortest Paths with Dijkstra's Algorithm](#)
- [Lecture 42 - Full-Netlist Routing](#)
- [Lecture 43 - Introduction: Detailed Routing](#)
- [Lecture 44 - Channel Routing Algorithms - I](#)
- [Lecture 45 - Channel Routing Algorithms - II](#)
- [Lecture 46 - Switchbox and Over the cell routing](#)
- [Lecture 47 - Timing Constraints in latch based system](#)
- [Lecture 48 - Timing Constraints in Pulsed Latch-based System](#)
- [Lecture 49 - Time Borrowing in Latch](#)
- [Lecture 50 - Crosstalk Analysis](#)
- [Lecture 51 - Standard Cell Library](#)
- [Lecture 52 - Low Power Cells in Standard Cell Library](#)
- [Lecture 53 - Sub-threshold Standard Cell Library](#)
- [Lecture 54 - Timing Library for Standard Cells](#)
- [Lecture 55 - PDK and Other files](#)
- [Lecture 56 - Open-Source Tool Installation and Qflow](#)
- [Lecture 57 - Open-Source tool - YOSYS](#)
- [Lecture 58 - OpenSTA Static Timing Analyzer](#)
- [Lecture 59 - OpenROAD Physical Synthesis Flow - I](#)
- [Lecture 60 - OpenROAD Physical Synthesis Flow - II](#)

Lecture 1 - Introduction and Objectives of the course

Lecture 2 - Definition of a system and history of semiconductors

Lecture 3 - Products and levels of packaging

Lecture 4 - Packaging aspects of handheld products; Case studies in applications

Lecture 5 - Case Study (continued); Definition of PWB, summary and Questions for review

Lecture 6 - Basics of Semiconductor and Process flowchart; Video on "Sand-to-Silicon"

Lecture 7 - Wafer fabrication, inspection and testing

Lecture 8 - Wafer packaging; Packaging evolution; Chip connection choices

Lecture 9 - Wire bonding, TAB and flipchip-1

Lecture 10 - Wire bonding, TAB and flipchip-2; Tutorials

Lecture 11 - Why packaging? & Single chip packages or modules (SCM)

Lecture 12 - Commonly used packages and advanced packages; Materials in packages

Lecture 13 - Advances packages (continued); Thermal mismatch in packages; Current trends in packaging

Lecture 14 - Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Quiz on packages

Lecture 15 - Electrical Issues " I; Resistive Parasitic

Lecture 16 - Electrical Issues " II; Capacitive and Inductive Parasitic

Lecture 17 - Electrical Issues " III; Layout guidelines and the Reflection problem

Lecture 18 - Electrical Issues " IV; Interconnection

Lecture 19 - Quick Tutorial on packages; Benefits from CAD; Introduction to DFM, DFR & DFT

Lecture 20 - Components of a CAD package and its highlights

Lecture 21 - Design Flow considerations; Beginning a circuit design with schematic work and component layout

Lecture 22 - Demo and examples of layout and routing; Technology file generation from CAD; DFM check list and design rules; Design for Reliability

Lecture 23 - Review of CAD output files for PCB fabrication; Photo plotting and mask generation

Lecture 24 - Process flow-chart; Vias; PWB substrates

Lecture 25 - Substrates continued; Video highlights; Surface preparation

Lecture 26 - Photoresist and application methods; UV exposure and developing; Printing technologies for PWBs

Lecture 27 - PWB etching; Resist stripping; Screen-printing technology

Lecture 28 - Through-hole manufacture process steps; Panel and pattern plating methods

Lecture 29 - Video highlights on manufacturing; Solder mask for PWBs; Multilayer PWBs; Introduction to microvias

Lecture 30 - Microvia technology and Sequential build-up technology process flow for high-density interconnects

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

Lecture 31 - Conventional Vs HDI technologies; Flexible circuits; Tutorial session

Lecture 32 - SMD benefits; Design issues; Introduction to soldering

Lecture 33 - Reflow and Wave Soldering methods to attach SMDs

Lecture 34 - Solders; Wetting of solders; Flux and its properties; Defects in wave soldering

Lecture 35 - Vapour phase soldering, BGA soldering and Desoldering/Repair; SMT failures

Lecture 36 - SMT failure library and Tin Whiskers

Lecture 37 - Tin-lead and lead-free solders; Phase diagrams; Thermal profiles for reflow soldering; Lead-free alloys

Lecture 38 - Lead-free solder considerations; Green electronics; RoHS compliance and e-waste recycling issues

Lecture 39 - Thermal Design considerations in systems packaging

Lecture 40 - Introduction to embedded passives; Need for embedded passives; Design Library; Embedded resistor processes

Lecture 41 - Embedded capacitors; Processes for embedding capacitors; Case study examples; Summary of materials in packaging

Lecture 42 - Chapter-wise summary

Lecture 1 - Course introduction and overview

Lecture 2 - Distributed generation technologies

Lecture 3 - Distributed storage technologies

Lecture 4 - Distribution system protection

Lecture 5 - Circuit breaker coordination

Lecture 6 - Symmetrical component analysis and sequence excitation

Lecture 7 - Modeling of distribution system components

Lecture 8 - Protection components

Lecture 9 - Impact of distributed generation of distribution protection

Lecture 10 - Consumption and distribution grounding

Lecture 11 - Islanding of distribution systems

Lecture 12 - Modeling of islanded distribution systems

Lecture 13 - Distribution system problems and examples

Lecture 14 - Distribution system problems and examples continued

Lecture 15 - Anti-islanding methods

Lecture 16 - Solid state circuit switching

Lecture 17 - Relaying for distributed generation

Lecture 18 - Feeder voltage regulation

Lecture 19 - Grounding, distribution protection coordination problems and examples

Lecture 20 - Ring and network distribution

Lecture 21 - Economic evaluation of DG systems

Lecture 22 - Design for effective initial cost

Lecture 23 - Single phase inverters

Lecture 24 - DC bus design in voltage source inverter

Lecture 25 - Electrolytic capacitor reliability and lifetime

Lecture 26 - Inverter switching and average model

Lecture 27 - Common mode and differential mode model of inverters

Lecture 28 - Two leg single phase inverter

Lecture 29 - Distribution system problems, and examples

Lecture 30 - DG evaluation problems and examples

Lecture 31 - Switch selection in two level voltage source inverters and loss evaluation

[Lecture 32 - Thermal model, management and cycling failure of IGBT modules](#)

[Lecture 33 - Semiconductor switch design reliability considerations](#)

[Lecture 34 - AC filters for grid connected inverters](#)

[Lecture 35 - AC inductor design and need for LCL filter](#)

[Lecture 36 - LCL filter design](#)

[Lecture 37 - Examples in power electronic design for DG systems](#)

[Lecture 38 - Examples in power electronic design for DG systems continued](#)

[Lecture 39 - Higher order passive damping design for LCL filters](#)

[Lecture 40 - Balance of hardware component for inverters in DG systems](#)

Lecture 1 - Electronic switches

Lecture 2 - DC - DC converters

Lecture 3 - DC - AC converters

Lecture 4 - Multilevel converters - I

Lecture 5 - Multilevel converters - II

Lecture 6 - Applications of voltage source converter - I

Lecture 7 - Applications of voltage source converter - II

Lecture 8 - Applications of voltage source converter - III

Lecture 9 - Purpose of PWM - I

Lecture 10 - Purpose of PWM - II

Lecture 11 - Low switching frequency PWM - I

Lecture 12 - Low switching frequency PWM - II

Lecture 13 - Selective harmonic elimination

Lecture 14 - Off-line optimized pulsewidth modulation

Lecture 15 - Sine-triangle pulsewidth modulation

Lecture 16 - Harmonic injection pulsewidth modulation

Lecture 17 - Bus-clamping pulsewidth modulation

Lecture 18 - Triangle-comparison based PWM for three-phase inverter

Lecture 19 - Concept of space vector

Lecture 20 - Conventional space vector PWM

Lecture 21 - Space vector based bus-clamping PWM

Lecture 22 - Space vector based advanced bus-clamping PWM

Lecture 23 - Harmonic analysis of PWM techniques

Lecture 24 - Analysis of RMS line current ripple using the notion of stator flux ripple

Lecture 25 - Evaluation of RMS line current ripple using the notion of stator flux ripple

Lecture 26 - Analysis and design of PWM techniques from line current ripple perspective

Lecture 27 - Instantaneous and average dc link current in a voltage source inverter

Lecture 28 - DC link current and DC capacitor current in a voltage source inverter

Lecture 29 - Analysis of torque ripple in induction motor drives - I

Lecture 30 - Analysis of torque ripple in induction motor drives - II

Lecture 31 - Evaluation of conduction loss in three-phase inverter

[Lecture 32 - Evaluation of switching loss in three-phase inverter](#)

[Lecture 33 - Design of PWM for reduced switching loss in three-phase inverter](#)

[Lecture 34 - Effect of dead-time on inverter output voltage for continuous PWM schemes](#)

[Lecture 35 - Effect of dead-time on inverter output voltage for bus-clamping PWM schemes](#)

[Lecture 36 - Analysis of overmodulation in sine-triangle PWM from space vector perspective](#)

[Lecture 37 - Overmodulation in space vector modulated inverter](#)

[Lecture 38 - PWM for three-level neutral-point-clamped inverter - I](#)

[Lecture 39 - PWM for three-level neutral-point-clamped inverter - II](#)

[Lecture 40 - PWM for three-level neutral-point-clamped inverter - III](#)

Lecture 1 - Introduction to DC-DC converter

Lecture 2 - Diode

Lecture 3 - Controlled Switches

Lecture 4 - Prior Art

Lecture 5 - Inductor

Lecture 6 - Transformer

Lecture 7 - Capacitor

Lecture 8 - Issues related to switches

Lecture 9 - Energy storage - Capacitor

Lecture 10 - Energy storage - Inductor

Lecture 11 - Primitive Converter

Lecture 12 - Non-Isolated converter - I

Lecture 13 - Non-Isolated converter - II

Lecture 14 - Isolated Converters - I

Lecture 15 - Isolated Converters - II

Lecture 16 - Conduction Mode

Lecture 17 - Problem set - I

Lecture 18 - Problem set - II

Lecture 19 - Modeling DC-DC converters

Lecture 20 - State space representation - I

Lecture 21 - State Space representation - II

Lecture 22 - Circuit Averaging - I

Lecture 23 - Circuit Averaging - II

Lecture 24 - State Space Model of Boost Converter

Lecture 25 - DC-DC converter controller

Lecture 26 - Controller Structure

Lecture 27 - PID Controller - I

Lecture 28 - PID Controller - II

Lecture 29 - PID Controller - III

Lecture 30 - Implementation of PID controller

Lecture 31 - Pulse Width Modulator

[Lecture 32 - Controller Design - I](#)

[Lecture 33 - Controller Design - II](#)

[Lecture 34 - Controllers and Sensing Circuit](#)

[Lecture 35 - Regulation of Multiple outputs - I](#)

[Lecture 36 - Regulation of Multiple outputs - II](#)

[Lecture 37 - Current Control](#)

[Lecture 38 - Unity Power Factor Converter](#)

[Lecture 39 - Magnetic Design](#)

[Lecture 40 - DC-DC Converter Design](#)

Lecture 1 - Basic Electrical Technology

Lecture 2 - Passive Components

Lecture 3 - Sources

Lecture 4 - Kirchoff's Law

Lecture 5 - Modelling of Circuit - Part 1

Lecture 6 - Modelling of Circuit - Part 2

Lecture 7 - Analysis Using MatLab

Lecture 8 - Sinusoidal steady state

Lecture 9 - Transfer Function and Pole Zero domain

Lecture 10 - Transfer function & pole zero

Lecture 11 - The Sinusoid

Lecture 12 - Phasor Analysis - Part 1

Lecture 13 - Phasor Analysis - Part 2

Lecture 14 - Power Factor

Lecture 15 - Power ports

Lecture 16 - Transformer Basics - Part 1

Lecture 17 - Transformer Basics - Part 2

Lecture 18 - Transformer Basics - Part 3

Lecture 19 - The Practical Transformer - Part 1

Lecture 20 - The Practical Transformer - Part 2

Lecture 21 - The Practical Transformer - Part 3

Lecture 22 - DC Machines - Part 1

Lecture 23 - DC Machines - Part 2

Lecture 24 - DC Generators - Part 1

Lecture 25 - DC Generators - Part 2

Lecture 26 - DC Motors - Part 1

Lecture 27 - DC Motors - Part 2

Lecture 28 - DC Motors - Part 3

Lecture 29 - Three Phase System - Part 1

Lecture 30 - Three Phase System - Part 2

Lecture 31 - Three Phase System - Part 3

[Lecture 32 - Three Phase System - Part 4](#)

[Lecture 33 - Three Phase Transformer - Part 1](#)

[Lecture 34 - Three Phase Transformer - Part 2](#)

[Lecture 35 - Induction Motor - Part 1](#)

[Lecture 36 - Induction Motor - Part 2](#)

[Lecture 37 - Induction Motor - Part 3](#)

[Lecture 38 - Induction Motor - Part 4](#)

[Lecture 39 - Synchronous Machine](#)

- Lecture 1 - Electric Drive
- Lecture 2 - Controlled Rectifier - Part-1
- Lecture 3 - Controlled Rectifier - Part-2 (Three phase)
- Lecture 4 - Controlled Rectifier - Part-3 (Three phase)
- Lecture 5 - Controlled Rectifier - Part-4 (Three Phase)
- Lecture 6 - Controlled Rectifier - Part-5 (Three Phase)
- Lecture 7 - Power Electronics Improvements
- Lecture 8 - Four Quadrant Dc to Dc Converter
- Lecture 9 - Sine Triangle PWM Control of Converter
- Lecture 10 - Front-end Ac-Dc Converter with harmonic control
- Lecture 11 - Ac to Dc Converter Close Loop Control Schematic
- Lecture 12 - Ac-Dc Converter Close loop Control Block Diagram
- Lecture 13 - Design of the Converter Controller & AC to DC
- Lecture 14 - Front-End Ac to Dc Converter-Design
- Lecture 15 - Front-End Ac to Dc Converter - Simulation study
- Lecture 16 - Dc Motor Speed Control - Introduction
- Lecture 17 - Dc Motor Speed Control - Block Diagram
- Lecture 18 - Dc Motor Speed Control Current Control & S C L
- Lecture 19 - Dc-Motor Speed Control Controller Design - Part-1
- Lecture 20 - Dc Motor Speed Control Controller Design - Part-2
- Lecture 21 - Dc Motor Speed Control Controller Design - Part-3
- Lecture 22 - Basics of DC to AC Converter - Part-1
- Lecture 23 - Basics of DC to AC Converter - Part-2
- Lecture 24 - Inverter Sine Triangle PWM
- Lecture 25 - Inverter - Current Hysteresis Controlled PWM
- Lecture 26 - C H controlled & Basics of space vector PWM
- Lecture 27 - Space Vector PWM - Part-2
- Lecture 28 - Space Vector PWM - Part-3
- Lecture 29 - Space Vector PWM Signal Generation
- Lecture 30 - Speed Control of Induction Motor - Part-1
- Lecture 31 - Speed Control of Induction Motor - Part-2

[Lecture 32 - High dynamic performance of I M Drive](#)

[Lecture 33 - Dynamic Model of Induction Motor - Part-1](#)

[Lecture 34 - Dynamic Model of Induction Motor - Part-2](#)

[Lecture 35 - Vector Control of Induction Motor](#)

[Lecture 36 - Effect of Switching Time lag in Inverter](#)

[Lecture 37 - Power Switch Protection - Snubbers](#)

Lecture 1 - Introduction to IOTs - Part I

Lecture 2 - Introduction to IOTs - Part II

Lecture 3 - Introduction to IOTs - Examples

Lecture 4 - IOT applications - I

Lecture 5 - IOT applications - II

Lecture 6 - Power management in IOT device

Lecture 7 - Introduction to LDO

Lecture 8 - Design with an LDO

Lecture 9 - Introduction to switching regulators

Lecture 10 - Designing with LDO's, switching regulators and case studies - Part I

Lecture 11 - Designing with LDO's, switching regulators and case studies - Part II

Lecture 12 - Designing with LDO's, switching regulators and case studies - Part II

Lecture 13 - Designing with LDO's, switching regulators and case studies - Part IV

Lecture 14 - Power Conditioning with Energy Harvesters - I

Lecture 15 - Power Conditioning with Energy Harvesters - II

Lecture 16 - Power Conditioning with Energy Harvesters - III

Lecture 17 - Battery less power supply and battery life calculation for embedded devices - I

Lecture 18 - Battery less power supply and battery life calculation for embedded devices - II

Lecture 19 - Battery less power supply and battery life calculation for embedded devices - III

Lecture 20 - Introduction to MQTT

Lecture 21 - Quality of Service in MQTT

Lecture 22 - Standards and Security in MQTT

Lecture 23 - Introduction and Implementation of AMQP

Lecture 24 - Implementation of CoAP and MDNS

Lecture 25 - Basics of RFID

Lecture 26 - RFID protocol and applications

Lecture 27 - BLE Security

Lecture 28 - LPWAN technologies

Lecture 29 - Choice of Microcontrollers

Lecture 30 - Case Study 1 - Joule Jotter

Lecture 31 - Case Study 2 - Cloud Based Systems

Lecture 1 - Advantages of HVAC/DC Transmission, Introduction to Grid Management

Lecture 2 - Transmission system development, Important components of transmission system

Lecture 3 - Insulation coordination, over voltage in power systems

Lecture 4 - Design/selection of insulators, Importance of grading/cc rings

Lecture 5 - Non ceramic insulators performance-service experience

Lecture 6 - Failure of apparatus in the field, importance of reliability and testing

Lecture 7 - Pollution flashover phenomena, modeling etc

Lecture 8 - Planning of High Voltage laboratories

Lecture 9 - Importance of High Voltage testing and techniques employed

Lecture 10 - Basic philosophy of HV testing, tests for various HV apparatus

Lecture 11 - HV testing techniques for various apparatus

Lecture 12 - HV testing on Composite Insulators

Lecture 13 - Surface degradation studies on composite insulators

Lecture 14 - Surface morphological techniques for composite insulators

Lecture 15 - Conductors used for EHV/UHV transmission

Lecture 16 - Corona and interference on transmission lines

Lecture 17 - Introduction of HTLS conductors and their advantages

Lecture 18 - Mechanical considerations for HV conductors

Lecture 19 - Introduction to Towers and importance of foundations

Lecture 20 - Selection/Design of clearances for HV towers

Lecture 21 - Design Optimization for UHV towers

Lecture 22 - Introduction to 1100kV HVDC

Lecture 23 - Introduction to HV Substations

Lecture 24 - Types of Substations, comparison

Lecture 25 - Insulation coordination, Components in a typical substation

Lecture 26 - Preventive maintenance of Substation

Lecture 27 - Electric and magnetic fields, mitigations techniques

Lecture 28 - Importance of Grounding, reducing Earthing resistance

Lecture 29 - Introduction to the use of Fiber optic cables, OPGW

Lecture 30 - Introduction to communication and SCADA

Lecture 31 - Precautions and safety measures in substation

[Lecture 32 - Electrical hazards, minimum clearances in substation](#)

[Lecture 33 - Importance of Generation of HVDC in the laboratory](#)

[Lecture 34 - Importance of Generation of HVAC, Impulse Voltage and Currents in the laboratory](#)

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NPTEL : NOC:Electronics Equipment Integration and Prototype Building (Electrical Engineering)

Co-ordinators : Prof. N.V.Chalapathi Rao

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- Lecture 2 - Examples from real life: Parts to system
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- Lecture 7 - Top down, outside to internals
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- Lecture 9 - Details of displays and keys
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- Lecture 11 - Mass production in sheet metal
- Lecture 12 - Prototyping of user interfaces for concepts
- Lecture 13 - Stacking of equipment to make a system
- Lecture 14 - Recapitulating a sub system
- Lecture 15 - Off the shelf enclosures and making a user interface
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- Lecture 17 - Representation on paper
- Lecture 18 - Example features of surfaces and solids
- Lecture 19 - Simple and curved surfaces
- Lecture 20 - Describing inclined surfaces
- Lecture 21 - Basics of engineering Drawing
- Lecture 22 - Introduction to sizing and fits
- Lecture 23 - Practical mechanical assemblies
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- Lecture 25 - Solid modelling
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- Lecture 28 - Dimensioning of electronics components
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- Lecture 7 - Resuming a simulation in Octave
- Lecture 8 - PV cell model - review
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Lecture 8 - Introduction to electrical equivalent circuit models for biological systems

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Lecture 17 - Marton's conditional transportation cost inequality

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- Lecture 4 - Lab 2 - Cleanroom and Gowning Protocol
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- Lecture 11 - Lab 3 - Lithography: Demonstration
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- Lecture 13 - Tunnel diodes and Introduction to Gunn diodes
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- Lecture 15 - Introduction to MESFETs
- Lecture 16 - Advanced concepts of GaAs MESFETs
- Lecture 17 - GaAs MESFET fabrication and practical aspects
- Lecture 18 - Practical aspects of FET design and small-signal model
- Lecture 19 - GaAs MESFETs: cut-off frequency and aspects of power devices
- Lecture 20 - GaAs MESFETs for power amplifiers
- Lecture 21 - Modulation doping in compound semiconductors
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- Lecture 23 - Design issues and methodology for microwave HEMTs
- Lecture 24 - Small-signal model and noise in HEMTs
- Lecture 25 - The concept of pseudomorphic or pHEMTs
- Lecture 26 - Multi-finger HEMTs
- Lecture 27 - pHEMTs for low noise and introduction to InP HEMT
- Lecture 28 - InP HEMTs for power and the concept of metamorphic HEMTs
- Lecture 29 - AlGaIn/GaN HEMT: applications, structure, substrates and FOM
- Lecture 30 - AlGaIn/GaN HEMT: device basics, current collapse and passivation
- Lecture 31 - AlGaIn/GaN HEMT: gate process, field-plate and trade-offs in design

- Lecture 32 - AlGaIn/GaN HEMT: Practical aspects and commercial HEMTs
- Lecture 33 - GaN RF HEMT on eval board, and emerging topics of research
- Lecture 34 - Linearity in GaN HEMTs - A device perspective
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- Lecture 37 - RF MOSFET Layout and RF Silicon-on-insulator
- Lecture 38 - Noise in MOSFETs and Introduction to LDMOS
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- Lecture 41 - LDMOS: HCI, snapback, finger layout and some aspects of commercial devices
- Lecture 42 - BJT: common base and common emitter from the device point of view
- Lecture 43 - BJT: Kirk effect, Ebers-Moll model and base transit time
- Lecture 44 - BJT: small-signal model, gain and cut-off frequency
- Lecture 45 - BJT: Emitter and base designs and drift transistor
- Lecture 46 - Collector design in modern BJT and Introduction to HBTs
- Lecture 47 - HBT: base current and collapse of the current gain
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- Lecture 49 - SiGe HBT: various resistances and capacitances, scaling and aspects of BiCMOS
- Lecture 50 - Basics of microwave: transmission line theory
- Lecture 51 - Waveguides, T-lines and introduction to 2-port networks
- Lecture 52 - S-parameters and the basics of Smith Chart
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- Lecture 55 - Passives in microwave circuits
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- Lecture 57 - More on passive elements in microwave circuits
- Lecture 58 - On-wafer measurement and S-parameters
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- Lecture 32 - Nobel Identities & The Haar Wave Packet Transform
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- Lecture 34 - Constructing the Lattice & its Variants
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- Lecture 37 - Modulation Analysis and The 3-Band Filter Bank, Applications
- Lecture 38 - The Applications *Data Mining, *Face Recognition
- Lecture 39 - Proof that a non-zero function can not be both time and band-limited
- Lecture 40 - M-Band Filter Banks and Looking Ahead
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- Lecture 44 - Tutorial on Two band Filter Bank
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- Lecture 46 - Zoom in and Zoom out using Wavelet Transform
- Lecture 47 - More Thoughts on Wavelets : Zooming In
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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Advanced VLSI Design (Electronics and Communication Engineering)

Co-ordinators : Prof. A.N. Chandorkar, Prof. D.K. Sharma, Prof. Sachin Patkar, Prof. Virendra Singh

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Lecture 11 - Bandpass Signal Representation (Part-2)

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Co-ordinators : Dr. Debabrata Sikdar, Dr. Debabrata Sikdar

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NPTEL : NOC:Estimation for Wireless Communications, MIMO, OFDM Cellular and Sensor Networks (Electronics and Communication Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

Lecture 1 - Basics - Sensor Network and Noisy Observation Model

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Lecture 29 - Example Orthogonal Frequency Division Multiplexing OFDM $\hat{\theta}$ – Transmission of Samples with Cyclic Prefix

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Lecture 4 - Introduction to Linear Block Codes, Generator Matrix and Parity Check Matrix

Lecture 5 - Syndrome, Error Correction and Error Detection

Lecture 6 - Problem Solving Session - I

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**NPTEL : NOC:Bayesian, MMSE Estimation for Wireless Communications MIMO, OFDM Cellular and Sensor Networks
(Electronics and Communication Engineering)**

Co-ordinators : Prof. Aditya K. Jagannatham

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Lecture 3 - Derivation of Minimum Mean Squared Error MMSE Estimate for Gaussian Parameter \hat{A} – Part I

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Lecture 3 - Elements in series and parallel; Superposition in linear circuits

Lecture 4 - Controlled sources; Determining the characteristics of a two terminal element; Realizing a resistor using a VCCS or a CCVS

Lecture 5 - Nodal analysis of a network with conductances and current sources; Setting up the equations; Conductance matrix; Superposition

Lecture 6 - Circuit analysis; Number of KCL and KVL equations in a circuit; Nodal analysis of a network with conductances and current sources; Setting up the equations; Conductance matrix;

Lecture 7 - Nodal analysis with voltage sources and controlled sources; Brief introduction to modified nodal analysis; Use of supernode to solve circuits with voltage sources; Superposition theorem

Lecture 8 - Mesh analysis of a circuit with resistors and voltage sources; Comparison with nodal analysis; Mesh analysis of circuits with current sources-supermesh

Lecture 9 - Choice of nodal versus mesh analysis; Circuit theorems: Pushing a voltage source through a node, splitting a current source, substitution theorem, superposition

Lecture 10 - Thevenin and Norton (theorem and) equivalent circuits; Power conservation in a circuit

Lecture 11 - Tellegen's theorem; Reciprocity theorem

Lecture 12 - Compensation Theorem; Two ports

Lecture 13 - Two port parameters-y parameters

Lecture 14 - Two port parameters(z, h, and g); Reciprocal two ports

Lecture 15 - Opamp, ideal opamp circuits, non-inverting and inverting amplifiers; Ensuring that the opamp has negative feedback

Lecture 16 - RC circuit natural response; First order differential equation

Lecture 17 - RC (first-order) circuit, complete response with step inputs; Transient(natural) and steady state(forced) responses; Zero-state and zero-input responses

Lecture 18 - Step response of RC circuit with loops of voltage sources and capacitors; RL circuits; RLC circuits

Lecture 19 - Second order(RLC circuit) natural response; Series and parallel RLC circuits; Differential equation-characteristic equation and solutions; Forced response of a second order circuit

Lecture 20 - General formulation of second order(RLC circuit) natural response; Natural frequency and damping/quality factor; Series/parallel RLC circuits; R, L, C in sinusoidal steady state

Lecture 21 - Sinusoidal steady state response of RC and RLC circuits

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Lecture 3 - Voltage

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Lecture 6 - Kirchhoff's Voltage law (KVL)

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Lecture 16 - Series connection of R, L, C, current source

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Lecture 3 - Processor core VS CPU core, ARM7TDMI Interface signals, Memory Interface, Bus Cycle types, Register set, Operational Modes

Lecture 4 - Instruction Format, ARM Core Data Flow Model, ARM 3 stage Pipeline, ARM family attribute comparison

Lecture 5 - ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution

Lecture 6 - ARM ISA and Processor Variants, Different Types of Instructions, ARM Instruction set, data processing instructions

Lecture 7 - Shift Operations, shift Operations using RS lower byte, Immediate value encoding

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NPTEL : NOC:Networks and Systems (Electronics and Communication Engineering)

Co-ordinators : Prof. V.G.K. Murti, Mr. C. S. Ramalingam, Dr. Andrew Thangaraj

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Nanoelectronics: Devices and Materials (Electronics and Communication Engineering)

Co-ordinators : Dr. Navakanta Bhat, Prof. K.N. Bhat, Dr. S.A. Shivashankar

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- Lecture 30 - Decision making in System Design (Continued...)

NPTEL : Vehicle Dynamics (Engineering Design)

Co-ordinators : Dr. R. Krishnakumar

Lecture 1 - Introduction to Vehicle Dynamics

Lecture 2 - Longitudinal Dynamics

Lecture 3 - Vehicle Load Distribution - Acceleration and Braking

Lecture 4 - Brake Force Distribution, Braking Efficiency and Braking Distance

Lecture 5 - Tractor - Semi Trailer

Lecture 6 - Tire Mechanics - An Introduction

Lecture 7 - Mechanical Properties of Rubber

Lecture 8 - Slip, Grip and Rolling Resistance

Lecture 9 - Tire Construction and Force Development

Lecture 10 - Contact Patch and Contact Pressure Distribution

Lecture 11 - Tire Brush Model

Lecture 12 - Lateral Force Generation

Lecture 13 - Ply Steer and Conicity - Part 1

Lecture 14 - Ply Steer and Conicity - Part 2

Lecture 15 - Tire Models - Magic Formula

Lecture 16 - Classification of Tyre Models and Combined Slip

Lecture 17 - Lateral Dynamics - An Introduction

Lecture 18 - Lateral Dynamics - Bicycle Model

Lecture 19 - Lateral Dynamics - Stability and Steering Conditions

Lecture 20 - Understeer Gradient and State Space Approach

Lecture 21 - Handling Response of a Vehicle

Lecture 22 - Mimuro Plot for Lateral Transient Response - Part 1

Lecture 23 - Mimuro Plot for Lateral Transient Response - Part 2

Lecture 24 - Parameters affecting vehicle handling characteristics

Lecture 25 - Subjective and Objective Evaluation of Vehicle Handling - Part 1

Lecture 26 - Subjective and Objective Evaluation of Vehicle Handling - Part 2

Lecture 27 - Subjective and Objective Evaluation of Vehicle Handling and Rollover P

Lecture 28 - Rollover Prevention (Continued...) and Vertical Dynamics

Lecture 29 - Vertical Dynamics - An Introduction

Lecture 30 - Vertical Dynamics - Quarter Car Model

Lecture 31 - Noise, Vibration and Harshness - Random Processes

Lecture 1 - Introduction to Control Systems - Part 1

Lecture 2 - Introduction to Control Systems - Part 2

Lecture 3 - Overview of Feedback Control Systems - Part 1

Lecture 4 - Overview of Feedback Control Systems - Part 2

Lecture 5 - Mathematical Preliminaries - Part 1

Lecture 6 - Mathematical Preliminaries - Part 2

Lecture 7 - Transfer Function - Part 1

Lecture 8 - Transfer Function - Part 2

Lecture 9 - System Response - Part 1

Lecture 10 - System Response - Part 2

Lecture 11 - BIBO Stability - Part 1

Lecture 12 - BIBO Stability - Part 2

Lecture 13 - Effect of Zeros - Part 1

Lecture 14 - Effect of Zeros - Part 2

Lecture 15 - Closed Loop System - Part 1

Lecture 16 - Closed Loop System - Part 2

Lecture 17 - First Order Systems - Part 1

Lecture 18 - First Order Systems - Part 2

Lecture 19 - Second Order Systems - Part 1

Lecture 20 - Second Order Systems - Part 2

Lecture 21 - Controllers - Part 1

Lecture 22 - Controllers - Part 2

Lecture 23 - Closed Loop Control - Part 1

Lecture 24 - Closed Loop Control - Part 2

Lecture 25 - Routh's Stability Criterion - Part 1

Lecture 26 - Routh's Stability Criterion - Part 2

Lecture 27 - Special Cases of Routh's Stability Criterion - Part 1

Lecture 28 - Special Cases of Routh's Stability Criterion - Part 2

Lecture 29 - Performance Specifications - Part 1

Lecture 30 - Performance Specifications - Part 2

Lecture 31 - Steady State Error Analysis - Part 1

[Lecture 32 - Steady State Error Analysis - Part 2](#)

[Lecture 33 - Root Locus 1 - Part 1](#)

[Lecture 34 - Root Locus 1 - Part 2](#)

[Lecture 35 - Root Locus 2 - Part 1](#)

[Lecture 36 - Root Locus 2 - Part 2](#)

[Lecture 37 - Root Locus 3 - Part 1](#)

[Lecture 38 - Root Locus 3 - Part 2](#)

[Lecture 39 - Root Locus 4 - Part 1](#)

[Lecture 40 - Root Locus 4 - Part 2](#)

[Lecture 41 - Case Study - Modelling - Part 1](#)

[Lecture 42 - Case Study - Modelling - Part 2](#)

[Lecture 43 - Case Study - Control Design - Part 1](#)

[Lecture 44 - Case Study - Control Design - Part 2](#)

[Lecture 45 - State Space Representation - Part 1](#)

[Lecture 46 - State Space Representation - Part 2](#)

[Lecture 47 - Frequency Response - Part 1](#)

[Lecture 48 - Frequency Response - Part 2](#)

[Lecture 49 - Bode Plot 1 - Part 1](#)

[Lecture 50 - Bode Plot 1 - Part 2](#)

[Lecture 51 - Bode Plot 2 - Part 1](#)

[Lecture 52 - Bode Plot 2 - Part 2](#)

[Lecture 53 - Bode Plot 3 - Part 1](#)

[Lecture 54 - Bode Plot 3 - Part 2](#)

[Lecture 55 - Bode Plot 4 - Part 1](#)

[Lecture 56 - Bode Plot 4 - Part 2](#)

[Lecture 57 - Nyquist Plot 1 - Part 1](#)

[Lecture 58 - Nyquist Plot 1 - Part 2](#)

[Lecture 59 - Nyquist Plot 2 - Part 1](#)

[Lecture 60 - Nyquist Plot 2 - Part 2](#)

[Lecture 61 - Nyquist Stability Criterion - Part 1](#)

[Lecture 62 - Nyquist Stability Criterion - Part 2](#)

[Lecture 63 - Relative Stability 1 - Part 1](#)

[Lecture 64 - Relative Stability 1 - Part 2](#)

[Lecture 65 - Relative Stability 2 - Part 1](#)

[Lecture 66 - Relative Stability 2 - Part 2](#)

[Lecture 67 - Lead Compensation - Part 1](#)

[Lecture 68 - Lead Compensation - Part 2](#)

[Lecture 69 - Lead Compensator Design - Part 1](#)

[Lecture 70 - Lead Compensator Design - Part 2](#)

[Lecture 71 - Lag and Lag-Lead Compensation - Part 1](#)

[Lecture 72 - Lag and Lag-Lead Compensation - Part 2](#)

[Lecture 1 - Course Overview and Classification of Internal Combustion Engines - Part 1](#)

[Lecture 2 - Course Overview and Classification of Internal Combustion Engines - Part 2](#)

[Lecture 3 - Engine Components - Part 1](#)

[Lecture 4 - Engine Components - Part 2](#)

[Lecture 5 - Operation of Four Stroke Engines - Part 1](#)

[Lecture 6 - Operation of Four Stroke Engines - Part 2](#)

[Lecture 7 - Two Stroke Engine and Engine Cycles - Part 1](#)

[Lecture 8 - Two Stroke Engine and Engine Cycles - Part 2](#)

[Lecture 9 - Otto Cycle and Diesel Cycle - Part 1](#)

[Lecture 10 - Otto Cycle and Diesel Cycle - Part 2](#)

[Lecture 11 - Dual Cycle and Engine Performance - Part 1](#)

[Lecture 12 - Dual Cycle and Engine Performance - Part 2](#)

[Lecture 13 - Engine Performance - Part 1](#)

[Lecture 14 - Engine Performance - Part 2](#)

[Lecture 15 - Supercharging and Combustion in SI Engines - Part 1](#)

[Lecture 16 - Supercharging and Combustion in SI Engines - Part 2](#)

[Lecture 17 - Knocking in SI Engines - Part 1](#)

[Lecture 18 - Knocking in SI Engines - Part 2](#)

[Lecture 19 - Combustion in CI Engines and Carburetion - Part 1](#)

[Lecture 20 - Combustion in CI Engines and Carburetion - Part 2](#)

[Lecture 21 - Fuel Introduction Systems - Part 1](#)

[Lecture 22 - Fuel Introduction Systems - Part 2](#)

[Lecture 23 - Analysis of Carburetor - Part 1](#)

[Lecture 24 - Analysis of Carburetor - Part 2](#)

[Lecture 25 - Engine Emissions - Part 1](#)

[Lecture 26 - Engine Emissions - Part 2](#)

[Lecture 27 - Emission Control Systems - Part 1](#)

[Lecture 28 - Emission Control Systems - Part 2](#)

[Lecture 29 - Automotive Powertrain - Part 1](#)

[Lecture 30 - Automotive Powertrain - Part 2](#)

[Lecture 31 - Automotive Clutch - Part 1](#)

[Lecture 32 - Automotive Clutch - Part 2](#)

[Lecture 33 - Transmission - Part 1](#)

[Lecture 34 - Transmission - Part 2](#)

[Lecture 35 - Powertrain Analysis - Part 1](#)

[Lecture 36 - Powertrain Analysis - Part 2](#)

[Lecture 37 - Powertrain Analysis 2 - Part 1](#)

[Lecture 38 - Powertrain Analysis 2 - Part 2](#)

[Lecture 39 - Transmission Matching - Part 1](#)

[Lecture 40 - Transmission Matching - Part 2](#)

[Lecture 41 - Brake System - Part 1](#)

[Lecture 42 - Brake System - Part 2](#)

[Lecture 43 - Components of a Brake System and Drum Brake - Part 1](#)

[Lecture 44 - Components of a Brake System and Drum Brake - Part 2](#)

[Lecture 45 - Disc Brake and Introduction to Hydraulic Brake - Part 1](#)

[Lecture 46 - Disc Brake and Introduction to Hydraulic Brake - Part 2](#)

[Lecture 47 - Hydraulic Brake System - Part 1](#)

[Lecture 48 - Hydraulic Brake System - Part 2](#)

[Lecture 49 - Air Brake System - Part 1](#)

[Lecture 50 - Air Brake System - Part 2](#)

[Lecture 51 - Antilock Brake System 1 - Part 1](#)

[Lecture 52 - Antilock Brake System 1 - Part 2](#)

[Lecture 53 - Antilock Brake System 2 - Part 1](#)

[Lecture 54 - Antilock Brake System 2 - Part 2](#)

[Lecture 55 - Braking Analysis - Part 1](#)

[Lecture 56 - Braking Analysis - Part 2](#)

[Lecture 57 - Steering System - Part 1](#)

[Lecture 58 - Steering System - Part 2](#)

[Lecture 59 - Manual Steering Systems - Part 1](#)

[Lecture 60 - Manual Steering Systems - Part 2](#)

[Lecture 61 - Power Steering and Kinematic Steering Analysis - Part 1](#)

[Lecture 62 - Power Steering and Kinematic Steering Analysis - Part 2](#)

[Lecture 63 - Wheel Alignment - Part 1](#)

[Lecture 64 - Wheel Alignment - Part 2](#)

[Lecture 65 - Introduction to Suspension System - Part 1](#)

[Lecture 66 - Introduction to Suspension System - Part 2](#)

[Lecture 67 - Shock Absorbers and Independent Suspension - Part 1](#)

[Lecture 68 - Shock Absorbers and Independent Suspension - Part 2](#)

[Lecture 69 - Dependent Suspension and Suspension Analysis - Part 1](#)

[Lecture 70 - Dependent Suspension and Suspension Analysis - Part 2](#)

[Lecture 71 - Introduction to Electric and Hybrid Powertrain - Part 1](#)

[Lecture 72 - Introduction to Electric and Hybrid Powertrain - Part 2](#)

[Lecture 73 - Tyres - Part 1](#)

[Lecture 74 - Tyres - Part 2](#)

Lecture 1 - Introduction

Lecture 2 - Birth and Growth of a Product

Lecture 3 - Types of Design

Lecture 4 - Stage-Gate and Spiral Design

Lecture 5 - Stages in New Product Development

Lecture 6 - Laboratory Exercise - 1

Lecture 7 - Reverse Engg. and Redesign

Lecture 8 - Technical Questioning and Mission Statement

Lecture 9 - Mission Statement- Examples

Lecture 10 - Laboratory Exercise - 2

Lecture 11 - Identifying Customer Needs

Lecture 12 - Customer Need Analysis

Lecture 13 - Product Specifications

Lecture 14 - Laboratory Exercise - 3

Lecture 15 - Need - Metric Matrix

Lecture 16 - Establishing Target Specifications

Lecture 17 - HoQ

Lecture 18 - Laboratory Exercise - 4

Lecture 19 - Functional Decomposition

Lecture 20 - FAST Method

Lecture 21 - Laboratory Exercise - 5

Lecture 22 - Function Structure (Flow Method)

Lecture 23 - Flow Method Examples

Lecture 24 - Laboratory Exercise - 6

Lecture 25 - Product and Portfolio Architecture

Lecture 26 - Portfolio Architecture Selection

Lecture 27 - Laboratory Exercise - 7

Lecture 28 - Product Architecture

Lecture 29 - Identification of Modules

Lecture 30 - Laboratory Exercise - 8

Lecture 31 - Concept Development

[Lecture 32 - Intuitive Methods](#)

[Lecture 33 - Laboratory Exercise - 9](#)

[Lecture 34 - Logical Method- TRIZ](#)

[Lecture 35 - Concept Selection](#)

[Lecture 36 - Laboratory Exercise - 10](#)

[Lecture 37 - Concept Scoring](#)

[Lecture 38 - Laboratory Exercise - 11](#)

Lecture 1 - Introduction

Lecture 2 - Evolution of Robotics

Lecture 3 - Kinematics- Coordinate transformations

Lecture 4 - Homogeneous Transformation Matrix

Lecture 5 - Industrial Robot- Kinematic Structures

Lecture 6 - Robot Architectures

Lecture 7 - Kinematic Parameters

Lecture 8 - DH Algorithm

Lecture 9 - DH Algorithm- Examples

Lecture 10 - Forward Kinematics

Lecture 11 - Forward Kinematics- Examples

Lecture 12 - Inverse Kinematics

Lecture 13 - Inverse Kinematics- Examples

Lecture 14 - Differential Relations

Lecture 15 - Manipulator Jacobian and Statics

Lecture 16 - Overview of Electric Actuators and Operational Needs

Lecture 17 - Principles of DC Motor Operation

Lecture 18 - DC Motor Equations and Principles of Control

Lecture 19 - DC Motor Control Regions and Principles of Power Electronics

Lecture 20 - Power Electronic Switching and Current Ripple

Lecture 21 - The H-Bridge and DC Motor Control Structure

Lecture 22 - The Brushless DC Machine

Lecture 23 - Control of the Brushless DC Motor

Lecture 24 - The PM Synchronous Motor (PMSM) and SPWM

Lecture 25 - Principles of PMSM Control

Lecture 26 - Encoders for Speed and Position Estimation

Lecture 27 - Stepper Motors

Lecture 28 - Introduction to Probabilistic Robotics.

Lecture 29 - Recursive State Estimation: Bayes Filter

Lecture 30 - Recursive State Estimation: Bayes Filter Illustration

Lecture 31 - Probability basics

[Lecture 32 - Probability basics](#)

[Lecture 33 - Kalman Filter](#)

[Lecture 34 - Extended Kalman Filter](#)

[Lecture 35 - Particle Filter](#)

[Lecture 36 - Binary Bayes](#)

[Lecture 37 - Velocity Motion Model](#)

[Lecture 38 - Odometry Motion Model](#)

[Lecture 39 - Occupa Grid Mapping](#)

[Lecture 40 - Range Finder Measurement Model](#)

[Lecture 41 - Localization Taxonomy](#)

[Lecture 42 - Markov Localization](#)

[Lecture 43 - Path Planning](#)

Lecture 1 - Introduction to Japanese scripts

Lecture 2 - Jiko shoukai (Self introduction)

Lecture 3 - Dochira kara desu ka (Where are you from?)

Lecture 4 - Senmon wa nan desu ka (What is your specialization?)

Lecture 5 - Kore wa hon desu (This is a book)

Lecture 6 - Ikura desu ka (How much is it?)

Lecture 7 - Ima nan-ji desu ka (What is the time now?)

Lecture 8 - Kaigi wa roku-ji-han kara desu (The meeting is from 6:30)

Lecture 9 - Ashita Tokyo e ikimasu. (I will go to Tokyo tomorrow)

Lecture 10 - Watashi wa mainichi roku-ji ni okimasu (I wake up at 6â€™oclock everyday)

Lecture 11 - Itsu Kanpur e kimashita ka (When did you come to Kanpur?)

Lecture 12 - Y?binkyoku wa asoko ni arimasu (The post office is over there)

Lecture 13 - Rao san wa doko ni imasu ka (Where is Mr. Rao?)

Lecture 14 - Pikuniku e ikimash? (Letâ€™s go for a picnic)

Lecture 15 - Kesa pan to tamago o tabemashita (I ate eggs and bread for breakfast)

Lecture 16 - Depa-to no tonari no biru wa gink? desu (The building next to the department store is the bank)

Lecture 17 - Taj hoteru wa ookii hoteru desu(Hotel Taj is a big hotel)

Lecture 18 - Hoteru de nani o tabemashita ka (What did you eat at the hotel?)

Lecture 19 - Tokyo wa ?kikute kirei desu (Tokyo is big and beautiful)

Lecture 20 - Ko-hi- wa oishiku arimasen(Coffee is not tasty)

Lecture 21 - Hantai kotoba (Opposites)

Lecture 22 - Watashi wa mainichi miruku o nomimasu (I drink milk everyday)

Lecture 23 - Watashi wa oniisan ni kamera o moratta(I received a camera from my brother)

Lecture 24 - Nani o tabetai desu ka(What do you want to eat?)

Lecture 25 - Nani o sashiagemasu ka (Giving and Receiving)

Lecture 26 - Sensei wa watashi ni hon o kuremashita (My teacher gave me a book)

Lecture 27 - Chotto matte kudasai (Just a minute please)

Lecture 28 - Ke-ki o tabete mite kudasai (Eat and see how is the cake)

Lecture 29 - Nani o shite imasu ka(What are you doing?)

Lecture 30 - Tokyo ni sunde imasu (I live in Tokyo)

Lecture 31 - Kanji ga kakemasu (I can write Kanji)

[Lecture 32 - Im?to wa ningy? o hoshigatte imasu \(My sister wants a doll\)](#)

[Lecture 33 - Aisukuri-mu ga ke-ki yori suki desu \(I like ice-cream more than cakes\)](#)

[Lecture 34 - Kutsu o kai ni ikimasu \(I am going to buy shoes\)](#)

[Lecture 35 - Ashita motto atsuku narimasu \(It is going to become very hot tomorrow\)](#)

[Lecture 36 - Rainen Tokyo e iku to omoimasu \(I think I will go to Tokyo next year\)](#)

[Lecture 37 - Pen de kaite mo ii desu ka\(Is it alright to write in pen?\)](#)

[Lecture 38 - Comprehensions and Expressions](#)

[Lecture 39 - Basic Kanji](#)

[Lecture 40 - Basic Kanji](#)

[Lecture 1 - Introduction](#)

[Lecture 2 - Pre Siddhantic Astronomy](#)

[Lecture 3 - Siddhantic Astronomy](#)

[Lecture 4 - Astronomy in Medieval India](#)

[Lecture 5 - Introduction to Telescopic Astronomy and Concluding remarks](#)

- Lecture 1 - What is Stress
- Lecture 2 - Sources of stress
- Lecture 3 - Types of Stress
- Lecture 4 - Personality Factors and Stress
- Lecture 5 - Stress and the College Student
- Lecture 6 - Stress and Nervous System
- Lecture 7 - Hypothalamic-Pituitary-Adrenal (HPA) Axis
- Lecture 8 - Effect of Stress on Immune System
- Lecture 9 - Health Risk Associated with Chronic Stress
- Lecture 10 - Stress and Major Psychiatric Disorders
- Lecture 11 - Understanding your stress level
- Lecture 12 - Role of Personality Pattern, Self Esteem, Locus of Control
- Lecture 13 - Role of Thoughts Beliefs and Emotions - I
- Lecture 14 - Role of Thoughts Beliefs and Emotions - II
- Lecture 15 - Life Situation Intrapersonal : (Assertiveness, Time Management)
- Lecture 16 - Developing Cognitive Coping Skills
- Lecture 17 - Autogenic Training, Imagery and Progressive Relaxation
- Lecture 18 - Other Relaxation Techniques
- Lecture 19 - Exercise and Health
- Lecture 20 - DIY Strategies Stress Management

[Lecture 1 - Introduction to Need of 21st Century Education](#)

[Lecture 2 - Accreditation](#)

[Lecture 3 - Outcome based Learning](#)

[Lecture 4 - Approach to Design Outcome based Learning](#)

[Lecture 5 - Approach to Design Outcome based Learning \(Continued...\)](#)

[Lecture 6 - Instructional Design for Active Learning](#)

[Lecture 7](#)

[Lecture 8](#)

[Lecture 9](#)

[Lecture 10](#)

[Lecture 11](#)

[Lecture 12](#)

[Lecture 13](#)

[Lecture 14](#)

[Lecture 15](#)

[Lecture 16](#)

[Lecture 17](#)

[Lecture 18](#)

[Lecture 19](#)

[Lecture 20](#)

NPTEL : Ayurvedic Inheritance of India (General)

Co-ordinators : Dr. M.S. Valiathan

Lecture 1 - Roots of Ayurveda

Lecture 2 - Traditional Medicine in Buddhist India

Lecture 3 - Period of Systematization

Lecture 4 - Philosophical ideas in Ayurveda

Lecture 5 - Human Body in Health

Lecture 6 - Human Body in Disease

Lecture 7 - Food and Drinks

Lecture 8 - Code for Healthy Living

Lecture 9 - Diseases

Lecture 10 - Diagnosis and Prognosis

Lecture 11 - Medical Treatment of Diseases

Lecture 12 - Materia Medica

Lecture 13 - Surgical Treatment of Diseases

Lecture 14 - Surgical Instruments

Lecture 15 - Treatment of fractures; some surgical procedures

Lecture 16 - Principles and methods of rejuvenation: enhancement of sexual potency and fertility

Lecture 17 - Selection of Students: Oath at initiation: Process of Training

Lecture 18 - A Science Initiative in Ayurveda (ASIIA)

Lecture 19 - Ayurvedic Biology: Illustrative Studies

Lecture 20 - Conclusion: An Ayurvedic View of Life

Co-ordinators : Dr. G. Phanikumar, Prof. C. Balaji, Dr. Arun K.Tangirala, Dr. Abhijit P. Deshpande, Prof. M.S. Ananth, Dr. Prathap Haridoss

Lecture 1 - Insight into research

Lecture 2 - Role of Guide and Student

Lecture 3 - Art of Re-Search

Lecture 4 - Persistent small steps towards success

Lecture 5 - Overview of research

Lecture 6 - Overview of Literature Survey

Lecture 7 - Literature Survey using Web of Science

Lecture 8 - Literature Survey using Scopus

Lecture 9 - Writing Up

Lecture 10 - Tutorial on using BibTeX with LaTeX to add references to a document

Lecture 11 - Tutorial on using Microsoft Word with Bibliographic Sources

Lecture 12 - Tutorial on using Microsoft Word with endnote entries

Lecture 13 - Experimental skills

Lecture 14 - Data analysis - Part 1

Lecture 15 - Data analysis - Part 2

Lecture 16 - Modelling skills - Part 1

Lecture 17 - Modelling skills - Part 2

Lecture 18 - Safety in laboratory

Lecture 19 - How to make Technical presentation

Lecture 20 - Technical Writing

Lecture 21 - Creativity in research - Part 1

Lecture 22 - Creativity in research - Part 2

Lecture 23 - Creativity in Research - Part 3

Lecture 24 - Group discussion on Ethics in Research

Lecture 25 - Intellectual property - Part 1

Lecture 26 - Intellectual property - Part 2

Lecture 27 - DOE Part 1

Lecture 28 - DOE part 2

Lecture 29 - DOE part 3

Lecture 30 - DOE part 4

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[Lecture 31 - DOE part 5](#)

[Lecture 32 - Research in Applied Mechanics](#)

[Lecture 33 - Research in Chemical Engineering](#)

[Lecture 34 - Research in Civil Engineering](#)

[Lecture 35 - Research in Computer Science and Engineering](#)

[Lecture 36 - Research in Engineering Design](#)

[Lecture 37 - Research in Humanities and Social Sciences](#)

[Lecture 38 - Research in Mechanical Engineering](#)

[Lecture 39 - Research in Metallurgical and Materials Engineering](#)

[Lecture 40 - Research in Ocean Engineering](#)

[Lecture 41 - Research in Management Studies](#)

[Lecture 42 - Research in Aerospace Engineering](#)

[Lecture 43 - Research in Biotechnology](#)

[Lecture 44 - Research in Chemistry](#)

[Lecture 45 - Research in Electrical Engineering](#)

[Lecture 46 - Research in Mathematics](#)

[Lecture 47 - Research in Physics](#)

[Lecture 48 - Discussion with Research Scholars](#)

Lecture 1 - Introduction

Lecture 2 - Origin of Life

Lecture 3 - Evolution

Lecture 4 - Cells

Lecture 5 - Biomolecules: Lipids

Lecture 6 - Biomolecules: Carbohydrates, Water

Lecture 7 - Biomolecules: Amino acids, Proteins

Lecture 8 - Biomolecules: Enzymes

Lecture 9 - Biomolecules: Nucleotides

Lecture 10 - Cell structure and function – Prokaryotes

Lecture 11 - Cell structure and function – Eukaryotes

Lecture 12 - Cell cycle

Lecture 13 - Cell division – mitosis

Lecture 14 - Cell division – meiosis

Lecture 15 - Culture growth

Lecture 16 - Mendelian genetics: Genetic disorders

Lecture 17 - Mendelian genetics: Mendelian inheritance principles

Lecture 18 - Mendelian genetics: Pedigree analysis

Lecture 19 - Mendelian genetics: Non-Mendelian inheritance

Lecture 20 - DNA replication

Lecture 21 - Transcription

Lecture 22 - Translation

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NPTEL : NOC:Digital and the Everyday - from Codes to Cloud (General)

Co-ordinators : Prof. Amit Prakash, Prof. Bidisha Chaudhuri

Lecture 1 - Introduction to the Course

Lecture 2 - Introduction to the Winter School

Lecture 3 - Socio-algorithmic processes and the Everyday - Part 1

Lecture 4 - Socio-algorithmic processes and the Everyday - Part 2

Lecture 5 - Socio-algorithmic processes and the Everyday - Part 3

Lecture 6 - Data Protection and Privacy Regulation in the Digital Era - Part 1

Lecture 7 - Data Protection and Privacy Regulation in the Digital Era - Part 2

Lecture 8 - Data Protection and Privacy Regulation in the Digital Era - Part 3

Lecture 9 - Data-driven Identities - Part 1

Lecture 10 - Data-driven Identities - Part 2

Lecture 11 - Data-driven Identities - Part 3

Lecture 12 - Promises and Challenges of e-Health - Part 1

Lecture 13 - Promises and Challenges of e-Health - Part 2

Lecture 14 - Promises and Challenges of e-Health - Part 3

Lecture 15 - Digital Finance - Part 1

Lecture 16 - Digital Finance - Part 2

Lecture 17 - Digital and our everyday interactions with the state - Part 1

Lecture 18 - Digital and our everyday interactions with the state - Part 2

Lecture 19 - Digital and our everyday interactions with the state - Part 3

Lecture 20 - Creating a Machine Zone through Affected Feedback: Leisure and Entertainment on Social Media - Part 1

Lecture 21 - Creating a Machine Zone through Affected Feedback: Leisure and Entertainment on Social Media - Part 2

Lecture 22 - Creating a Machine Zone through Affected Feedback: Leisure and Entertainment on Social Media - Part 3

- Lecture 1 - Introduction to the course
- Lecture 2 - An Inexperienced Engineering Teacher's View
- Lecture 3 - From traditional lecturing to helping students learn - 1
- Lecture 4 - From traditional lecturing to helping students learn - 2
- Lecture 5 - Better learning (Bloom's Taxonomy)
- Lecture 6 - Problem based learning (PBL) and Problem Solving - Part 1
- Lecture 7 - Problem based learning (PBL) and Problem Solving - Part 2
- Lecture 8 - Writing Learning Outcomes for a Course
- Lecture 9 - Active Learning
- Lecture 10 - Cooperative Group Learning
- Lecture 11 - Flipped Classroom
- Lecture 12 - Effective Laboratory Courses
- Lecture 13 - Assessment - Part 1
- Lecture 14 - Assessment - Part 2
- Lecture 15 - How can we use research in education? - Part A1
- Lecture 16 - How can we use research in education? - Part A2
- Lecture 17 - The Class, as a Whole - Part A3
- Lecture 18 - Psychological Type (Orientation) and Learning - Part B
- Lecture 19 - Cognitive Development Theories - Two Main Examples - Part C
- Lecture 20 - Learning Theories - Part D
- Lecture 21 - Feedback and Reflection - Part 1
- Lecture 22 - Feedback and Reflection - Part 2
- Lecture 23 - Feedback and Reflection - Part 3
- Lecture 24 - Live Session 1
- Lecture 25 - Live Session 2

- Lecture 1 - Course mechanics
- Lecture 2 - Goals and VR definitions
- Lecture 3 - Historical perspective
- Lecture 4 - Birds-eye view (general)
- Lecture 5 - Birds-eye view (general) (Continued...)
- Lecture 6 - Birds-eye view (hardware)
- Lecture 7 - Birds-eye view (software)
- Lecture 8 - Birds-eye view (sensation and perception)
- Lecture 9 - Geometric modeling
- Lecture 10 - Transforming models
- Lecture 11 - Matrix algebra and 2D rotations
- Lecture 12 - 3D rotations and yaw, pitch, and roll
- Lecture 13 - 3D rotations and yaw, pitch, and roll (Continued...)
- Lecture 14 - Axis-angle representations
- Lecture 15 - Quaternions
- Lecture 16 - Converting and multiplying rotations
- Lecture 17 - Converting and multiplying rotations (Continued...)
- Lecture 18 - Homogeneous transforms
- Lecture 19 - The chain of viewing transforms
- Lecture 20 - Eye transforms
- Lecture 21 - Eye transforms (Continued...)
- Lecture 22 - Canonical view transform
- Lecture 23 - Viewport transform
- Lecture 24 - Viewport transform (Continued...)
- Lecture 25 - Three interpretations of light
- Lecture 26 - Refraction
- Lecture 27 - Simple lenses
- Lecture 28 - Diopters
- Lecture 29 - Imaging properties of lenses
- Lecture 30 - Lens aberrations
- Lecture 31 - Optical system of eyes

Lecture 32 - Photoreceptors

Lecture 33 - Sufficient resolution for VR

Lecture 34 - Light intensity

Lecture 35 - Eye movements

Lecture 36 - Eye movements (Continued...)

Lecture 37 - Eye movement issues for VR

Lecture 38 - Neuroscience of vision

Lecture 39 - Three Psychophysical Laws

Lecture 40 - Sensation and Perception

Lecture 41 - Psychophysics of Visual Perception

Lecture 42 - Gamma Encoding

Lecture 43 - Limiting Resolution

Lecture 44 - Depth perception

Lecture 45 - Depth perception (Continued...)

Lecture 46 - Motion perception from Visual System

Lecture 47 - Frame rates and displays

Lecture 48 - Frame rates and displays (Continued...)

Lecture 49 - Psychophysics of Depth Perception

Lecture 50 - Overview

Lecture 51 - Orientation tracking

Lecture 52 - Tilt drift correction

Lecture 53 - Yaw drift correction

Lecture 54 - Tracking with a camera

Lecture 55 - Perspective n-point problem

Lecture 56 - Filtering

Lecture 57 - Lighthouse approach

Lecture 58 - Visual Rendering-Overview

Lecture 59 - Visual Rendering-overview (Continued...)

Lecture 60 - Shading models

Lecture 61 - Rasterization

Lecture 62 - Pixel shading

Lecture 63 - VR-specific problems

Lecture 64 - Distortion shading

[Lecture 65 - Post-rendering image warp](#)

[Lecture 66 - Why Haptics?](#)

[Lecture 67 - What is Haptics?](#)

[Lecture 68 - Branches of Haptics](#)

[Lecture 69 - Human Haptics - Tactile System](#)

[Lecture 70 - Kinesthetic System](#)

[Lecture 71 - Motor System](#)

[Lecture 72 - Haptic Devices and Interfaces - Kinesthetic Devices](#)

[Lecture 73 - Haptic Devices and Interfaces - Tactile Devices](#)

[Lecture 74 - Physics and Physiology](#)

[Lecture 75 - Auditory perception](#)

[Lecture 76 - Auditory localization](#)

[Lecture 77 - Rendering](#)

[Lecture 78 - Spatialization and display](#)

[Lecture 79 - Combining other senses](#)

[Lecture 80 - Interfaces -overview](#)

[Lecture 81 - Evaluation of VR Systems](#)

[Lecture 82 - Social interaction](#)

[Lecture 83 - System control](#)

[Lecture 84 - Manipulation](#)

[Lecture 85 - Locomotion](#)

[Lecture 86 - Principles of Perception](#)

[Lecture 87 - Introduction to Kalman Filter](#)

[Lecture 88 - Introduction to Extended Kalman Filter](#)

[Lecture 89 - Grand Challenges in VR/AR](#)

[Lecture 90 - Ultimate VR/AR System](#)

- Lecture 1 - Renewable Energy Technologies
- Lecture 2 - Energy Usage by Humans - Estimate of Impact on Atmosphere
- Lecture 3 - Conventional Sources of Energy
- Lecture 4 - Non-Conventional Sources of Energy - An Overview
- Lecture 5 - Energy consumption
- Lecture 6 - Details of Energy usage in each sector
- Lecture 7 - Consequences of Energy consumption
- Lecture 8 - Solar Energy incident on Earth, Solar Spectrum
- Lecture 9 - The Solar Energy Budget
- Lecture 10 - Electromagnetic Radiation - The Solar Spectrum
- Lecture 11 - Solar flat plate collector
- Lecture 12 - Solar Radiator
- Lecture 13 - Solar Energy - The Semiconductor
- Lecture 14 - Solar energy - The p-n junction
- Lecture 15 - Solar Cell - Growing the single crystal and making the p-n junction
- Lecture 16 - Solar Energy - Interaction of p-n junction with radiation
- Lecture 17 - Solar Energy - Solar cell characteristics and usage
- Lecture 18 - Solar Energy - Solar cell construction
- Lecture 19 - Solar Energy - Solar Photocatalysis
- Lecture 20 - Wind Energy - Overview
- Lecture 21 - Wind Energy - Energy Considerations
- Lecture 22 - Wind Energy - Efficiency
- Lecture 23 - Wind Energy - Parts and Materials
- Lecture 24 - Wind Energy - Design Considerations
- Lecture 25 - Ocean Thermal Energy - Conversion (OTEC)
- Lecture 26 - Geothermal Energy
- Lecture 27 - Geothermal Energy Technological aspects
- Lecture 28 - Biomass Usage and Issues
- Lecture 29 - Battery Basics
- Lecture 30 - Battery Testing and Performance
- Lecture 31 - Lithium ion Batteries

[Lecture 32 - Common Battery Structures and Types](#)

[Lecture 33 - Types of Fuel Cells](#)

[Lecture 34 - Fuel Processing for PEM Fuel Cells](#)

[Lecture 35 - Fuel Cells : Concept to Product](#)

[Lecture 36 - Characterization of Electrochemical Devices](#)

[Lecture 37 - Fuel Cells : Parts and Assembly](#)

[Lecture 38 - Supercapacitors](#)

[Lecture 39 - Flywheels](#)

[Lecture 40 - Magnetohydrodynamic Power Generation](#)

NPTEL : NOC:Introduction to Remote Sensing (General)

Co-ordinators : Dr.Arun K.Saraf

Lecture 1 - What is satellite based remote sensing?

Lecture 2 - Development of remote sensing technology and advantages

Lecture 3 - Different platforms of remote sensing.

Lecture 4 - Electromagnetic Spectrum, solar reflection and thermal emission

Lecture 5 - Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission

Lecture 6 - Interaction mechanism of EM radiation with ground and spectral response curve

Lecture 7 - Principles of image interpretation

Lecture 8 - Multi-spectral scanners and imaging devices

Lecture 9 - Salient characteristics of Landsat, IRS, Cartosat, Resourcesat sensors

Lecture 10 - Image characteristics and different resolutions in Remote Sensing

Lecture 11 - Image interpretation of different geological landforms, rock types and structures

Lecture 12 - Remote Sensing Integration with GIS and GPS

Lecture 13 - Geo-referencing Technique

Lecture 14 - Basic Image Enhancement Techniques

Lecture 15 - Spatial Filtering, Band ratio and Principal Component Analysis techniques

Lecture 16 - Image Classification Techniques

Lecture 17 - InSAR Techniques in its applications

Lecture 18 - Hyperspectral Remote Sensing

Lecture 19 - Integrated applications of RS and GIS in groundwater studies

Lecture 20 - Limitations of Remote Sensing Techniques

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Contemporary Issues in Philosophy of Mind and Cognition (Humanities and Social Sciences)

Co-ordinators : Dr. Rajakishore Nath, Dr. Ranjan K. Panda

Lecture 1 - Introduction

Lecture 2 - Transcendental Consciousness

Lecture 3 - Plato's Theory of Mind

Lecture 4 - Parable of Cave : Plato's

Lecture 5 - Aristotle's Concept Mind

Lecture 6 - The Concept of Mind in Upanishadas

Lecture 7 - Dualism - I

Lecture 8 - Dualism - II

Lecture 9 - Dualism - III

Lecture 10 - Against Dualism

Lecture 11 - Property Dualism

Lecture 12 - Varieties of Materialism

Lecture 13 - Mind-Body Identity Theory

Lecture 14 - Functionalism

Lecture 15 - Different Models of Cognitive Mind

Lecture 16 - Connectionism and Folk - Psychology

Lecture 17 - Representation - I

Lecture 18 - Representation - II

Lecture 19 - Artificial Intelligence - I

Lecture 20 - Artificial Intelligence - II

Lecture 21 - Artificial Intelligence - III

Lecture 22 - The Limit of Artificial Intelligence - I

Lecture 23 - The Limit of Artificial Intelligence - II

Lecture 24 - Biological Naturalism

Lecture 25 - The Concept of Intentionality

Lecture 26 - The Structure of Consciousness - I

Lecture 27 - The Structure of Consciousness - II

Lecture 28 - Phenomenal Consciousness - I

Lecture 29 - Phenomenal Consciousness - II

Lecture 30 - Language, Representation & Meaning - I

Lecture 31 - Language & Meaning - II

[Lecture 32 - Language & Mind](#)

[Lecture 33 - Language & World - I](#)

[Lecture 34 - Language & World - II](#)

[Lecture 35 - Emergentism & Supervenience](#)

[Lecture 36 - Reduction & Realization - I](#)

[Lecture 37 - Reduction & Realization - II](#)

[Lecture 38 - The Cartesian Mind Revisited](#)

[Lecture 39 - Personal Identity - I](#)

[Lecture 40 - Personal Identity - II](#)

[Lecture 41 - Creativity : Human Vs Machine - I](#)

[Lecture 42 - Creativity : Human Vs Machine - II](#)

- Lecture 1 - Overview
- Lecture 2 - In Conversation with Richard Schechner
- Lecture 3 - Multilingual Plurality: Our Environment - Part I
- Lecture 4 - Multilingual Plurality: Our Environment - Part II
- Lecture 5 - Interplay of Languages and Forms of Writing - Part I
- Lecture 6 - Interplay of Languages and Forms of Writing - Part II
- Lecture 7 - Creativity and Cultures
- Lecture 8 - Notion of Play and The Three Domain Activities
- Lecture 9 - Theory of Enjoyment: Critical Assessment
- Lecture 10 - Divergences and Convergences - Part I
- Lecture 11 - Divergences and Convergences - Part II
- Lecture 12 - Creative and Cultural Spaces for Students
- Lecture 13 - Being and Doing: Writing as Performance
- Lecture 14 - Writers and Writing: The Dialogic Process
- Lecture 15 - Creativity, Writing, Creative Writing: Recent Viewpoints
- Lecture 16 - Issues Related to the Teaching of Creative Writing
- Lecture 17 - Writers on Writing: Albert Camus
- Lecture 18 - Critical Reading of Great Writers: Albert Camus
- Lecture 19 - Critical Reading of Important Writers: Margaret Atwood
- Lecture 20 - Reading and Writing
- Lecture 21 - Indian Writing: Writers/Narrators
- Lecture 22 - Contemporary Indian Writers: The Search for Creativity - Part I
- Lecture 23 - Contemporary Indian Writers: The Search for Creativity - Part II
- Lecture 24 - Mosaic Patterns: Module 2
- Lecture 25 - Introduction to Drama
- Lecture 26 - Performance and Script Writing: Mime
- Lecture 27 - Western Classical Theory
- Lecture 28 - Student Response - I
- Lecture 29 - Indian Drama: Classical Theory and Practice
- Lecture 30 - Interacting Continuum: Classical, Folk and Modern Drama
- Lecture 31 - From The Perspective of Playwriting: Monologue

[Lecture 32 - From The Playwright's Perspective - Part I](#)

[Lecture 33 - From The Playwright's Perspective - Part II](#)

[Lecture 34 - From The Perspective of Playwriting: Anton Chekhov](#)

[Lecture 35 - Drama in the Classroom: Experience and Writing](#)

[Lecture 36 - Student Response - II](#)

[Lecture 37 - Performative Reading of the Cherry Orchard](#)

[Lecture 38 - Short Story as a Genre](#)

[Lecture 39 - Short Stories by Indian Women Writers](#)

[Lecture 40 - Modern Western Short Story](#)

[Lecture 41 - Varieties of Writing Processes](#)

- Lecture 1 - Energy Flow Diagram
- Lecture 2 - Global Trends in Energy Use
- Lecture 3 - Energy Use in India: Some Calculations
- Lecture 4 - Energy and Environment
- Lecture 5 - The Kaya Identity
- Lecture 6 - Emission Factor
- Lecture 7 - Energy and Quality of Life
- Lecture 8 - Energy Inequality
- Lecture 9 - Energy Security
- Lecture 10 - Introduction to Country Energy Balance assignment
- Lecture 11 - Energy balance of Japan
- Lecture 12 - Energy balance of Australia
- Lecture 13 - Energy balance of Mexico
- Lecture 14 - Energy Economics - Part 1
- Lecture 15 - Energy Economics - Part 2
- Lecture 16 - Energy Economics - Part 3
- Lecture 17 - Energy Economics - Tutorial
- Lecture 18 - Energy resources - Part 1
- Lecture 19 - Energy resources - Part 2
- Lecture 20 - Renewable Energy Sources - Part 1
- Lecture 21 - Renewable Energy Sources - Part 2
- Lecture 22 - Materials for Energy
- Lecture 23 - Non Renewable Resource Economics - Part 1
- Lecture 24 - Non Renewable Resource Economics - Part 2
- Lecture 25 - Non Renewable Resource Economics - Part 3
- Lecture 26 - Preferences and Utility
- Lecture 27 - Utility and Social Choice - Part 1
- Lecture 28 - Utility and Social Choice - Part 2
- Lecture 29 - Utility and Social Choice - Part 3
- Lecture 30 - Utility and Social Choice - Part 4
- Lecture 31 - Revision Paper-1 - Part 1

[Lecture 32 - Public and Private Good/Bads](#)

[Lecture 33 - Aggregation of Demand Curves](#)

[Lecture 34 - Externalities](#)

[Lecture 35 - Revision Paper-1 - Part 2](#)

[Lecture 36 - Revision paper-1 - Part 3](#)

[Lecture 37 - Energy Project Financing - Part 1](#)

[Lecture 38 - Energy Project Financing - Part 2](#)

[Lecture 39 - Energy Project Financing - Tutorial](#)

[Lecture 40 - Input Output Analysis - Part 1](#)

[Lecture 41 - Input Output Analysis - Part 2](#)

[Lecture 42 - Input Output Analysis - Part 3](#)

[Lecture 43 - Input Output Analysis - Tutorial](#)

[Lecture 44 - Primary Energy Analysis - Part 1](#)

[Lecture 45 - Primary Energy Analysis - Part 2](#)

[Lecture 46 - Net Energy Analysis - Part 1](#)

[Lecture 47 - Net Energy Analysis - Part 2](#)

[Lecture 48 - Net Energy Analysis - Part 3](#)

[Lecture 49 - Net Energy Analysis - Part 4](#)

[Lecture 50 - Energy Policy - Part 1](#)

[Lecture 51 - Energy Policy - Part 2](#)

[Lecture 52 - Energy Policy Examples - Part 1](#)

[Lecture 53 - Energy Policy Examples - Part 2](#)

[Lecture 54 - Revision Paper-2 - Part 1](#)

[Lecture 55 - Revision Paper-2 - Part 2](#)

[Lecture 56 - Future Energy Systems](#)

Lecture 1 - Aims and objectives of the course

Lecture 2 - Systemic and Textual approaches to study PĀṅṅinian grammar

Lecture 3 - PĀṅṅini and his linguistic background

Lecture 4 - Scholars and texts in the PĀṅṅinian grammatical tradition and their contribution

Lecture 5 - Non-PĀṅṅinian grammatical traditions

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

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- Lecture 1 - Introduction to the contents of the course
- Lecture 2 - General features of the tatpuruśa compound
- Lecture 3 - Basics of the theory of compound formation in PĀṅīnīan grammar
- Lecture 4 - Meaning of the term samĀsa
- Lecture 5 - Sanskrit, samĀsa and the process of speech production as described in the PĀṅīnīan grammar
- Lecture 6 - Artha and introduction to Karaka
- Lecture 7 - 6 Karakas
- Lecture 8 - Introduction to Samartha
- Lecture 9 - Explanation of Samartha
- Lecture 10 - Samarthyā
- Lecture 11 - EkĀrthābhāva and its three features
- Lecture 12 - AsamarthasamĀsa
- Lecture 13 - Basic terms and processes of compounding
- Lecture 14 - Steps in the process of Compounding
- Lecture 15 - Rules of compounding in PĀṅīnīan grammar - 1
- Lecture 16 - Rules of compounding in PĀṅīnīan grammar - 2
- Lecture 17 - Rules of compounding in PĀṅīnīan grammar - 3
- Lecture 18 - Rules of compounding in PĀṅīnīan grammar - 4
- Lecture 19 - Rules of compounding in PĀṅīnīan grammar - 5
- Lecture 20 - General remarks on compounding and historical development of Sanskrit Language
- Lecture 21 - Vibhakti-tatpuruśa samĀsa - dvitīyā
- Lecture 22 - Vibhakti-tatpuruśa - 1
- Lecture 23 - Vibhakti-tatpuruśa - 2
- Lecture 24 - Vibhakti-tatpuruśa
- Lecture 25 - Vibhakti-tatpuruśa
- Lecture 26 - Vibhakti-tatpuruśa - 1
- Lecture 27 - Vibhakti-tatpuruśa - 2

Lecture 59 - [svarakArya](#)

Lecture 60 - Examples

- Lecture 1 - Introduction to the contents of the course
- Lecture 2 - General features of the àç...àçµàçàç-àç-àçàçàç/àçµ avyayĀ«bhĀva, àç-àç'àçµàçàçàç-àçàç, bahuvrĀ«hi
- Lecture 3 - Basics of the theory of compound formation in PĀĀ'†inian grammar
- Lecture 4 - Meaning of the term àç, àç@àç/àç, samĀsa
- Lecture 5 - àç, àç@àç/àç, samĀsa and the process of speech production as described in the PĀĀ'†inian grammar
- Lecture 6 - àç...àç°àçàç artha and introduction to àç•àç/àç°àç• karaka
- Lecture 7 - 6 àç•àç/àç°àç•s karakas
- Lecture 8 - Introduction to àç, àç@àç°àçàç samartha
- Lecture 9 - Explanation of àç, àç@àç°àçàç samartha
- Lecture 10 - àç, àç/àç@àç°àçàç sĀmarthya
- Lecture 11 - àçàç•àç/àç°àçàçàçàçàçàç/àçµ ekĀrthĀ«bhĀva and its three features
- Lecture 12 - àç...àç, àç@àç°àçàç, àç@àç/àç, asamarthasamĀsa
- Lecture 13 - Basic terms and processes of compounding
- Lecture 14 - Steps in the process of Compounding
- Lecture 15 - Rules of compounding in PĀĀ'†inian grammar - 1
- Lecture 16 - Rules of compounding in PĀĀ'†inian grammar - 2
- Lecture 17 - Rules of compounding in PĀĀ'†inian grammar - 3
- Lecture 18 - Rules of compounding in PĀĀ'†inian grammar - 4
- Lecture 19 - Rules of compounding in PĀĀ'†inian grammar - 5
- Lecture 20 - General remarks on compounding and historical development of Sanskrit Language
- Lecture 21 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, avyayĀ«bhĀva samĀsa àç“ Genral information
- Lecture 22 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 23 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 24 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 25 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 26 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 27 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 28 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 29 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 30 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 31 - àç...àçµàçàç-àç-àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna

Lecture 1 - Introduction to the course

Lecture 2 - Marshall McLuhan : The Medium is the Message

Lecture 3 - Marshall McLuhan : The Gutenberg Galaxy - Part 1

Lecture 4 - Marshall McLuhan : The Gutenberg Galaxy - Part 2

Lecture 5 - Walter Ong: Orality and Literacy - Part 1

Lecture 6 - Walter Ong: Orality and Literacy - Part 2

Lecture 7 - Walter Ong: Orality and Literacy - Part 3

Lecture 8 - Dastangoi : History - Part 1

Lecture 9 - Dastangoi : Chouboli - Part 2

Lecture 10 - Manuscript Culture: Europe

Lecture 11 - Manuscript Culture: India

Lecture 12 - Feudalism to Capitalism

Lecture 13 - Febre and Martin: "The Discovery of Printing" and "The Chinese Precedent"

Lecture 14 - Gutenberg and Revolution 15th Century

Lecture 15 - Consequences of Print 16-17 Century

Lecture 16 - John Dryden: [macFlecknoe]

Lecture 17 - Robert Darnton: "What is the History of Books?"

Lecture 18 - Benedict Anderson: "The Origins of National Consciousness"

Lecture 19 - Colonialism

Lecture 20 - Print in Bengal

Lecture 21 - Surveillance and Censorship

Lecture 22 - Rise of the Telugu Novel

Lecture 23 - Publishing in Hindi and Urdu

Lecture 24 - Walter Benjamin: 'The Work of Art in the Age of Mechanical Reproduction'

Lecture 25 - Raymond Williams: 'Television'

Lecture 26 - Jay David Bolter: Seeing and Writing

Lecture 27 - Robert Coover: The End of Books - Part 1

Lecture 28 - Robert Coover: The End of Books - Part 2

Lecture 29 - N. Katherine Hayles: Electronic Literature

Lecture 30 - Richard Stallman: The GNU Manifesto

Lecture 31 - Lawrence Lessig: Free Cultures

[Lecture 32 - Copyright - Part 1](#)

[Lecture 33 - Copyright - Part 2](#)

[Lecture 34 - Nicholas Carr: Juggler's Brain](#)

[Lecture 35 - Scott Galloway: Google](#)

[Lecture 36 - Zeynep Tufekci: Twitter and Facebook - Part 1](#)

[Lecture 37 - Zeynep Tufekci: Twitter and Facebook - Part 2](#)

[Lecture 38 - Conclusion](#)

Lecture 1 - Introduction to Psychology

Lecture 2 - Introduction to Positive Psychology

Lecture 3 - Research Methods

Lecture 4 - Character Strengths and Virtues/Positive Personality Traits - Part 1

Lecture 5 - Character Strengths and Virtues/Positive Personality Traits - Part 2

Lecture 6 - Character Strengths and Virtues/Positive Personality Traits - Part 3

Lecture 7 - Happiness and Well-Being - Part 1

Lecture 8 - Happiness and Well-Being - Part 2

Lecture 9 - Happiness and Well-Being - Part 3

Lecture 10 - Positive Emotional States and Processes - Part 1

Lecture 11 - Positive Emotional States and Processes - Part 2

Lecture 12 - Hope and Optimism

Lecture 13 - Self and related Concepts

Lecture 14 - Resilience

Lecture 15 - Flow

Lecture 16 - Mindfulness

Lecture 17 - Spirituality, Grit and Mindset

Lecture 18 - Mindfulness and Compassion

Lecture 19 - Forgiveness, Humanity and Gratitude

Lecture 20 - Love, Empathy and Altruism

Lecture 21 - Recent Trends and Directions In Positive Psychology - Part 1

Lecture 22 - Recent Trends and Directions In Positive Psychology - Part 2

Lecture 23 - Recent Trends and Directions In Positive Psychology - Part 3

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Science Communication: Research Productivity and Data Analytics using Open Source Software (Humanities and Social Sciences)

Co-ordinators : Prof. Nabi Hasan, Prof. Mohit Garg

Lecture 1 - Introduction to Science Communication

Lecture 2 - Channels of Science Communication

Lecture 3 - Open Science and Open Access

Lecture 4 - Open Research Data and Open Peer Review

Lecture 5 - Overview of Tools for Maximizing Academic Visibility and Impact of Research Output

Lecture 6 - Understanding Research Metrics: Author, Journal and Article Level Metrics

Lecture 7 - Abstract and Citation Database Scopus

Lecture 8 - Abstract and Citation Database: Web of Science

Lecture 9 - Health Science Database: PubMed

Lecture 10 - Free Academic Search Engine: Google Scholar

Lecture 11 - Installation of R

Lecture 12 - Installation of RStudio

Lecture 13 - Object and different types

Lecture 14 - Vector and Data Frame

Lecture 15 - Lists, Matrices, Factor, Array

Lecture 16 - Packages and Help

Lecture 17 - Science communication and different metrics

Lecture 18 - Lotka's law

Lecture 19 - Bradford's law

Lecture 20 - Zipf's Law

Lecture 21 - Descriptive Analysis - I

Lecture 22 - Descriptive Analysis - II

Lecture 23 - Descriptive Analysis - III

Lecture 24 - Analysis of Bradford and Lotka Law

Lecture 25 - Science Mapping - I

Lecture 26 - Science Mapping - II

Lecture 27 - Data Visualization: An overview, history and skills for researchers

Lecture 28 - Data Visualization: Types, tools and technologies

Lecture 29 - Visualization of Scientific Research Patterns and Trends with VOSviewer and CiteSpace

Lecture 30 - Text Mining - Introduction

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[Lecture 31 - Regular Expression](#)

[Lecture 32 - Text Pre-processing](#)

[Lecture 33 - Topic Modeling](#)

[Lecture 34 - THE, QS, Sanghai \(ARWU\) and \(NIRF\) Ranking](#)

[Lecture 35 - Academic Integrity and Ethical Guidelines in Science Communication](#)

[Lecture 36 - IPR/Copyright Issues and Practices in Print and Digital Environment](#)

[Lecture 37 - Predatory Publishing: Issues, Challenges and the Road Ahead](#)

[Lecture 38 - Case Study #1 Subject Domain](#)

[Lecture 39 - Case Study #2 Author](#)

[Lecture 40 - Case Study #3 Journal and Institution](#)

[Lecture 1 - Understanding Cultural Studies - Part 1](#)

[Lecture 2 - Understanding Cultural Studies - Part 2](#)

[Lecture 3 - Evolution and Culture](#)

[Lecture 4 - Evolutionary Psychology](#)

[Lecture 5 - The Modern Mind: Its Origins](#)

[Lecture 6 - Memetics](#)

[Lecture 7 - Cultural Theory: Structuralism](#)

[Lecture 8 - Marxism - Part 1](#)

[Lecture 9 - Marxism - Part 2](#)

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Lecture 8 - Old English

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Lecture 19 - Modern Literature

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Lecture 4 - Matching Pennies, Stag Hunt and Nash Equilibrium

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Lecture 8 - Virtual Ergonomics and its Advantages

Lecture 9 - Notes 3

Lecture 10 - Introduction of Digital Human Modeling (DHM) and Simulation

Lecture 11 - Notes 4

Lecture 12 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part A (Part I)

Lecture 13 - Notes 5

Lecture 14 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part B (Part I)

Lecture 15 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part B (Part II)

Lecture 16 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part B (Part III)

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Lecture 18 - Application of Digital Human Modeling and Simulation in various Industrial Sectors - Part I

Lecture 19 - Application of Digital Human Modeling and Simulation in various Industrial Sectors - Part II

Lecture 20 - Notes 7

Lecture 21 - Future research avenues and steps to be taken towards widespread - Part I

Lecture 22 - Future research avenues and steps to be taken towards widespread - Part II

Lecture 23 - Future research avenues and steps to be taken towards widespread - Part III

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- Lecture 1 - Cognitive Dimensions - I
- Lecture 2 - Cognitive Dimensions - II
- Lecture 3 - Ethical Dimensions
- Lecture 4 - Inductivism and Hypothesisism - I
- Lecture 5 - Inductivism and Hypothesisism - II
- Lecture 6 - Positivism - I
- Lecture 7 - Positivism - II
- Lecture 8 - Karl Popper - I
- Lecture 9 - Karl Popper - II
- Lecture 10 - Thomas Kuhn
- Lecture 11 - Popper versus Kuhn
- Lecture 12 - Paul Feyerabend
- Lecture 13 - Rewards and Recognitions - I
- Lecture 14 - Rewards and Recognitions - II
- Lecture 15 - Rewards and Recognitions - III
- Lecture 16 - Cumulative Advantage and Symbolism of Intellectual Property - I
- Lecture 17 - Cumulative Advantage and Symbolism of Intellectual Property - II
- Lecture 18 - Cumulative Advantage and Symbolism of Intellectual Property - III
- Lecture 19 - Max Weber
- Lecture 20 - Preliminary Exercise and Explanation
- Lecture 21 - Edwin Layton Jr.
- Lecture 22 - Langdon Winner - I
- Lecture 23 - Langdon Winner - II
- Lecture 24 - Langdon Winner - III
- Lecture 25 - Donald MacKenzie and Judy Wajcman - I
- Lecture 26 - Donald MacKenzie and Judy Wajcman - II
- Lecture 27 - Thomas Edison
- Lecture 28 - Capitalism, class, gender, city, machine, workplace - I
- Lecture 29 - Capitalism, class, gender, city, machine, workplace - II
- Lecture 30 - Capitalism, class, gender, city, machine, workplace - III
- Lecture 31 - Alvin Toffler and Daniel Bell

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Lecture 2 - Performativity and Embodiment

Lecture 3 - The Chess Players - Part 1

Lecture 4 - The Chess Players - Part 2

Lecture 5 - Shooting an Elephant - Part 1

Lecture 6 - Shooting an Elephant - Part 2

Lecture 7 - Heart of Darkness - Part 1

Lecture 8 - Heart of Darkness - Part 2

Lecture 9 - Heart of Darkness - Part 3

Lecture 10 - The Fly - Part 1

Lecture 11 - The Fly - Part 2

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Lecture 15 - Look Back in Anger - Part 4

Lecture 16 - Look Back in Anger - Part 5

Lecture 17 - Look Back in Anger - Part 6

Lecture 18 - Gender and Popular Culture Lecture - 1

Lecture 19 - Gender and Popular Culture Lecture - 2

Lecture 20 - Gender and Popular Culture Lecture - 3

Lecture 21 - Gender and Popular Culture Final Lecture

Lecture 1 - Ecology and Society - 1

Lecture 2 - Ecology and Society - 2

Lecture 3 - Culture and Cultural Ecology

Lecture 4 - Cultural Ecology and Economic

Lecture 5 - Cultural Ecological Theory

Lecture 6 - Human Ecology: Concept and Meaning

Lecture 7 - Human Ecology - Theoretical Approach

Lecture 8 - Ecological Anthropology

Lecture 9 - Ecosystem-based and Actor-based Model of Human Ecology

Lecture 10 - Nature and Culture Debate

Lecture 11 - Nature - A Contested Concept

Lecture 12 - Conceptions of Nature

Lecture 13 - Contested Domains and Boundaries of Culture

Lecture 14 - MCQs Discussion

Lecture 15 - Paradigms in Human-Environmental Relations - Part I

Lecture 16 - Paradigms in Human-Environmental Relations - Part II

Lecture 17 - Nature, Culture, Magic and Science

Lecture 18 - Religion, Nature and Environment

Lecture 19 - Religion, Nature and Environment Continue

Lecture 20 - The Historical Roots of our Ecological Crisis

Lecture 21 - Biodiversity Conservation Ethics in Buddhism

Lecture 22 - Hinduism and Nature Conservation, Christian Religion Response to Ecological Crisis

Lecture 23 - Hinduism and Nature Conservation, Christian Religion Response to Ecological Crisis

Lecture 24 - Deep Ecology

Lecture 25 - Social Ecology

Lecture 26 - Ecological Feminist Philosophies

Lecture 27 - Indigenous Knowledge

Lecture 28 - Ecological Journey

Lecture 29 - Kuki Jhumming Practices

Lecture 30 - Debates on Shifting Cultivation

Lecture 31 - Course Summary

- Lecture 1 - Thematic Preliminaries - I
- Lecture 2 - Thematic Preliminaries - II
- Lecture 3 - Thematic Preliminaries - III
- Lecture 4 - Sociological Modernism: Karl Marx - I
- Lecture 5 - Sociological Modernism: Karl Marx - II
- Lecture 6 - Sociological Modernism: Karl Marx - III
- Lecture 7 - Sociological Modernism: Max Weber - I
- Lecture 8 - Sociological Modernism: Max Weber - II
- Lecture 9 - Sociological Modernism: Max Weber - III
- Lecture 10 - Sociological Modernism: Max Weber - IV
- Lecture 11 - Sociological Modernism: Marx vs. Weber
- Lecture 12 - Structuralist Interpretation - I
- Lecture 13 - Structuralist Interpretation - II
- Lecture 14 - Structuralist Interpretation - III
- Lecture 15 - Western Marxism - I
- Lecture 16 - Western Marxism - II
- Lecture 17 - Modernity and Social Theory - I
- Lecture 18 - Modernity and Social Theory - II
- Lecture 19 - Modernity and Social Theory - III
- Lecture 20 - Modernity and Social Theory - IV
- Lecture 21 - Deconstruction of Modernity: The Feminist Challenge - I
- Lecture 22 - Deconstruction of Modernity: The Feminist Challenge - II
- Lecture 23 - Deconstruction of Modernity: Towards Cultural Studies - I
- Lecture 24 - Deconstruction of Modernity: Towards Cultural Studies - II
- Lecture 25 - Deconstruction of Modernity: The Postmodernist Critique - I
- Lecture 26 - Deconstruction of Modernity: The Postmodernist Critique - II
- Lecture 27 - A New Totality - I
- Lecture 28 - A New Totality - II
- Lecture 29 - Modernity in India
- Lecture 30 - What have we discussed?

Lecture 1 - A Brief History of Cognitive Psychology - 1

Lecture 2 - A Brief History of Cognitive Psychology - 2

Lecture 3 - Studying Cognition

Lecture 4 - Perception:Basic Principles

Lecture 5 - Models of Perception - 1

Lecture 6 - Models of Perception - 2

Lecture 7 - Basic Attention Processes

Lecture 8 - Models of Attention

Lecture 9 - Automization and Attention

Lecture 10 - Memory Introduction

Lecture 11 - Short Term Memory

Lecture 12 - Working Memory

Lecture 13 - Long-Term Memory Encoding

Lecture 14 - Retrieval from Long-Term Memory

Lecture 15 - Semantic Memory Basics

Lecture 16 - Models of Semantic Memory

Lecture 17 - Introducing Concepts and Categories - 1

Lecture 18 - Introducing Concepts and Categories - 2

Lecture 19 - Basics of Visual Memory

Lecture 20 - Object Transformation in Visual Memory

Lecture 21 - Basic Issues in Language

Lecture 22 - Comprehension and Understanding of Language

Lecture 23 - Introduction to Problem Solving

Lecture 24 - Factors Influencing Problem Solving

Lecture 25 - Insight and Creativity

Lecture 26 - Reasoning - 1

Lecture 27 - Reasoning - 2

Lecture 28 - Classical Theory of Decision Making

Lecture 29 - Prospect Theory of Decision Making

Lecture 30 - Course Summary

- Lecture 1 - Introduction to the course
- Lecture 2 - Raja Rammohan Roy : Religious reforms
- Lecture 3 - Raja Rammohan Roy : Modern education
- Lecture 4 - Raja Rammohan Roy : Freedom of Press
- Lecture 5 - Rabindranath Tagore : Nationalism
- Lecture 6 - Rabindranath Tagore : Cosmopolitanism
- Lecture 7 - Rabindranath Tagore : Idea of man
- Lecture 8 - Aurobindo Ghosh : Self
- Lecture 9 - Aurobindo Ghosh : Community and Religion
- Lecture 10 - Vivekananda : Introduction
- Lecture 11 - Vivekananda : Revitalisation of Indian life
- Lecture 12 - Mahatma Gandhi : Introduction
- Lecture 13 - Mahatma Gandhi : Hind swaraj and Critique of Modern Civilisation
- Lecture 14 - Mahatma Gandhi : India of His Dreams
- Lecture 15 - Muhammad Iqbal : Community
- Lecture 16 - Muhammad Iqbal : Religion and Nation
- Lecture 17 - Savarkar : Introduction
- Lecture 18 - Savarkar : Hinduism and Hindutva
- Lecture 19 - Jawaharlal Nehru : Discovery of India
- Lecture 20 - Jawaharlal Nehru : Secularism
- Lecture 21 - Jawaharlal Nehru : Internationalism
- Lecture 22 - B.R.Ambedkar : Introduction
- Lecture 23 - B.R.Ambedkar : Caste
- Lecture 24 - B.R.Ambedkar : Liberal Democracy and Constitutional Morality
- Lecture 25 - Pandita Ramabai : Introduction
- Lecture 26 - Pandita Ramabai : Gender and Caste
- Lecture 27 - Rammanohar Lohia : Introduction
- Lecture 28 - Rammanohar Lohia : Caste and Class
- Lecture 29 - Rammanohar Lohia : Views on Indian Languages
- Lecture 30 - Conclusion

Lecture 1 - Introduction to Consumer Psychology - I

Lecture 2 - Introduction to Consumer Psychology - II

Lecture 3 - Problem Recognition - I

Lecture 4 - Problem Recognition - II

Lecture 5 - Alternate Evaluation - I

Lecture 6 - Alternate Evaluation - II

Lecture 7 - Alternate Evaluation - III

Lecture 8 - Post Purchase and Consumption - I

Lecture 9 - Post Purchase and Consumption - II

Lecture 10 - Perception and Cognition - I

Lecture 11 - Perception and Cognition - II

Lecture 12 - Memory and Learning - I

Lecture 13 - Memory and Learning - II

Lecture 14 - Emotion Motivation and Mood - I

Lecture 15 - Emotion Motivation and Mood - II

Lecture 16 - Attitude and Attitude Change - I

Lecture 17 - Attitude and Attitude Change - II

Lecture 18 - Communication and Persuasion - I

Lecture 19 - Communication and Persuasion - II

Lecture 20 - Summary

Lecture 1 - Sanskrit and National Theatre

Lecture 2 - History of Parsi Theatre and Female Impersonation

Lecture 3 - Female Impersonation and Indian Folk Traditions

Lecture 4 - Early Indian Playwrights

Lecture 5 - Silence! The Court is in Session

Lecture 6 - A Friend's Story

Lecture 7 - Ghashiram Kotwal

Lecture 8 - Kanyadaan

Lecture 9 - Hayavadana

Lecture 10 - Tughlaq

Lecture 11 - The Dreams of Tipu Sultan

Lecture 12 - The Fire and the Rain

Lecture 13 - Broken Images

Lecture 14 - Summary

Lecture 15 - Introduction and Garbo

Lecture 16 - Old Stone Mansion

Lecture 17 - Desire in the Rocks

Lecture 18 - Sonata

Lecture 19 - Summary of Mahesh Elkunchwar

Lecture 20 - Introduction and Final Solutions

Lecture 21 - Bravely Fought the Queen

Lecture 22 - Dance Like a Man

Lecture 23 - Summary of Mahesh Dattani

Lecture 24 - Introduction and Procession

Lecture 25 - Bhoma

Lecture 26 - Stale News and Summary

Lecture 27 - Conclusion

- Lecture 1 - General Outline and methods
- Lecture 2 - Political theories and ideologies
- Lecture 3 - Liberty: republican conception of freedom
- Lecture 4 - Freedom as autonomy;Positive and negative liberty
- Lecture 5 - Freedom as Swaraj, Free speech and hate speech
- Lecture 6 - Introduction: Equity and egalitarianism
- Lecture 7 - Equality of opportunity; preferential treatment
- Lecture 8 - Luck Egalitarianism and its critiques; Equality and Liberty
- Lecture 9 - Introduction and forms of rights
- Lecture 10 - Conflicts between rights
- Lecture 11 - Rights and Duties
- Lecture 12 - Justice : A distributive concept
- Lecture 13 - Justice : Procedural and Substantive; Justice as fairness
- Lecture 14 - Justice : Capability approach; libertarian, communitarian conception of Justice
- Lecture 15 - Justice : Feminist conceptions of justice; Global justice
- Lecture 16 - Introduction to Power and authority
- Lecture 17 - Power, legitimacy and hegemony
- Lecture 18 - Power and knowledge; different conceptions of power
- Lecture 19 - Introduction and different conceptions of state and sovereignty
- Lecture 20 - Modern nation state; liberal, Marxist and feminist conceptions of state
- Lecture 21 - State and governmentality
- Lecture 22 - Introduction: Procedural and Substantive Democracy
- Lecture 23 - Various models of democracy
- Lecture 24 - Challenges and Limits of Democracy; Free press and Democracy
- Lecture 25 - Citizenship: Subject and Citizen
- Lecture 26 - T H Marshal and liberal conceptions of citizenship as legal and equal member
- Lecture 27 - Multiculturalism and Cosmopolitan Citizenship
- Lecture 28 - Introduction; Doom and Gloom; Democracy and environmental crisis
- Lecture 29 - Climate change and environmental justice
- Lecture 30 - Revisiting some key themes and concepts

Lecture 1 - Introduction to the Science of Human Behavior - I

Lecture 2 - Introduction to the Science of Human Behavior - II

Lecture 3 - Sensation - I

Lecture 4 - Sensation - II

Lecture 5 - Perception - I

Lecture 6 - Perception - II

Lecture 7 - Learning - I

Lecture 8 - Learning - II

Lecture 9 - Memory - I

Lecture 10 - Memory - II

Lecture 11 - Language - I

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Lecture 13 - Intelligence - I

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Lecture 5 - Speech Perception - I

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Lecture 7 - Speech Production - I

Lecture 8 - Speech Production - II

Lecture 9 - Words - I

Lecture 10 - Words - II

Lecture 11 - Words - III

Lecture 12 - Sentences - I

Lecture 13 - Sentences - II

Lecture 14 - Discourse - I

Lecture 15 - Discourse - II

Lecture 16 - Reading and Writing - I

Lecture 17 - Reading and Writing - II

Lecture 18 - Bilingualism - I

Lecture 19 - Bilingualism - II

Lecture 20 - Overall Review

Lecture 1 - Reflections on Development Studies and Development Research

Lecture 2 - Types, Forms, and Processes of Development Studies Research

Lecture 3 - The Rigour in Development Studies Research

Lecture 4 - Paradigms of Development Research

Lecture 5 - Development Research-Development Work Continuum and Action Research in Development Studies

Lecture 6 - Ethics in Development Studies and Development Research

Lecture 7 - Literature Study

Lecture 9 - Introducing Qualitative Research Methods

Lecture 10 - Introducing Qualitative Research Methods (Continued...)

Lecture 11 - Interviews and Focus Group Discussions

Lecture 12 - Participatory Methods and Approaches

Lecture 13 - Conducting Case Studies and Maintaining Field Diaries

Lecture 14 - Introducing Quantitative Research Methods

Lecture 15 - An Overview of Mixed Methods Research

Lecture 16 - Field Surveys and Inventories

Lecture 17 - Logical Framwork and SWOT Analysis

Lecture 18 - The importance of Census and other Secondary Data in Development Studies

Lecture 19 - Communicating Research

Lecture 20 - Operationalizing Rights-based Approaches to Development

Lecture 21 - Poverty Measures and Analysis

Lecture 22 - Gender-sensitive Indicators and Gender Analysis

Lecture 23 - Social Capital Assessment Tools

Lecture 24 - Moitoring and Evaluation

Lecture 25 - A Final Note

Lecture 1 - Introduction and General Outline

Lecture 2 - Sources and Methodology to Study Indian Business History

Lecture 3 - East India Company's early ventures in India

Lecture 4 - Agency Houses: Jagat Seths and Early Banking operations

Lecture 5 - Emergence of Bombay and Cotton Trade, 1750-1850

Lecture 6 - Indian Business: Changes and Styles

Lecture 7 - Emergence of Calcutta: Impact on Industries

Lecture 8 - Swadeshi Movement: Impact on Indian Industries

Lecture 9 - Case Studies: Indian Business Houses: TATAs

Lecture 10 - Indian Economy and Business during WW I

Lecture 11 - Impact of the Second World War WW II

Lecture 12 - Political Economy of the Global wars for India; Case Study: Hindustan Aeronautics Limited (HAL)

Lecture 13 - Impact of Independence and Partition: Evolution of the Railways in India

Lecture 14 - Planning, Statistics and Industrialization Policies

Lecture 15 - Global Currents of economic Thought, 1947-1960

Lecture 16 - Industrial Licensing Policies, Institutions 1947-1964

Lecture 17 - Industrial Licensing Policies, 1966-1980

Lecture 18 - Case Study: Amul and Rural Cooperatives

Lecture 19 - Liberalisation of the Indian Economy, 1990s

Lecture 20 - Business Developments in India; India's Energy Diplomacy through ONGC

Lecture 21 - Indian Business History: Trends and Prospects

Lecture 22 - Learning Outcomes from Indian Business History

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Lecture 2 - Method: Text and Context

Lecture 3 - Intro and Justice

Lecture 4 - State and Philosopher King

Lecture 5 - Communism of Wives and Property and Critical Assessment of his Thought

Lecture 6 - Intro and Ethics or Virtue

Lecture 7 - Politics and His Ideal State

Lecture 8 - Aristotle-III: Citizenship, Views on Revolution and Critical Assessment of his Thought

Lecture 9 - Machiavelli-I: Intro and Virtù and Fortuna

Lecture 10 - Machiavelli-II: Politics, Violence, and Religion

Lecture 11 - Machiavelli-III: Republicanism and Critical Assessment of his Thought

Lecture 12 - Intro and Human Nature

Lecture 13 - The Leviathan or Sovereign

Lecture 14 - Political Obligation and Critical Assessment of his Thought

Lecture 15 - Intro, State of Nature and Natural Rights

Lecture 16 - Limited Government

Lecture 17 - Right to Dissent and Critical Assessment of his Thought

Lecture 18 - Rousseau-I: Intro and Social Contract

Lecture 19 - Rousseau-II: General Will and Critical Assessment of his Thought

Lecture 20 - Kant-I: Intro and What is Enlightenment?

Lecture 21 - Kant-II: Morality, Autonomy and Freedom

Lecture 22 - Kant-III: Kingdom of Ends and Critical Assessment of his Thought

Lecture 23 - Hegel-I: Intro and Freedom

Lecture 24 - Hegel-II: Civil Society and State

Lecture 25 - Hegel-III: Rights and Critical Assessment of his Thought

Lecture 26 - Marx-I: Intro and Historical Materialism

Lecture 27 - Marx-II: State and Class

Lecture 28 - Marx-III: Views on Politics, Communism and Critical Assessment of his Thought

Lecture 29 - Mill-I: Intro, Utilitarianism and Subjection of Women

Lecture 30 - Mill-II: On Liberty, Representative Government and Critical Assessment of his Thought

Lecture 1 - The Nature of Stress - 1

Lecture 2 - The Nature of Stress - 2

Lecture 3 - The Biology of Stress

Lecture 4 - Stress, Health, and Non-infectious Diseases

Lecture 5 - Stress and Infectious Diseases

Lecture 6 - Stress and Psychological Disorders

Lecture 7 - Stress, Trauma and Posttraumatic growth - 1

Lecture 8 - Stress, Trauma and Posttraumatic growth - 2

Lecture 9 - Factors Influencing Stress Tolerance

Lecture 10 - Coping Strategies: Definition and Types

Lecture 11 - Unconscious mind and defensive coping

Lecture 12 - Characteristics of constructive coping; Physical ways of coping

Lecture 13 - Coping with relaxation exercises

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Lecture 15 - Coping with social support

Lecture 16 - Coping with meditation and mindfulness

Lecture 17 - Positive mental health and well-being

Lecture 18 - Well-being and resilience

Lecture 19 - What is happiness? What makes us happy?

Lecture 20 - Socio-demographic factors and happiness

Lecture 21 - Positive emotions

Lecture 22 - Genetic set point and hedonic adaptation

Lecture 23 - Sustainable happiness model

Lecture 24 - Sustainable happiness with intentional activities

Lecture 25 - Cultivating happiness with gratitude

Lecture 26 - Cultivating happiness with acts of kindness

Lecture 27 - Social comparison and happiness

Lecture 28 - Cultivating happiness with signature strengths 1 (VIA character strengths)

Lecture 29 - Cultivating happiness with signature strengths 2 (Gallup's/Clifton strength finder)

Lecture 30 - Cultivating happiness with Flow

Lecture 31 - Humanistic psychology and self-actualization

[Lecture 32 - Self-determination, motivation, and well-being](#)

[Lecture 33 - Meaning in life and well-being](#)

[Lecture 34 - Life goals and well-being](#)

Lecture 1 - Articulation of consonants - 1

Lecture 2 - Articulation of consonants - 2

Lecture 3 - Articulation of vowels

Lecture 4 - Language endangerment and linguistic diversity

Lecture 5 - Linguistic diversity - consonants in the languages of the world

Lecture 6 - Linguistic diversity - consonants and vowels in the languages of the world

Lecture 7 - Linguistic diversity - conclusion

Lecture 8 - Acoustic analysis: sound waves

Lecture 9 - Acoustic analysis: source filter theory and spectrograms

Lecture 10 - Acoustic analysis: vowels and formants

Lecture 11 - Acoustic analysis: formant calculation

Lecture 12 - Perceptual cues, variability in the speech signal, acoustic-phonetic invariance

Lecture 13 - Segmentation problem, categorical perception, cp in infants and animals

Lecture 14 - Measuring perceptual distinctiveness, multidimensional scaling, speech perception theories

Lecture 15 - development of the ideas of phonemes and features

Lecture 16 - phonemes as categories, phonemes in different languages, allophonic rules

Lecture 17 - problems in phonemic analysis, context and phonotactics

Lecture 18 - Psychological reality of phonemes

Lecture 19 - Distinctive features and natural classes

Lecture 20 - Phonological rule application

Lecture 21 - Distinctive features, feature economy and markedness

Lecture 22 - Morphophonological rules

Lecture 23 - Syllables

Lecture 24 - Stress

Lecture 25 - Phonetics and phonology of intonation, microprosody, stylization

Lecture 26 - Nuclear tone, pitch accent and boundary tones

Lecture 27 - Focus, givenness

Lecture 1 - Empiricism and Rationalism

Lecture 2 - Comte and Positivism; Epistemology and Ontology

Lecture 3 - The Rules of Sociological Method

Lecture 4 - Sociology of Knowledge

Lecture 5 - Religion and the Division of Labour in Society

Lecture 6 - Positivism and Neo-Kantianism

Lecture 7 - Methodology of the Social Sciences

Lecture 8 - Interpretive Sociology

Lecture 9 - Methodological Individualism and Interpretative Understanding of Social Action

Lecture 10 - Weberian Social Sciences: Methodological Implications

Lecture 11 - Materialist Conception of History

Lecture 12 - Dialectic

Lecture 13 - Nature, Ideology and Science

Lecture 14 - Systematic Falsification

Lecture 15 - Hypothetico - Deductive Model

Lecture 16 - The Structure of Scientific Revolutions

Lecture 17 - Popper Versus Kuhn

Lecture 18 - Positivism Versus Hermeneutics - I

Lecture 19 - Positivism Versus Hermeneutics - II

Lecture 20 - Philosophy of Social Sciences: Taking Stock

Lecture 21 - End of the Philosophy of the Social Sciences

Lecture 22 - Return of Grand Theory in the Human Sciences

Lecture 23 - An Overview of the Course

Lecture 1 - Sociology of development: An overview

Lecture 2 - Development historically

Lecture 3 - Decolonization, nationalism and development - I

Lecture 4 - Decolonization, nationalism and development - II

Lecture 5 - Decolonization, nationalism and development - III

Lecture 6 - Social evolution and social change

Lecture 7 - Social change and progress

Lecture 8 - Modernization Theory: An Overview

Lecture 9 - State and Class under Peripheral Capitalism

Lecture 10 - Critique of Samuel Huntington

Lecture 11 - Class, State and Revolution

Lecture 12 - The Empirical Peasantry and the Hypothetical Proletariat

Lecture 13 - Class and Classness: Substitutes and Realities

Lecture 14 - Modernization and Huntington's Argument

Lecture 15 - Huntington, Social Sciences and Ideology

Lecture 16 - The Ideological, Empirical and Methodological Critiques - I

Lecture 17 - The Ideological, Empirical and Methodological Critiques - II

Lecture 18 - Dependency Theory: Intellectual Antecedents

Lecture 19 - The Latin American Debates on Underdevelopment - I

Lecture 20 - The Latin American Debates on Underdevelopment - II

Lecture 21 - Dependency Theory in Transition - I

Lecture 22 - Dependency Theory in Transition - II

Lecture 23 - Critiques of Dependency Theory - I

Lecture 24 - Critiques of Dependency Theory - II

Lecture 25 - Limits to Growth - I

Lecture 26 - Limits to Growth - II

Lecture 27 - E. F. Schmacher's Small is Beautiful

Lecture 28 - Ivan Illich's Towards a History of Needs

Lecture 29 - Paradigms Lost, Paradigms Regained: Development studies in the 21st century - I

Lecture 30 - Paradigms Lost, Paradigms Regained: Development studies in the 21st century - II

- Lecture 1 - Development, Economic Growth and Sustainable Development
- Lecture 2 - Basic Ecosystem Ecology
- Lecture 3 - Environmentalism
- Lecture 4 - Environmental movement
- Lecture 5 - Environmentalism in the global south
- Lecture 6 - Ecofeminism
- Lecture 7 - Feminist political ecology
- Lecture 8 - Marx and ecology
- Lecture 9 - Deep ecology
- Lecture 10 - Gandhi and ecology
- Lecture 11 - Social ecology
- Lecture 12 - Religion, environment and historical roots of ecological crisis
- Lecture 13 - Biodiversity conservation ethics in Buddhism and Hinduism
- Lecture 14 - Christian religion in the age of ecological crisis
- Lecture 15 - Natural resource management
- Lecture 16 - Common property vs. private property
- Lecture 17 - Livelihoods, forests, and conservation
- Lecture 18 - Conservation-induced displacement
- Lecture 19 - Environment impact assessment and national rehabilitation and resettlement policy
- Lecture 20 - Dispossession and land acquisition
- Lecture 21 - Mining, development, and indigenous people
- Lecture 22 - Competing visions of development along the Narmada
- Lecture 23 - Dams, development, and resistance: Case studies
- Lecture 24 - Development theory and gendered approach to development
- Lecture 25 - Gender, environment and sustainable development
- Lecture 26 - Climate change interventions and policy framework
- Lecture 27 - Eastern Himalayas and climate change
- Lecture 28 - Ecological knowledge, biodiversity conservation and sustainability
- Lecture 29 - Traditional religion and conservation of nature in Northeast India: Case study
- Lecture 30 - Indigenous knowledge, environment and development
- Lecture 31 - Relevance of indigenous knowledge: Case study

- Lecture 1 - Introduction to Industrial Organization, Preferences
- Lecture 2 - Utility maximization and derivation of demand curve
- Lecture 3 - Examples of utility maximization, demand curve and market demand curve
- Lecture 4 - Tutorial Module 1
- Lecture 5 - Production Function
- Lecture 6 - Cost minimization problem
- Lecture 7 - Derivation of cost curves
- Lecture 8 - Tutorial on Production and cost curves
- Lecture 9 - Optimal output and supply curve of a firm
- Lecture 10 - Derivation of Market price in competitive market
- Lecture 11 - Long run market price and Pareto optimality
- Lecture 12 - Tutorial on Perfectly Competitive Market
- Lecture 13 - Monopoly price
- Lecture 14 - Price Discrimination - I
- Lecture 15 - Price Discrimination - II
- Lecture 16 - Tutorial on Monopoly
- Lecture 17 - Introduction to Game Theory, Iterated Elimination of Dominated Strategy
- Lecture 18 - Pure Strategy Nash Equilibrium
- Lecture 19 - Mixed Strategy Nash Equilibrium
- Lecture 20 - Existence of Nash Equilibrium in Games with 2 Players and 2 Strategies
- Lecture 21 - Tutorial on Normal Form Games
- Lecture 22 - Dynamic Games, Backward Induction
- Lecture 23 - Subgame Perfect Nash Equilibrium
- Lecture 24 - Tutorial on Dynamic Games
- Lecture 25 - Cournot Duopoly
- Lecture 26 - Cournot Oligopoly
- Lecture 27 - Tutorial on Cournot Competition
- Lecture 28 - Bertrand Competition with and without fixed cost
- Lecture 29 - Bertrand Competition with capacity constraint
- Lecture 30 - Bertrand Competition with capacity constraint
- Lecture 31 - Tutorial on Bertrand Competition

[Lecture 32 - Bertrand Competition with Decreasing returns to scale](#)

[Lecture 33 - Stackelberg Quantity Competition](#)

[Lecture 34 - Tutorial on Bertrand Competition and Stackelberg Quantity Competition](#)

[Lecture 35 - Stackelberg Price Competition](#)

[Lecture 36 - Simultaneous move Hotelling Model](#)

[Lecture 37 - Tutorial on Stackelberg Price Competition](#)

[Lecture 38 - Sequential Move Hotelling Model](#)

[Lecture 39 - Dixit's Model of Entry Deterrence](#)

[Lecture 40 - Tutorial on Sequential move Hotelling Model](#)

[Lecture 41 - Dixit's Model of Entry Deterrence](#)

[Lecture 42 - Bundling and Tying](#)

[Lecture 43 - Tutorial on Dixit's Model of Entry Deterrence](#)

Lecture 1 - Aim of the course, real numbers

Lecture 2 - Logic, proof

Lecture 3 - Definitions

Lecture 4 - Set operations

Lecture 5 - Definitions

Lecture 6 - Linear functions

Lecture 7 - Quadratic functions

Lecture 8 - Exponential functions, etc.

Lecture 9 - Differentiation: preliminaries

Lecture 10 - Rules of differentiation

Lecture 11 - Partial differentiation

Lecture 12 - Higher order differentiations

Lecture 13 - Approximations and elasticities

Lecture 14 - Differentiability, series, PDV

Lecture 15 - NPV, evaluation of investment projects

Lecture 16 - Exponential, logarithmic functions

Lecture 17 - Tutorials - 1a

Lecture 18 - Tutorials - 1b

Lecture 19 - Tutorials - 1c

Lecture 20 - Extreme, stationary points, first derivative test

Lecture 21 - Global and local extreme points

Lecture 22 - Second derivative test

Lecture 23 - Inflection points

Lecture 24 - Profit maximizations

Lecture 25 - Area under a curve, indefinite integral

Lecture 26 - Definite integral

Lecture 27 - Oil extraction, income distribution, PDV

Lecture 28 - Integration by parts, substitution, Lorenz curve

Lecture 29 - First order difference equations, solution

Lecture 30 - Dynamic stability, Cobweb model

Lecture 31 - Market model with inventory, Phase diagrams, Higher order equations

[Lecture 32 - Multiplier-acceleration model](#)

[Lecture 33 - Tutorials - 2a](#)

[Lecture 34 - Tutorials - 2b](#)

Lecture 1 - Nature of human thought - I

Lecture 2 - Brain and cognition, Seat of thought - II

Lecture 3 - Language, meaning, reality - III

Lecture 4 - Categorization

Lecture 5 - Categorization: (Continued...)

Lecture 6 - Frames: another way to understand categories

Lecture 7 - Metaphor

Lecture 8 - Metaphor and Metonymy

Lecture 9 - Image schema

Lecture 10 - Image schema (Continued...)

Lecture 11 - Language acquisition

Lecture 12 - Language acquisition (Continued...)

Lecture 13 - Language in the brain

Lecture 14 - Language in the brain (Continued...)

Lecture 15 - Language and attention

Lecture 16 - Language and visual attention

Lecture 17 - Attention in Sentence processing

Lecture 18 - Executive control/function and its facets

Lecture 19 - Role of executive function in language processing

Lecture 20 - Mental simulation and its relation with language; summary of the course

Lecture 1 - Becoming and being bilingual

Lecture 2 - Attitude, Acculturation and Bilingualism

Lecture 3 - Who is a Bilingual ?

Lecture 4 - Bilingual acquisition among children: simultaneous bilingualism

Lecture 5 - Successive Bilingualism

Lecture 6 - Language and cognition among bilinguals

Lecture 7 - Bilingual cognition (Continued...)

Lecture 8 - Bilingual Memory Models

Lecture 9 - Bilingual brain: neural representation of languages

Lecture 10 - Data from processing studies on bilingual representation in brain

Lecture 11 - Speech perception and comprehension: theories

Lecture 12 - Speech perception and production studies

Lecture 13 - Lexical processing: background

Lecture 14 - Lexical processing: different experimental paradigms: comprehension and production

Lecture 15 - Sentence processing

Lecture 16 - Metalinguistic Awareness

Lecture 17 - Executive Control: bilingual advantage

Lecture 18 - cognitive reserve, new developments

Lecture 19 - New research trends in bilingualism

Lecture 20 - New models. Applied areas

- Lecture 1 - Emotions: Concepts and Categories
- Lecture 2 - Historical Background and Theories
- Lecture 3 - Communication and Measurement of Emotions
- Lecture 4 - Universals and cultural differences in emotions - 1
- Lecture 5 - Universals and cultural differences in emotions - 2
- Lecture 6 - Emotions and the Body
- Lecture 7 - Emotions and the Brain
- Lecture 8 - Self-evaluative emotions-Guilt, shame, Embarrassment, and pride
- Lecture 9 - Social Comparison Emotions-Envy and Jealousy
- Lecture 10 - Positive Emotions
- Lecture 11 - Happiness and Subjective Well-being - 1
- Lecture 12 - Happiness and Subjective Well-being - 2
- Lecture 13 - Emotions in Groups - 1
- Lecture 14 - Emotions in Groups - 2
- Lecture 15 - Emotions and Cognitions: Introduction
- Lecture 16 - Emotion and Memory
- Lecture 17 - Emotion and Judgment/Decision making
- Lecture 18 - Depression
- Lecture 19 - Anxiety Disorders
- Lecture 20 - Emotion regulation: Introduction
- Lecture 21 - Adaptive emotion regulation using ABC model
- Lecture 22 - Adaptive emotion regulation using mindfulness
- Lecture 23 - Emotional intelligence: Introduction
- Lecture 24 - Skills of EI-Self-awareness
- Lecture 25 - Skills of EI-Self-regulation/Self-management
- Lecture 26 - Skills of EI-Self-Motivation
- Lecture 27 - Skills of EI-Empathy
- Lecture 28 - Skills of EI-Social intelligence and social skills
- Lecture 29 - Emotional intelligence and workplace
- Lecture 30 - Emotional intelligence, health and well-being
- Lecture 31 - Development of emotional intelligence

Lecture 1 - Introduction

Lecture 2 - Barriers to Communication - 1

Lecture 3 - Barriers to Communication - 2

Lecture 4 - Barriers to Communication - 3

Lecture 5 - Non-Verbal Communication - 1

Lecture 6 - Non-Verbal Communication - 2

Lecture 7 - Non-Verbal Communication - 3

Lecture 8 - Non-Verbal Communication - 4

Lecture 9 - Non-Verbal Communication - 5

Lecture 10 - Listening Skills - 1

Lecture 11 - Listening Skills - 2

Lecture 12 - Listening Skills - 3

Lecture 13 - Business Letters Writing - 1

Lecture 14 - Business Letters Writing - 2

Lecture 15 - Business Letters Writing - 3

Lecture 16 - Business Letters Writing - 4

Lecture 17 - Report Writing - 1

Lecture 18 - Report Writing - 2

Lecture 19 - Group Discussion - 1

Lecture 20 - Group Discussion - 2

Lecture 21 - Group Discussion - 3

Lecture 22 - Interview Skills - 1

Lecture 23 - Interview Skills - 2

Lecture 24 - Interview Skills - 3

Lecture 25 - Interview Skills - 4

Lecture 26 - Interview Skills - 5

Lecture 27 - Interview Skills - 6

Lecture 28 - Interview Skills - 7

Lecture 29 - Netiquette - 1

Lecture 30 - Netiquette - 2

Lecture 31 - Oral Presentation - 1

[Lecture 32 - Oral Presentation - 2](#)

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[Lecture 34 - Cross Cultural Communication - 1](#)

[Lecture 35 - Cross Cultural Communication - 2](#)

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[Lecture 38 - Common Errors - 1](#)

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- Lecture 1 - Introduction to Ethics - 'Crito' A Socratic dialogue
- Lecture 2 - Introduction to Ethics -An assessment of Ethical relativism
- Lecture 3 - Consequentialism -Introduction
- Lecture 4 - Consequentialism Rule and Act
- Lecture 5 - Hedonism
- Lecture 6 - Utilitarianism
- Lecture 7 - Deontological theories - Introduction
- Lecture 8 - Deontological theories - Immanuel Kant
- Lecture 9 - Ethical Rules (with reference to W D Ross)
- Lecture 10 - Situation Ethics
- Lecture 11 - Virtue Ethics
- Lecture 12 - Metaethical Theories
- Lecture 13 - Ethical Relativism: A discussion on Universal Declaration of Human Rights
- Lecture 14 - Ethical Naturalism
- Lecture 15 - Ethical Naturalism (Continued...)
- Lecture 16 - Ethical Naturalism-Emotivism
- Lecture 17A - Ethical Non-naturalism
- Lecture 17B - Ethical Non-naturalism-II
- Lecture 18 - Non-cognitive or Nondescriptivist Theories - Intuitionism
- Lecture 19 - Non-cognitive or Nondescriptivist Theories - Intuitionism Nihilism
- Lecture 20 - Why be Moral?
- Lecture 21 - Ethics in the Indian tradition
- Lecture 22 - Theory of Karma - Part 1
- Lecture 23 - Theory of Karma - Part 2
- Lecture 24 - Nishkama Karma - Part 1
- Lecture 25 - Nishkama Karma - Part 2
- Lecture 26 - Gandhian Ethics - Part 1
- Lecture 27 - Gandhian Ethics - Part 2
- Lecture 28 - Gandhian Ethics - Part 3 (Satyagraha)
- Lecture 29 - Purusharthas
- Lecture 30 - Buddhist Ethics - Part 1

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[Lecture 34 - Discussing Thomas Pogge's 'Real World Justice' - Part 1](#)

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Lecture 1 - Identification of Arguments

Lecture 2 - Non-arguments

Lecture 3 - Types of Arguments: Deductive vs Inductive

Lecture 4 - Nature and Scope of Deductive and Inductive Arguments

Lecture 5 - Truth, Validity and Soundness

Lecture 6 - Strength of Inductive arguments, Counter example method

Lecture 7 - Toulmin's Model of Argumentation

Lecture 8 - Identification of Formal and Informal Fallacies

Lecture 9 - Informal Fallacies: Fallacies of relevance

Lecture 10 - Fallacies of Weak Induction and Fallacies arising out of ambiguity in Language

Lecture 11 - Introduction and motivation for Syllogistic Logic

Lecture 12 - Aristotle theory of Syllogisms - 1

Lecture 13 - Syllogistic Poem, Reduction of Syllogisms

Lecture 14 - Syllogistic Poem, Reduction of Syllogisms

Lecture 15 - Nature and Scope of Propositional Logic

Lecture 16 - Syntax of Propositional Logic

Lecture 17 - Logical Connectives: Truth Tables

Lecture 18 - Truth Table Method: Validity, Consistency, Logical Equivalence

Lecture 19 - Semantic Tableaux Method for Propositional Logic

Lecture 20 - Knights and Knaves Puzzles

Lecture 21 - Semantic Tableaux Method: Further Examples

Lecture 22 - Natural Deduction Method

Lecture 23 - Natural Deduction: Examples

Lecture 24 - Conjunctive and Disjunctive Normal Forms

Lecture 25 - CNF, DNF and satisfiability and Validity

Lecture 26 - Resolution and refutation method

Lecture 27 - Resolution and refutation method: Examples

Lecture 28 - Axiomatic Propositional Logic

Lecture 29 - Hilbert Ackermann Axiomatic system

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Lecture 3 - Perspectives On Population

Lecture 4 - Indian Society

Lecture 5 - Social Change in India

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Lecture 7 - Methodology

Lecture 8 - Primary and Secondary Data and Related Issues

Lecture 9 - Sources of Population Data

Lecture 10 - Participatory Rural Appraisal

Lecture 11 - Demographic Models - I

Lecture 12 - Demographic models - II

Lecture 13 - Contemporary Issues In Modelling Population Processes

Lecture 14 - World Population Growth

Lecture 15 - Demographic Transition in the Nineteenth and Twentieth Centuries

Lecture 16 - Demographic schism between Developed and Developing Countries and Future Prospects

Lecture 17 - History Of Growth

Lecture 18 - Population of India - II

Lecture 19 - Trends In Death and Birth Rates

Lecture 20 - Population projections, Migration and Future Prospects

Lecture 21 - Urbanization and Development

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Lecture 26 - Marxist theory Of Population

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[Lecture 36 - Differences In Perception Between Developed and Developing Countries](#)

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[Lecture 38 - Emerging Issues In sociology Of Population](#)

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Lecture 1 - What is sociology?

Lecture 2 - Sociological approaches

Lecture 3 - Nature of society: Individuals and groups

Lecture 4 - Cooperation and conflict

Lecture 5 - Family-I: Definition and classification of family

Lecture 6 - Family-II: Perspectives on family

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Lecture 8 - State-II: State in India

Lecture 9 - State-III: The concept of power

Lecture 10 - State-IV: Functionalist and Marxist perspectives on power

Lecture 11 - Sociology of work-I: Need for work

Lecture 12 - Sociology of work-II: Social change and work

Lecture 13 - Sociology of work-III: Development and work

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Lecture 15 - Religion-I: Social conditions and religious thought

Lecture 16 - Religion-II: Bases of religion

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Lecture 18 - What is sociology?

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Lecture 20 - Religion-VI: Contributions of Marx and Weber

Lecture 21 - Education-I: Concept of education?

Lecture 22 - Education-II: Functions of education

Lecture 23 - Social stratification-I: Social inequality and stratification

Lecture 24 - Social stratification-II: Explanations of social stratification

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NPTEL : Money and Banking (Humanities and Social Sciences)

Co-ordinators : Prof. Surajit Sinha

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Module-2 - Lecture-1 : Dimensions of Adjustment

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Module-3 - Lecture-1 : Adjustment? Range of Reactions

Module-4 - Lecture-1 : Human adjustment process?II

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Module-7 - Lecture-1 : Facets of human adjustment: Stress, Resilience and Coping

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NPTEL : Selected Topics in Psychology (Humanities and Social Sciences)

Co-ordinators : Prof. Manas K Mandal, Prof. JBP Sinha, Prof. Alok Bajpai, Prof. Rakesh K. Gupta, Prof. Ramadhar Singh, Prof. Braj Bhushan, Prof. Vivek Benegal, Prof. Ajit Dalal, Prof. Girishwar Misra

- Lecture 1 - Introduction Selected Topics in Psychology
- Lecture 2 - Psychology: Emerging of a discipline
- Lecture 3 - Psychology: Emerging of a discipline
- Lecture 4 - Beginning, growth and decline of Western psychology in India
- Lecture 5 - The core and context of Indian psychology
- Lecture 6 - The indigenization of psychology in India
- Lecture 7 - Weaving culture into psychology
- Lecture 8 - Culture and Self: Implications for Social Behaviour
- Lecture 9 - Cultural and organizational behaviour
- Lecture 10 - How do similar attitudes determine attraction?
- Lecture 11 - Why do similar attitudes determine attraction?
- Lecture 12 - A beautiful mind? Perspective on brain , mind and it's challenges
- Lecture 13 - Emotion and well?being
- Lecture 14 - Mental health and illness - Part 1
- Lecture 15 - Mental health and illness - Part 2
- Lecture 16 - Folk Healing Traditions in India
- Lecture 17 - To sleep or not
- Lecture 18 - Issues and challenges in psychological assessment
- Lecture 19 - Nontraditional research in behavioural sciences
- Lecture 20 - What a surprise: My results are nonsignificant
- Lecture 21 - Neuropsychology and cognitive neuroscience research
- Lecture 22 - Functional MRI in psychology - Part 1
- Lecture 23 - Functional MRI in psychology - Part 2
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- Lecture 35 - Nanika tabetai desu ka?
- Lecture 36 - Dokoemo ikitakunai desu
- Lecture 37 - Chotto matte kudasai
- Lecture 38 - Mata irashite kudasai
- Lecture 39 - Omiyage o tsutsumanaide kudasai
- Lecture 40 - Watashi wa aisukurimu ga suki desu
- Lecture 41 - Nihongo no jishou ga hoshii desu
- Lecture 42 - Rainen kuni e kaeru tsumori desu
- Lecture 43 - Hikouki to shinkansen to dochira no houga hayai desu ka?
- Lecture 44 - Kurasu no naka de dare ga ichiban kashikoi desu ka?
- Lecture 45 - Kore wa tanaka san no jishou da to omoimasu
- Lecture 46 - Kasa wa eigo de nan to iimasu ka?
- Lecture 47 - Watashi ha Nihongo ga yomemasen
- Lecture 48 - Watashi wa kanji o kaku koto ga dekimasu
- Lecture 49 - Sonna koto iwanaide kudasai
- Lecture 50 - Watashiwa kuruma o unten suru toki ongaku o kikimasu
- Lecture 51 - Kanji o kaku koto ga dekimasu
- Lecture 52 - Shousetsu o yomu tame ni toshoukan e ikimasu
- Lecture 53 - Shashin o totte mo ii desu ka?
- Lecture 54 - Mainichi kaisha ni ikanakereba narimasen
- Lecture 55 - Tanaka san wa yoku hatarakimasu

Lecture 1 - Kore wa watashi no hon desu (This is my book)

Lecture 2 - Ima nan ji desu ka? (What is the time now?)

Lecture 3 - Hon wa tsukue no ue ni arimasu (The book is on the table)

Lecture 4 - Ashita kurabu e ikimasen ka? (Will you please come to the club tomorrow?)

Lecture 5 - Kodoma-tachi wa ima asonde imasu (Children are playing now)

Lecture 6 - Kodomotachi wa asonde kara benkyou shimasu (Children will study after playing)

Lecture 7 - Douzo meshiagatte kudasai (Please eat it)

Lecture 8 - Tabete mite kudasai (Please eat and see)

Lecture 9 - Koko de tabenaide kudasai (Please do not eat here)

Lecture 10 - Hitori de ikimasu ka? (Will you go alone?)

Lecture 11 - Irasshaimase ! (Welcome !)

Lecture 12 - Shiken wa dou deshita ka? (How was the exam?)

Lecture 13 - Tomodachi wa tanjoubi ni hana o kuremashita (My friend gave me flowers on my birthday)

Lecture 14 - Tomodachi wa ke-ki o tsukutte kuremashita (My friend made a cake and gave it to me)

Lecture 15 - Kimura to moushimasu (I am Kimura)

Lecture 16 - O-genki desu ka ? (How are you ?)

Lecture 17 - Kare wa 'happyou wa ashita desu' to iimashita (He said, 'the presentation is tomorrow)

Lecture 18 - Tanaka to iu hito ni aimashita (I met a person called Tanaka)

Lecture 19 - Tomodachi ga kuru to omoimasu (I think my friend will come)

Lecture 20 - Watashi wa hitori de ikemasu (I can go alone)

Lecture 21 - Ikka-getsu de dekimasu (I can do it in one mouth)

Lecture 22 - Kare wa Indo no shuukan no koto o yoku shitte imasu (He know a lot about Indian customs)

Lecture 23 - Aisatsu (Greetings)

Lecture 24 - Aisatsu (Greetings)

Lecture 25 - Chokore-to yori aisukuri-mu ga suki desu (I like ice cream more than chocolate)

Lecture 26 - Dochira ga suki desu ka ? (Which do you like ?)

Lecture 27 - Mira san asobi ni irashite kudasai (Mira san please visit us)

Lecture 28 - Houmon (Visiting)

Lecture 29 - Pen de kaite mo ii desu ka ? (Can I write with a pen?)

Lecture 30 - Konakute mo ii desu ka ? (Is is alright if I do not come ?)

Lecture 31 - Nani mo tabetakunai desu (I do not want to eat anything)

Lecture 32 - Watashi wa eiwa jiten ga hoshii desu (I want an English-Japanese dictionary)

Lecture 33 - Rainen kekkon suru tsumori desu (I intend to get married next year)

Lecture 34 - Soto wa kuraku narimashita (It has become dark outside)

Lecture 35 - Kyuujitai and Shinjitai

Lecture 36 - Nihon e itta koto ga arimasu (I have been to Japan)

Lecture 37 - Minikui ahiru no ko - I (Ugly duckling - I)

Lecture 38 - Minikui ahiru no ko - II (Ugly duckling - II)

Lecture 39 - Working in Japan

Lecture 40 - Haru ni naru to sakura ga saku (When it is spring cherry blossoms will bloom)

Lecture 41 - Mira wa konai kamoshirenai (Mira may not come)

Lecture 42 - Okane ga attara uchi o kaimasu (If I have money I will buy a house)

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Computer Aided Decision Systems - Industrial Practices using Big Analytics (Humanities and Social Sciences)

Co-ordinators : Prof. Deepu Philip, Prof. Amandeep Singh Oberoi

Lecture 1 - Introduction to Decision Support Systems (DSS)

Lecture 2 - Characteristics and Capabilities of DSS

Lecture 3 - Misconception and Components of DSS

Lecture 4 - Decision Process

Lecture 5 - Overview of Database Management Systems

Lecture 6 - Introduction to Modelbase Management Systems

Lecture 7 - Introduction to User Interface System

Lecture 8 - Principles of Graphical User Interface

Lecture 9 - Introduction to Database

Lecture 10 - Reasons behind using DBMS

Lecture 11 - Concepts and Architecture of Database Systems

Lecture 12 - Entity Relationship

Lecture 13 - Entity Relationship Diagrams

Lecture 14 - Translation of ER Diagram to DB

Lecture 15 - Database Normalization

Lecture 16 - More SQL Commands

Lecture 17 - Big Data: An Overview

Lecture 18 - Big Data Analytics Team

Lecture 19 - Big Data Analytics Lifecycle - Phase 1

Lecture 20 - Big Data Analytics Lifecycle - Phase 2

Lecture 21 - Big Data Analytics Lifecycle - Phase 3 and 4

Lecture 22 - Big Data Analytics Lifecycle - Phase 5 and 6

Lecture 23 - Big Data Analytics Tools and Software - Part 1

Lecture 24 - Big Data Analytics Tools and Software - Part 2

Lecture 25 - Big Data Analytics Tools and Software - Part 3

Lecture 26 - Big Data Analytics Tools and Software - Part 4

Lecture 27 - Big Data Analytics Lifecycle - Case Study

Lecture 28 - Introduction to Industrial Internet of Things (IIoT)

Lecture 29 - Structure of BDA in IIoT

Lecture 30 - BDA in IIoT, Gas Pipeline Case Study

Lecture 31 - BDA in IIoT, RR Engine Case Study

[Lecture 32 - DSS in CAD/CAM](#)

[Lecture 33 - Assembly Tree](#)

[Lecture 34 - BDA in Computer Aided Design](#)

[Lecture 35 - Product Data Exchange - Part 1](#)

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[Lecture 39 - DSS in Additive Manufacturing](#)

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[Lecture 41 - Usability Problems and Usability Design Process](#)

[Lecture 42 - Usability Principles](#)

[Lecture 43 - HTML as a User Interface Language - 1](#)

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[Lecture 45 - Introduction to PHP](#)

[Lecture 46 - Basic Components of PHP](#)

[Lecture 47 - More on PHP: Hypertext PreProcessor \(PHP\)](#)

[Lecture 48 - MySQL and PHP - The Backend of Decision Support Systems](#)

[Lecture 49 - Forms and PHP - Design of Interactive and Dynamic Applications](#)

[Lecture 50 - An Introduction to Networking](#)

[Lecture 51 - Data Visualization - Part 1](#)

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[Lecture 10 - Toilet as a Tool of Change: Exemplifying Sulabh International Social Service Organization](#)

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- Lecture 2 - Negotiations and Contractual Aspect
- Lecture 3 - Risks and Opportunities
- Lecture 4 - Regulatory Issues
- Lecture 5 - Implication on Stakeholders
- Lecture 6 - Joint Venture [JV] Options
- Lecture 7 - Types of Joint Venture [JV]
- Lecture 8 - Issues Frequently Arise During JV Negotiation
- Lecture 9 - Key Compliance
- Lecture 10 - Governing Laws in Cross-Border Transaction
- Lecture 11 - Formation of Joint Venture Agreement
- Lecture 12 - Governance Issues in Joint Venture
- Lecture 13 - Business Plan in Joint Venture
- Lecture 14 - Shareholder Agreement in Joint Venture
- Lecture 15 - Specific Issues of Share Transfer in Joint Venture
- Lecture 16 - Preparation for SPV
- Lecture 17 - Formation of SPV
- Lecture 18 - Disclosure to be made by SPV
- Lecture 19 - Risk Management and SPV
- Lecture 20 - Offset and SPV

- Lecture 1 - Why we need a business form for startup
- Lecture 2 - How to choose appropriate business form for startup
- Lecture 3 - Comparative Analysis of Incorporation Requirement
- Lecture 4 - Comparative Analysis of Compliance Cost
- Lecture 5 - Other Formalities to Comply
- Lecture 6 - Law relating to Partnership and Deed
- Lecture 7 - Law relating to LL.P
- Lecture 8 - How to Incorporate LL.P
- Lecture 9 - Law relating to Co-operative
- Lecture 10 - How to Incorporate Co-operative
- Lecture 11 - Law Relating to One Person Company
- Lecture 12 - Law Relating to Pvt. Ltd. Company
- Lecture 13 - Law Relating to Pub. Ltd. Compnay
- Lecture 14 - Law Relating to Non-Profit Company
- Lecture 15 - How to Incorporate these Companies
- Lecture 16 - How to Capitalize the Business
- Lecture 17 - Raising fund through Private Equity and Venture Capital
- Lecture 18 - Raising fund from Financial Institution
- Lecture 19 - Types of Instruments for raising the fund
- Lecture 20 - Issue of the Instruments

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Soft Skill Development (Humanities and Social Sciences)

Co-ordinators : Prof. Priyadarshi Patnaik, Prof. V.N. Giri, Prof. D. Suar

Lecture 1 - Understanding the Communicative Environment Â– I

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Lecture 3 - What to listen for and why

Lecture 4 - When to speak and how

Lecture 5 - Starting and Sustaining a Conversation

Lecture 6 - What to Present and How - Part I

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Lecture 9 - Communication Styles

Lecture 10 - Speaking in Groups

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Lecture 12 - Visual Perception

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Lecture 14 - The Body and the Way It Communicates

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Lecture 19 - Groups, Conflicts and their Resolution

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Lecture 21 - How Emotionally Mature Are You

Lecture 22 - Improving Your Emotional Intelligence

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Lecture 24 - Intrapersonal Communication

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Lecture 26 - Creativity : What Does It Mean

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Lecture 2 - Propositions, Arguments, Components, Basic Characteristics

Lecture 3 - Recognizing arguments, Diagramming logic flow

Lecture 4 - Types of arguments, Deductive, Inductive, different norms to assess arguments

Lecture 5 - Concepts of Validity Soundness, Consistency

Lecture 6 - History of Symbolic Language

Lecture 7 - Propositional Logic: Syntax

Lecture 8 - Connectives, Scope of Connectives

Lecture 9 - Truth-functional Connectives, Propositional Variables, Propositional Constants

Lecture 10 - Symbolization with Connectives

Lecture 11 - Propositional Logic: Semantics Basics of a Truth Table

Lecture 12 - Using Truth Table: Tautology, Contradiction, Contingent Propositions

Lecture 13 - Using Truth Table: Testing Arguments for Validity and Invalidity

Lecture 14 - Shorter Truth Table

Lecture 15 - Using Truth Table: Testing a Set of Propositions for consistency and inconsistency, and for logical equivalence

Lecture 16 - Introduction to Truth Trees

Lecture 17 - Truth Tree Rules and their Application

Lecture 18 - More on Truth-Tree Recovery of Partial Truth - Values

Lecture 19 - Using the Truth Trees

Lecture 20 - More on Truth Trees

Lecture 21 - Formal Proof of Validity

Lecture 22 - Valid Argument Forms:

Lecture 23 - How to Apply the Rules of Inference in a Proof

Lecture 24 - Understanding the Rules

Lecture 25 - Proofs with All Rules

Lecture 26 - Completeness : What it is

Lecture 27 - Indirect Proof

Lecture 28 - Conditional Proof

Lecture 29 - More on Conditional Proof

Lecture 30 - More on Derivations

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Lecture 2 - Introduction to Law

Lecture 3 - Theories of IP

Lecture 4 - Different Forms of IP

Lecture 5 - Different Forms of IP and Applicability of Theory

Lecture 6 - Patent Basic

Lecture 7 - Patent Ability Criteria

Lecture 8 - Non-Patentable Invention

Lecture 9 - Prier-Art Search

Lecture 10 - Patent Filing Procedure

Lecture 11 - Patent Prosecution

Lecture 12 - Patent Prosecution (Continued...)

Lecture 13 - International Patent

Lecture 14 - Patent Infringement

Lecture 15 - Patent Management

Lecture 16 - Utility Model Protection

Lecture 17 - Copyright Basic

Lecture 18 - Copy Right Registration

Lecture 19 - Copyright Infringement and Fair Use

Lecture 20 - Copyright in Digital Media

Lecture 21 - Industrial Design Basic

Lecture 22 - Industrial Design Registration

Lecture 23 - Utility Patent Vs Industrial Design

Lecture 24 - Trademark Basic

Lecture 25 - Trademark Registration

Lecture 26 - Trademark and Internet

Lecture 27 - Certification Mark and Collective Mark

Lecture 28 - Geographical Indication

Lecture 29 - Economics of GI Edit Lesson

Lecture 30 - Trademark Vs GI Trademark Managment

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Lecture 2 - Global Flows and New Media and Technologies

Lecture 3 - Globalization and Nation

Lecture 4 - Rise of Global Capitalism

Lecture 5 - Cultural Imperialism

Lecture 6 - Global Monocultures

Lecture 7 - Birth of Asian Kool

Lecture 8 - Bhangra Reinvention

Lecture 9 - Disorienting Bhangra

Lecture 10 - The Body of Dance

Lecture 11 - World Music I - Tabla

Lecture 12 - World Music II - Qawwali

Lecture 13 - World Music III - Baul

Lecture 14 - Is Chutney the New Rage

Lecture 15 - Bollywood Song and Dance

Lecture 16 - Planet Bollywood

Lecture 17 - Bollywood at Large

Lecture 18 - Bollywood Assemblages - Part I

Lecture 19 - Bollywood Assemblages - Part II

Lecture 20 - Bollywood's Soft Power

Lecture 21 - Travels of Dastan

Lecture 22 - Scripting the Nation

Lecture 23 - Cracking the Nation

Lecture 24 - Narrating and Interrogating the Nation

Lecture 25 - Cosmopolitans the Borderless World

Lecture 26 - Orientalism

Lecture 27 - Yoga, Meditation, Gurus

Lecture 28 - Beatles, Ravi Shankar and Sitar

Lecture 29 - Orientalizing India

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Lecture 31 - The Birth of Indo-Chic

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Lecture 3 - Quantitative vs. Qualitative Research

Lecture 4 - History of Qualitative Research

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Lecture 6 - Dominant Paradigms of Qualitative Research

Lecture 7 - Interpretivist Thinking

Lecture 8 - Verstehen

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Lecture 12 - Criticisms of Interpretivism and Constructivism

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Lecture 16 - Introduction to Qualitative Inquiry

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Lecture 18 - Qualitative Research Design (Continued...)

Lecture 19 - Ethnography

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Lecture 21 - Case Studies

Lecture 22 - Case Studies (Continued...)

Lecture 23 - Analyzing Interpretive Practice

Lecture 24 - Analyzing Interpretive Practice (Continued...)

Lecture 25 - Grounded Theory

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Lecture 27 - Participatory Action Research

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Lecture 3 - Introduction to EI and Related Concepts (Continued...)

Lecture 4 - Introduction to EI and Related Concepts (Continued...)

Lecture 5 - Introduction to Intelligence

Lecture 6 - Meaning, Nature, Scope, Types of Intelligence

Lecture 7 - Measurement of Intelligence

Lecture 8 - Applications

Lecture 9 - Discovery of Emotional Intelligence

Lecture 10 - Meaning, Nature Theory

Lecture 11 - Measurement of EI

Lecture 12 - Difference Between EQ and IQ

Lecture 13 - EQ Assessment

Lecture 14 - EQ and Empathy

Lecture 15 - EQ and Resilience

Lecture 16 - EQ and Health and Wellbeing

Lecture 17 - EQ Map

Lecture 18 - EQ Map (Continued...)

Lecture 19 - EQ Map (Continued...)

Lecture 20 - EQ Map (Continued...)

Lecture 21 - Emotional Intelligence in Education

Lecture 22 - Evaluation of EQ for Students

Lecture 23 - EI New Vision for Learning

Lecture 24 - EQ Skills for Students Success

Lecture 25 - EI in Health and Well Being

Lecture 26 - EI in Health and Well Being (Continued...)

Lecture 27 - EI and Cultural Adjustment

Lecture 28 - EI at Work

Lecture 29 - Emotional Intelligence and Happiness Positive Psychology

Lecture 30 - Emotional Intelligence and Happiness Positive Psychology (Continued...)

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- [Lecture 43 - Sustainable Education \(Continued...\)](#)
- [Lecture 44 - Sustainable Education \(Continued...\)](#)
- [Lecture 45 - Sustainable Education \(Continued...\)](#)
- [Lecture 46 - Sustainable Leadership](#)
- [Lecture 47 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 48 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 49 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 50 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 51 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 52 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 53 - Sustainable Leadership \(Continued...\)](#)
- [Lecture 54 - Sustainable Cities and Communities](#)
- [Lecture 55 - Sustainable Cities and Communities \(Continued...\)](#)
- [Lecture 56 - Sustainable Consumption and Production](#)
- [Lecture 57 - Sustainable Consumption and Production \(Continued...\)](#)
- [Lecture 58 - ESD for Global Partnership](#)
- [Lecture 59 - ESD for Global Partnership \(Continued...\)](#)
- [Lecture 60 - Sustainable Happiness](#)
- [Lecture 61 - Sustainable Happiness \(Continued...\)](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Elements of Literature and Creative Communication (Humanities and Social Sciences)

Co-ordinators : Prof. H.S. Komalesha

Lecture 1 - Elements of Literature and Creative communication

Lecture 2 - Literature and its relevance

Lecture 3 - A Multidimensional Engagement with Literature

Lecture 4 - How to read and appreciate Literature?

Lecture 5 - Literature - Learner's Perspective

Lecture 6 - Ways of Reading .1

Lecture 7 - Forms and Genres of Literature

Lecture 8 - Feminist Literary Criticism

Lecture 9 - Marxist Literary Criticism

Lecture 10 - Postcolonial Literary Criticism

Lecture 11 - Tracing the Roots of Poetry

Lecture 12 - Origins of Poetry

Lecture 13 - Poetry and its Tributaries - 1

Lecture 14 - Poetry and its Tributaries - 2

Lecture 15 - Reflecting on poetry and its forms (Quiz)

Lecture 16 - Elements of Poetry - 1

Lecture 17 - Elements of Poetry - 2

Lecture 18 - English Poetry: An Overview. Old English to Elizabethan

Lecture 19 - English Poetry: An Overview. Elizabethan to Metaphysical

Lecture 20 - English Poetry: An Overview. 17th century onwards

Lecture 21 - Indian English Poetry: The Beginnings

Lecture 22 - Arun Kolatkar and the Bombay Circle of Poets

Lecture 23 - Kamala Das

Lecture 24 - Confessional Poetry of Kamala Das

Lecture 25 - AK Ramanujan

Lecture 26 - Contemporary World poetry

Lecture 27 - Hafez: The Poet for Life

Lecture 28 - Date with European Poetry

Lecture 29 - Second date with European Poetry

Lecture 30 - American poetry

Lecture 31 - Introduction to Fiction

- Lecture 32 - Elements of Fiction - 1
- Lecture 33 - Elements of Fiction - 2
- Lecture 34 - Fiction and its Branches - 1
- Lecture 35 - Fiction and its Branches - 2
- Lecture 36 - Tools of the Trade: Narrative Techniques in Fiction
- Lecture 37 - Tools of the Trade: Narrative Techniques in Fiction
- Lecture 38 - Animal Farm - 1
- Lecture 39 - Animal Farm - 2
- Lecture 40 - Animal Farm: A Critical Exploration
- Lecture 41 - Introducing Short Fiction
- Lecture 42 - Origin and Development of Short Fiction
- Lecture 43 - Borges and the Book of Sand
- Lecture 44 - Two Stories and Three Cheers
- Lecture 45 - Quiz on Short Fiction
- Lecture 46 - Introduction to Drama
- Lecture 47 - Elements of Drama
- Lecture 48 - Drama and its types
- Lecture 49 - Comedy: Drama and its Types
- Lecture 50 - Dramatic Devices: Tricks and Tactics that make Theatre Tick
- Lecture 51 - Aristotle and the Dramatic Art
- Lecture 52 - A Snapshot of Western Drama
- Lecture 53 - Modern Drama
- Lecture 54 - A Doll's House
- Lecture 55 - A Critical Dismantling of Dolls House
- Lecture 56 - Indian Drama
- Lecture 57 - Modern Indian Drama
- Lecture 58 - Hayavadana
- Lecture 59 - Hayavadana: a critical perspective
- Lecture 60 - A Quiz

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Training and Development (Humanities and Social Sciences)

Co-ordinators : Prof. Susmita Mukhopadhyay, Prof. Sangeeta Sahney, Prof. S.Srinivasan

Lecture 1 - Employees Training and Development

Lecture 2 - Employee and Employer Relationship

Lecture 3 - Employment Contract

Lecture 4 - Employee as a Human Capital

Lecture 5 - Employees Training and Organizational Excellence

Lecture 6 - Strategic Training

Lecture 7 - Strategic Training and Its Process

Lecture 8 - Strategic Training Model

Lecture 9 - Learning, Training and Development from Change Model Perspective

Lecture 10 - Training as a Function of Human Resources Management

Lecture 11 - Concept and Importance of Training Need Assessment

Lecture 12 - Steps and Process of Training Need Assessment

Lecture 13 - When to Conduct TNA

Lecture 14 - Techniques Used in Need Assessment

Lecture 15 - Competency in Need Assessment

Lecture 16 - Concept, Types and Importance of Learning

Lecture 17 - Learning Theories

Lecture 18 - Transfer of Training

Lecture 19 - Factors Affecting Transfer of Training

Lecture 20 - Theories of Transfer of Training

Lecture 21 - Concept and Importance of Programme and Training Programme

Lecture 22 - Training Programme Design

Lecture 23 - Steps/Process of Programme Design

Lecture 24 - Basic Consideration for Programme Design

Lecture 25 - Documentation in Designing Training Program

Lecture 26 - Defining Evaluation

Lecture 27 - Training Evaluation

Lecture 28 - Training evaluation process

Lecture 29 - Tools and Techniques of Training Evaluation

Lecture 30 - Training Evaluation Design

Lecture 31 - Training Methods

Lecture 32 - Presentation Methods

Lecture 33 - Hands-on-training methods

Lecture 34 - Group Building Methods

Lecture 35 - Implication of Traditional Training Methods

Lecture 36 - Technology Based Training: Concept, Types and Importance

Lecture 37 - Computer Based Training

Lecture 38 - Social Media

Lecture 39 - Learning Management System (LMS)

Lecture 40 - Choosing a New Technology for Training

Lecture 41 - Employees Development

Lecture 42 - Career Development and Training

Lecture 43 - Development Planning System

Lecture 44 - Approaches to Employee Development

Lecture 45 - Interpersonal Relationship, Succession Planning

Lecture 46 - Social Responsibility

Lecture 47 - Legal Aspects of Social Responsibility

Lecture 48 - Managing Diversity in Training

Lecture 49 - Career Challenges

Lecture 50 - Meeting the Needs of Older Workers

Lecture 51 - Future of Training and Development

Lecture 52 - Future Trends of Trainers' Skills and Competencies

Lecture 53 - Emphasis for Future Training and Development

Lecture 54 - Trends of New Technology Used in Training

Lecture 55 - Training Partnership and Outsourcing

Lecture 56 - Train the Trainers

Lecture 57 - Concept of Disruption

Lecture 58 - Disruption in Creativity and Innovation

Lecture 59 - Implication of Digital Disruption in Training and Learning

Lecture 60 - Managing Disruptive Trainees

Lecture 61 - Managing Disruptive Trainees (Continued...)

Lecture 62 - Managing Disruption in Organizations through Training c

Lecture 63 - Some Examples/Cases

Lecture 64 - Some Examples/Cases (Continued...)

[Lecture 65 - Some Examples/Cases \(Continued...\)](#)

- Lecture 1 - Categorizing Resources Governed under Different Property Regimes
- Lecture 2 - Common Pool Resource Management
- Lecture 3 - Tragedy of The Commons
- Lecture 4 - Institutional Analysis and Development (IAD) Framework
- Lecture 5 - Institutional Analysis and Development (IAD) Framework (Continued...)
- Lecture 6 - Common Pool Resource Management
- Lecture 7 - Community Control of Natural Resources and Man-Made Resource
- Lecture 8 - Debates on Intellectual Property Rights
- Lecture 9 - The internet, Opensource and the commons
- Lecture 10 - Agricultural biotechnology, opensource and commons
- Lecture 11 - Natural resources and urban ecological commons in the city
- Lecture 12 - Urban Common and social ownership
- Lecture 13 - Ecological Commons and Sustainable City Planning
- Lecture 14 - Rethinking environmental justice in cities
- Lecture 15 - Urban Commons and Political Ecology
- Lecture 16 - Rights-based approaches to natural resources
- Lecture 17 - Reformistic legislations on resource management
- Lecture 18 - Case studies from specific rights-based resource management policies
- Lecture 19 - Critiques of decentralisation and participatory resource management
- Lecture 20 - Problems of Access and Distribution in Resource Management of Water

Lecture 1 - Overview

Lecture 2 - Sociological Theories of Urbanization and Key Concepts

Lecture 3 - Globalization, technology and the Growth of Cities

Lecture 4 - Urban Infrastructure and Governance

Lecture 5 - Urbanization in the Global South: Approaches of Understanding

Lecture 6 - Indian context and informality: Cities and slums

Lecture 7 - Urban Development and Sustainability in India

Lecture 8 - Major Policies of urban India

Lecture 9 - Gentrification, migration, inequality and urban social stratification in India.

Lecture 10 - Recent developments and emerging theories

Lecture 11 - Smart cities - global perspective and Indian perspective

Lecture 12 - Social Interactions in Publicspaces

Lecture 13 - Community, SmartCitizenship and the Digital Divide

Lecture 14 - Urban Commons

Lecture 15 - Urban Greens

Lecture 16 - Community and Identity

Lecture 17 - Gender Race and the City - Part I

Lecture 18 - Gender Race and the City - Part II

Lecture 19 - Natural and (Un)Natural Disaster in the City

Lecture 20 - Urban Subcultures

Lecture 1 - Introduction to Fixed Income Securities

Lecture 2 - Risks in Fixed Income Securities Investments

Lecture 3 - Bond Valuation - I

Lecture 4 - Bond Valuation - II

Lecture 5 - Bond Price Relations

Lecture 6 - Bond Returns - I

Lecture 7 - Bond Returns - II

Lecture 8 - Bond Returns - III

Lecture 9 - Bond Returns - IV

Lecture 10 - Level of Interest Rate Determination - I

Lecture 11 - Level of Interest Rate Determination - II

Lecture 12 - Level of Interest Rate Determination - III

Lecture 13 - The Term Structure of Interest Rates - I

Lecture 14 - The Term Structure of Interest Rates - II

Lecture 15 - The Term Structure of Interest Rates - III

Lecture 16 - The Term Structure of Interest Rates - IV

Lecture 17 - The Term Structure of Interest Rates - V

Lecture 18 - The Term Structure of Interest Rates - VI

Lecture 19 - The Term Structure of Interest Rates - VII

Lecture 20 - The Term Structure of Interest Rates - VIII

Lecture 21 - Determination of Theoretical Spot Rate and Forward Yield Curves

Lecture 22 - Interest Rate Risk

Lecture 23 - Bond Duration

Lecture 24 - Bond Convexity

Lecture 25 - Default Risk

Lecture 26 - Short-Term Government Bond Markets

Lecture 27 - Long-Term Government Bond Markets

Lecture 28 - Issuance and Trading Mechanism of Government Securities

Lecture 29 - Short-Term Corporate Bond Markets

Lecture 30 - Medium and Long-term Corporate Bond Markets

Lecture 31 - Issuance and Trading Mechanism of Corporate Securities

- Lecture 32 - Municipal Bonds - I
- Lecture 33 - Municipal Bonds - II
- Lecture 34 - Debt Securities of Commercial Banks
- Lecture 35 - International Bonds
- Lecture 36 - Bonds with Embedded Options
- Lecture 37 - Binomial Valuation of Callable Bonds - I
- Lecture 38 - Binomial Valuation of Callable Bonds - II
- Lecture 39 - Binomial Valuation of Puttable and Sinking-Fund Bonds
- Lecture 40 - Binomial Valuation of Convertible Bonds
- Lecture 41 - Estimation of Binomial Trees - I
- Lecture 42 - Estimation of Binomial Trees - II
- Lecture 43 - Estimation of Binomial Trees - III
- Lecture 44 - Estimation of Binomial Trees - IV
- Lecture 45 - Estimation of Binomial Trees - V
- Lecture 46 - Bond Investment Strategies - I
- Lecture 47 - Bond Investment Strategies - II
- Lecture 48 - Bond Investment Strategies - III
- Lecture 49 - Bond Investment Strategies - IV
- Lecture 50 - Bond Investment Strategies - V
- Lecture 51 - Mortgage Backed Securities - I
- Lecture 52 - Mortgage Backed Securities - II
- Lecture 53 - Mortgage Backed Securities - III
- Lecture 54 - Mortgage Backed Securities - IV
- Lecture 55 - Mortgage Backed Securities - V
- Lecture 56 - Fixed Income Securities Derivatives - I
- Lecture 57 - Fixed Income Securities Derivatives - II
- Lecture 58 - Fixed Income Securities Derivatives - III
- Lecture 59 - Fixed Income Securities Derivatives - IV
- Lecture 60 - Fixed Income Securities Derivatives - V

Lecture 1 - Relevance and Syllabus

Lecture 2 - Role of Oil

Lecture 3 - Energy and Sustainability

Lecture 4 - North-South conflict, Way to future

Lecture 5 - Introduction

Lecture 6 - Analysis of demand

Lecture 7 - Determinants of demand

Lecture 8 - Analysis of supply

Lecture 9 - Equilibrium

Lecture 10 - Elasticity

Lecture 11 - Revenue and price elasticity of demand

Lecture 12 - Petroleum rents and petroleum taxes

Lecture 13 - Welfare analysis

Lecture 14 - Government Intervention - I

Lecture 15 - Government Intervention - II

Lecture 16 - Introduction

Lecture 17 - Movement of oil price

Lecture 18 - Sector wise use of oil

Lecture 19 - Oil Price Movements 2010-15/16

Lecture 20 - Oil Price since 2018

Lecture 21 - Oil price in the recent times

Lecture 22 - Structure of OPEC

Lecture 23 - Cartel

Lecture 24 - Role of OPEC in explaining oil price

Lecture 25 - Role of Saudi Arabia

Lecture 26 - Petroleum as a depleting resource

Lecture 27 - Can depletion explain price development ?

Lecture 28 - Cost performance of global oil industry and Oil Spills

Lecture 29 - Structural change and resource discovery

Lecture 30 - Theory of Production: A brief overview

Lecture 31 - Production Possibility Frontier

- Lecture 32 - Labour Demand
- Lecture 33 - Theoretical model - I
- Lecture 34 - Theoretical Framework - II
- Lecture 35 - Country Experiences
- Lecture 36 - Market structure
- Lecture 37 - Oligopoly and Market structure
- Lecture 38 - Introduction to Game Theory - I
- Lecture 39 - Introduction to Game Theory - II
- Lecture 40 - Nash Equilibrium
- Lecture 41 - Competition versus collusion
- Lecture 42 - Collusive Oligopoly: Price Leadership
- Lecture 43 - Price Leadership Dominant Firm Model - I
- Lecture 44 - Price Leadership Dominant Firm Model - II
- Lecture 45 - Cartel
- Lecture 46 - Intemporal Allocation and Utility
- Lecture 47 - Optimum Choice of a Consumer: Problem of Utility Maximisation
- Lecture 48 - Optimal Division of Natural Resources
- Lecture 49 - Hotelling's rule
- Lecture 50 - Intertemporally Optimal Prices: Some observations
- Lecture 51 - Model of Economic Growth - I
- Lecture 52 - Model of Economic Growth - II
- Lecture 53 - Discovery of Natural Resources
- Lecture 54 - Model of Economic growth with uncertainty
- Lecture 55 - Exchange Rate and its Determination
- Lecture 56 - Oil Price Shock
- Lecture 57 - BoP Crisis of the Indian Economy in 1991
- Lecture 58 - Crisis and efficiency of exchange rate policies
- Lecture 59 - Concluding Remarks - I
- Lecture 60 - Concluding Remarks - II

Lecture 1 - Introduction: Why Happiness Matters and How We Will Go About Exploring It

Lecture 2 - Can We Define Happiness?

Lecture 3 - Happiness and Wellbeing : Do Cultures and Environments Call the Shots!

Lecture 4 - Doing Happiness' - Philosophical and existential questions, and responses

Lecture 5 - Happiness - antecedents and implications

Lecture 6 - Basic Issues

Lecture 7 - Myths and Misconceptions

Lecture 8 - Happiness - the unanswered questions

Lecture 9 - Evolution of Happiness

Lecture 10 - Belief and Gene

Lecture 11 - Empathy

Lecture 12 - Happiness and Morality

Lecture 13 - Exploring the self and the other

Lecture 14 - Pro-sociality and happiness - Generosity, give and take

Lecture 15 - Pro-sociality and happiness - Virtues and strengths

Lecture 16 - Relationship - Connected and happy

Lecture 17 - Networking and its relevance for happiness and wellbeing

Lecture 18 - Money and Happiness

Lecture 19 - How does optimism affect happiness?

Lecture 20 - Sharing and Belonging

Lecture 21 - Happiness and body language

Lecture 22 - Failure and Resilience

Lecture 23 - Innovation and Happiness

Lecture 24 - Conflicts and Stress

Lecture 25 - Stress and Coping

Lecture 26 - Reconnecting happiness: beyond pandemic

Lecture 27 - Meditation and Mindfulness: An Overview

Lecture 28 - Meditation and Mindfulness: Practice Toolkit

Lecture 29 - Creativity, Intuition and Flow

Lecture 30 - Can we really not be creative and happy?

Lecture 31 - Emotional intelligence

[Lecture 32 - Happiness at work](#)

[Lecture 33 - Nudging and Decision-making](#)

[Lecture 34 - Can we measure happiness? The case of cities and states](#)

[Lecture 35 - Happiness and leadership habits](#)

[Lecture 36 - Measurement of Happiness](#)

[Lecture 37 - Consumerism, happiness and wellbeing](#)

[Lecture 38 - Technology and happiness](#)

[Lecture 39 - Doing research on happiness: Connecting dots](#)

[Lecture 40 - Summing up: Social innovation and project ideas for social transformation](#)

Lecture 1 - Major Environmental Concerns and Pollution

Lecture 2 - Population Growth Models

Lecture 3 - Resource Consumption and Pollution

Lecture 4 - Measuring Environmental Impacts - the IPAT Model and Ecological Footprint

Lecture 5 - Measuring - Earth Overshoot Day, Energy Performance Index and Lifecycle Assessment

Lecture 6 - Principles of Sustainable Development

Lecture 7 - Principles of Sustainable Development (Sustainable Development Goals)

Lecture 8 - Principles of Sustainable Development (Achieving SDGs and Sustainability Indices)

Lecture 9 - Principles of Sustainable Development (Case Study I: Sustainable Urbanization)

Lecture 10 - Principles of Sustainable Development (Case Study II: Green Buildings)

Lecture 11 - Air Pollution (Definition, Causes, Sources and Types)

Lecture 12 - Air Pollution (Influence of Meteorology)

Lecture 13 - Air Pollution (Local Effects and Mitigation Measures)

Lecture 14 - Air Pollution (Regional Issues and Mitigation Measures)

Lecture 15 - Air Pollution (Global Issues and Mitigation Measures, Indoor Air Quality)

Lecture 16 - Climate Change (Definition and Evidence)

Lecture 17 - Climate Change (Causes and Determinants)

Lecture 18 - Climate Change (Projections and Related Impacts)

Lecture 19 - Climate Change (Mitigation Options)

Lecture 20 - Climate Change (Adaption and Policy Responses)

Lecture 21 - Renewable Energy - I (Overview)

Lecture 22 - Renewable Energy - I (Solar Energy - I)

Lecture 23 - Renewable Energy - I (Solar Energy - II)

Lecture 24 - Renewable Energy - I (Solar Energy - III)

Lecture 25 - Renewable Energy - I (Wind Energy)

Lecture 26 - Renewable Energy - II (Geothermal Energy)

Lecture 27 - Renewable Energy - II (Ocean Energy - I)

Lecture 28 - Renewable Energy - II (Ocean Energy - II)

Lecture 29 - Renewable Energy - II (Hydropower)

Lecture 30 - Renewable Energy - II (Bioenergy)

Lecture 31 - Circular Economy (Introduction to the Concept)

- Lecture 32 - Circular Economy (Circular Economy Strategies - I)
- Lecture 33 - Circular Economy (Circular Economy Strategies - II)
- Lecture 34 - Circular Economy (Circular Business Models)
- Lecture 35 - Circular Economy (Industrial Symbiosis)
- Lecture 36 - Hydrologic cycle, sources of water and water pollution
- Lecture 37 - Water Quality Parameters - General
- Lecture 38 - Water Quality Parameters - Oxygendemanding wastes and Microbial
- Lecture 39 - Nitrogen species in rivers and the DO Sag Curve
- Lecture 40 - NGT, WQI and reuse and recycling of wastewater
- Lecture 41 - Importance and Integrated Solid Waste Management
- Lecture 42 - Sources of MSW, MSW Generation Rates and Composition
- Lecture 43 - MSW Composition and Collection
- Lecture 44 - MSW Treatment and Disposal
- Lecture 45 - E-Waste Management
- Lecture 46 - Sound, noise and its characteristics
- Lecture 47 - Audiometry
- Lecture 48 - Effects of noise
- Lecture 49 - Noise rating systems and modeling
- Lecture 50 - Noise control and regulations
- Lecture 51 - Fundamentals of Ecology - I
- Lecture 52 - Fundamentals of Ecology - II
- Lecture 53 - Fundamentals of Ecology - III
- Lecture 54 - Soil Pollution - I
- Lecture 55 - Soil Pollution - II
- Lecture 56 - The Environmental Movement and its global and local impacts
- Lecture 57 - Environmental Law and Rules in India
- Lecture 58 - Important legal judgments pertaining to the Environment
- Lecture 59 - NGT and its important judgments
- Lecture 60 - Rapid Environmental Impact Assessment - A case study of the River Ib Barrage

[Lecture 1 - Psychology of Learning](#)

[Lecture 2 - Psychology of Learning \(Continued...\)](#)

[Lecture 3 - Psychology of Learning \(Continued...\)](#)

[Lecture 4 - Psychology of Learning \(Continued...\)](#)

[Lecture 5 - Psychology of Learning \(Continued...\)](#)

[Lecture 6 - Major Theories of Learning](#)

[Lecture 7 - Major Theories of Learning \(Continued...\)](#)

[Lecture 8 - Major Theories of Learning \(Continued...\)](#)

[Lecture 9 - Major Theories of Learning \(Continued...\)](#)

[Lecture 10 - Major Theories of Learning \(Continued...\)](#)

[Lecture 11 - Memory and Cognition](#)

[Lecture 12 - Memory and Cognition \(Continued...\)](#)

[Lecture 13 - Memory and Cognition \(Continued...\)](#)

[Lecture 14 - Memory and Cognition \(Continued...\)](#)

[Lecture 15 - Memory and Cognition \(Continued...\)](#)

[Lecture 16 - Thinking and Cognition](#)

[Lecture 17 - Thinking and Cognition \(Continued...\)](#)

[Lecture 18 - Thinking and Cognition \(Continued...\)](#)

[Lecture 19 - Thinking and Cognition \(Continued...\)](#)

[Lecture 20 - Thinking and Cognition \(Continued...\)](#)

[Lecture 21 - Motivation of Learning](#)

[Lecture 22 - Motivation of Learning \(Continued...\)](#)

[Lecture 23 - Motivation of Learning \(Continued...\)](#)

[Lecture 24 - Motivation of Learning \(Continued...\)](#)

[Lecture 25 - Motivation of Learning \(Continued...\)](#)

[Lecture 26 - Emotional Intelligence and Learning](#)

[Lecture 27 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 28 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 29 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 30 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 31 - Learning and Instruction](#)

- [Lecture 32 - Learning and Instruction \(Continued...\)](#)
- [Lecture 33 - Learning and Instruction \(Continued...\)](#)
- [Lecture 34 - Learning and Instruction \(Continued...\)](#)
- [Lecture 35 - Learning and Instruction \(Continued...\)](#)
- [Lecture 36 - Learning and Pedagogy](#)
- [Lecture 37 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 38 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 39 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 40 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 41 - Psychology of E-Learning](#)
- [Lecture 42 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 43 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 44 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 45 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 46 - Effective Learning: Assessment and Feedback](#)
- [Lecture 47 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 48 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 49 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 50 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 51 - Learning for Sustainability](#)
- [Lecture 52 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 53 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 54 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 55 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 56 - Learning for Sustainability](#)
- [Lecture 57 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 58 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 59 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 60 - Learning for Sustainability \(Continued...\)](#)

- Lecture 1 - How do we define language?
- Lecture 2 - What is knowledge of language?
- Lecture 3 - How is Human communication unique?
- Lecture 4 - Universal properties of language
- Lecture 5 - What do we do in Linguistics?
- Lecture 6 - Transdisciplinary Approach to Linguistics
- Lecture 7 - Rules of Language
- Lecture 8 - Competence and Performance, Langue and Parole
- Lecture 9 - Universal Grammar
- Lecture 10 - Faculty of Language
- Lecture 11 - Introduction to Phonetics
- Lecture 12 - More about Phonetics
- Lecture 13 - Introduction to IPA
- Lecture 14 - Introduction to Phonology
- Lecture 15 - More about Phonology
- Lecture 16 - Introducing Morphology
- Lecture 17 - Morpheme, Morph and Allomorph
- Lecture 18 - Types of Morpheme
- Lecture 19 - Morphological Processes
- Lecture 20 - More about Morphological Process
- Lecture 21 - Morphological Typology
- Lecture 22 - Introducing Syntax
- Lecture 23 - Syntactic Categories and Subcategories
- Lecture 24 - Constituents and Phrase Structures Rules
- Lecture 25 - More about Trees
- Lecture 26 - Different parts of a tree
- Lecture 27 - From Transformation to GB Theory
- Lecture 28 - Introducing Minimalism
- Lecture 29 - Introducing Semantics
- Lecture 30 - Lexical Semantics
- Lecture 31 - Introducing Pragmatics

- Lecture 32 - Language and Script
- Lecture 33 - Defining Computational Linguistics
- Lecture 34 - An Introduction to Corpus Linguistics
- Lecture 35 - Introducing Linguistic Typology
- Lecture 36 - More about Linguistic Typology
- Lecture 37 - Typology through Indian Languages
- Lecture 38 - Language Families of India
- Lecture 39 - More about Language Families of India
- Lecture 40 - India as a Linguistic Area
- Lecture 41 - Introducing Sociolinguistics
- Lecture 42 - Language Maintenance and Language Shift
- Lecture 43 - Multilingualism and Varieties of Language
- Lecture 44 - Language, Dialect and Standardization
- Lecture 45 - Standard Language Ideology
- Lecture 46 - Language Variation
- Lecture 47 - Language Change
- Lecture 48 - Language and Identity
- Lecture 49 - Language Endangerment
- Lecture 50 - Different Aspects of Language Endangerment
- Lecture 51 - Language Documentation
- Lecture 52 - Language Documentation and Revitalization
- Lecture 53 - A Discussion on Field Linguistics
- Lecture 54 - Language Teaching
- Lecture 55 - More about Language Teaching
- Lecture 56 - Sociolinguistics and language teaching
- Lecture 57 - Language Policy
- Lecture 58 - Endangered Languages and its Revitization through Classrooms
- Lecture 59 - Summing up
- Lecture 60 - Summing up

Lecture 1 - Introduction

Lecture 2 - Branches of Philosophy

Lecture 3 - Philosophy and other Subjects

Lecture 4 - History of Western Philosophy

Lecture 5 - Pre Socrates-Philosopher

Lecture 6 - Pre Socrates-Philosopher

Lecture 7 - Socrates

Lecture 8 - Plato

Lecture 9 - Aristotle

Lecture 10 - Rene Descartes

Lecture 11 - Rene Descartes

Lecture 12 - Rene Descartes

Lecture 13 - Benedict Spinoza

Lecture 14 - Benedict Spinoza

Lecture 15 - John Lock

Lecture 16 - John Lock

Lecture 17 - Hume

Lecture 18 - Hume

Lecture 19 - Critical argument against empiricism

Lecture 20 - Ethics

Lecture 21 - Branches of Ethics

Lecture 22 - Virtue Ethics

Lecture 23 - Hedonism

Lecture 24 - Utilitarianism

Lecture 25 - Mill on happiness

Lecture 26 - Immanuel Kant

Lecture 27 - Immanuel Kant

Lecture 28 - Immanuel Kant

Lecture 29 - Indian Philosophy

Lecture 30 - Indian Philosophy

Lecture 31 - Indian Philosophy

- [Lecture 32 - Indian Philosophy](#)
- [Lecture 33 - Indian Philosophy](#)
- [Lecture 34 - Sankara's philosophy](#)
- [Lecture 35 - Sankara's philosophy](#)
- [Lecture 36 - Sankara's philosophy](#)
- [Lecture 37 - Sankara's philosophy](#)
- [Lecture 38 - Sankara's philosophy](#)
- [Lecture 39 - Ramanuja's Philosophy](#)
- [Lecture 40 - Ramanuja's Philosophy](#)
- [Lecture 41 - Ramanuja's Philosophy](#)
- [Lecture 42 - Ramanuja's Philosophy](#)
- [Lecture 43 - Vedanta Philosophy](#)
- [Lecture 44 - Buddhist Philosophy](#)
- [Lecture 45 - Buddhist Philosophy](#)
- [Lecture 46 - Buddhist Philosophy](#)
- [Lecture 47 - Buddhist Philosophy](#)
- [Lecture 48 - Buddhist Philosophy](#)
- [Lecture 49 - Samkhya Philosophy](#)
- [Lecture 50 - Samkhya Philosophy](#)
- [Lecture 51 - Samkhya Philosophy](#)
- [Lecture 52 - Samkhya Philosophy](#)
- [Lecture 53 - Samkhya Philosophy](#)
- [Lecture 54 - The Jaina Philosophy](#)
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- Lecture 2 - Introductory concepts
- Lecture 3 - Goals of the course
- Lecture 4 - Introduction to Language Typology
- Lecture 5 - Linguistics as a discipline
- Lecture 6 - History of Linguistics
- Lecture 7 - Introduction to Morphology - Part 1
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- Lecture 10 - Simple Compound and Complex Words
- Lecture 11 - Morphology - Prefixes, Suffixes and Infixes
- Lecture 12 - Introduction to Neologism
- Lecture 13 - Word formation rules and Neologism - Part 1
- Lecture 14 - Word formation rules and Neologism - Part 2
- Lecture 15 - Lexical Typology: An Introduction
- Lecture 16 - Lexical Typology (Continued...)
- Lecture 17 - Lexical Typology: Generalizations (Kinship terms and Personal Pronouns)
- Lecture 18 - Lexical Typology: Generalizations (Numerals)
- Lecture 19 - Lexical Typology: Generalizations (Antonymic Adjectives)
- Lecture 20 - Typology of Affixes
- Lecture 21 - Morphological Typology: A Cross Linguistic Study - Part 1
- Lecture 22 - Morphological Typology: A Cross Linguistic Study - Part 2
- Lecture 23 - Morphological Typology: Generalizations
- Lecture 24 - Morphological Typology: Generalizations continued - Part 1
- Lecture 25 - Morphological Typology: Generalizations continued - Part 2
- Lecture 26 - Introduction to Phonetics - Part 1
- Lecture 27 - Introduction to Phonetics - Part 2
- Lecture 28 - Introduction to Phonetics and Speech sounds - Part 1
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- Lecture 30 - Phonological typology - Part 1
- Lecture 31 - Phonological typology - Part 2

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Inclusion and Technology Design (Humanities and Social Sciences)

Co-ordinators : Prof. Bidisha

Lecture 1 - Introduction: Inclusive Digital Societies

Lecture 2 - Missing Women in Tech: Why Lack of Female Technologists Matters for Technology Design and Development?

Lecture 3 - Are Technologies Gender Neutral?

Lecture 4 - ICTs and Gender: Field Concerns and Project Management Approaches for Technology Design

Lecture 5 - The Political Nature of Technology Design

Lecture 6 - Accessibility Fundamentals

Lecture 7 - Accessibility Fundamentals: Disabilities, Guidelines, and Laws

Lecture 8 - Accessibility Fundamentals: Disabilities, Guidelines, and Laws

Lecture 9 - Designing an Assistive Technology Ecosystem: STEM Education for the Visually Impaired

Lecture 10 - Inclusion in Designing ICT for Development Projects: Who Should Matter - Part 1

Lecture 11 - ICTs in Agricultural Markets: Are they Inclusive

Lecture 12 - Inclusion in Designing ICT for Development Projects: Who Should Matter - Part 2

Lecture 13 - Digital Labour, Platforms and the Future of Work

Lecture 14 - Assignment Video: Design Jam

Lecture 15 - Assignment Examples Video: Students Presentations

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- Lecture 2 - Energy as an Economic Resource - Classification of Energy Resource
- Lecture 3 - Energy as an Economic Resource - Measurement of Energy
- Lecture 4 - Energy as an Economic Resource - Energy Accounting
- Lecture 5 - Energy as an Economic Resource - Problem Discussion on Module 1
- Lecture 6 - Energy Demand - Part I - Basic concepts in Economics
- Lecture 7 - Energy Demand - Part I - Descriptive Analysis of Energy Demand
- Lecture 8 - Energy Demand - Part I - Decomposition Analysis and Parametric Approach
- Lecture 9 - Energy Demand - Part II - Demand Side Management
- Lecture 10 - Energy Demand - Part II - Load Management
- Lecture 11 - Energy Demand - Part II - Demand Side Management - Energy Efficiency
- Lecture 12 - Energy Demand - Part II - Rebound Effect
- Lecture 13 - Energy Supply - Part I - Supply Behaviour of a Producer
- Lecture 14 - Energy Supply - Part I - Energy Investment
- Lecture 15 - Energy Supply - Part I - Economics of Non-renewable Resources
- Lecture 16 - Energy Supply - Part II - Economics of Renewable Energy Supply Setting the context
- Lecture 17 - Energy Supply - Part II - Economics of Renewable Energy Supply - Part 1
- Lecture 18 - Energy Supply - Part II - Economics of Renewable Energy Supply - Part 2
- Lecture 19 - Energy Supply - Part II - Economics of Electricity Supply
- Lecture 20 - Energy Market - Perfect Competition as a Market Form
- Lecture 21 - Energy Market - Why Energy Market is not Perfectly Competitive?
- Lecture 22 - Energy Market - Market Failure and Monopoly
- Lecture 23 - Energy Market - Oil Market: Pre OPEC Era - I
- Lecture 24 - Energy Market - Oil Market: Pre OPEC Era - II
- Lecture 25 - Energy Market - Oil Market: OPEC
- Lecture 26 - Special Topics on Energy - Energy Security
- Lecture 27 - Special Topics on Energy - Energy Access
- Lecture 28 - Special Topics on Energy - Energy, Environment and Climate Change

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Lecture 2 - Charles Dickens 'THE SIGNAL - MAN' - I - Close reading and the anxieties of the age

Lecture 3 - Charles Dickens 'THE SIGNAL - MAN' - II - Close reading and the anxieties of the age

Lecture 4 - Charles Dickens 'THE SIGNAL - MAN' - III - Close reading and the anxieties of the age

Lecture 5 - Charles Dickens 'THE SIGNAL - MAN' - IV - Close Reading and the anxieties of the age

Lecture 7 - Rudyard Kipling - My own true ghost story

Lecture 8 - Imperial Gothic - Major Characteristics

Lecture 9 - Rudyard Kipling 'My own true ghost story' - Close reading for implications of the imperial Gothic - I

Lecture 10 - Rudyard Kipling 'My own true ghost story' - Close reading for implications of the imperial Gothic - II

Lecture 12 - Arthur Conan Doyle - The Red-Headed League - I

Lecture 13 - Arthur Conan Doyle - The Red-Headed League - II

Lecture 14 - Arthur Conan Doyle - The Red-Headed League - III

Lecture 15 - Arthur Conan Doyle 'The Red-Headed League' - A Conversation

Lecture 16 - Arthur Conan Doyle 'The Red-Headed League' - Summary and Interview of the Author

Lecture 17 - H.G. WELLS 'THE RED ROOM' - Close Reading And Its Implications

Lecture 18 - H.G. WELLS 'THE RED ROOM' - Victorian Gothic

Lecture 19 - H.G. WELLS 'THE RED ROOM' - Close Reading And Its Ideological Implications

- Lecture 1 - Was mochten Sie dieses Semester machen?
- Lecture 2 - Wiederholung : Dativ und Präpositionen
- Lecture 3 - Wir lernen das Perfekt
- Lecture 4 - Wir üben das Perfekt
- Lecture 5 - Was hast du in den Ferien gemacht ?
- Lecture 6 - Farben und Kleidung
- Lecture 7 - Wir lernen Präpositionen
- Lecture 8 - Wir üben Präpositionen
- Lecture 9 - Präpositionen Akkusativ oder Dativ?
- Lecture 10 - Was bringt mir der Postbote?
- Lecture 11 - Gesundheit: Was fehlt Ihnen?
- Lecture 12 - Jeder freut sich
- Lecture 13 - Reflexiv - Akkusativ oder Dativ ?
- Lecture 14 - Lektion 1 und Witze und Faust
- Lecture 15 - Lektion 2, Präteritum von Modalverben, Ordinalzahlen
- Lecture 16 - Lektion 2; Detour -- Was ist Geschichte ? | Basic Tenses
- Lecture 17 - Was hast du nach der Schule gemacht?
- Lecture 18 - Lektion 3: Welche Medien hast du gestern benutzt?
- Lecture 19 - Komparativ und Superlativ
- Lecture 20 - dass-Sätze
- Lecture 21 - Wir wiederholen Komparativ und Superlativ
- Lecture 22 - Imperativ mit 'du' und 'ihr'
- Lecture 23 - Wir machen Lektion 5
- Lecture 24 - Adjektivdeklination
- Lecture 25 - Lektion 6 | Verkehr und Verkehrsmittel
- Lecture 26 - Welche Verkehrsmittel benutzt du ? | Indirekte Fragesätze
- Lecture 27 - Lektion 6 -- Aufgaben 4 und 6
- Lecture 28 - Lektion 7 -- Es geht ums Lernen
- Lecture 29 - Was hast du wann gelernt?
- Lecture 30 - Probleme beim Lernen | Verben mit dem Dativ
- Lecture 31 - Welche Probleme hast du beim Lernen ?

Lecture 32 - Perfekt von untrennbaren Verben | Wie löse ich meine Probleme beim Lernen ?

Lecture 33 - Ratschläge mit sollten | Sprache und Berufe | Wir lesen vor. (Lektion 7)

Lecture 34 - Exkurs ins Absurde! | Generationenprojekte (Lektion 7)

Lecture 35 - Generationenprojekte - wir hören die Texte

Lecture 36 - Welche Sportart möchtest du ausprobieren? | deshalb, trotzdem

Lecture 37 - Wiederholung Lektion 7 | Wir machen mit Lektion 8 weiter.

Lecture 38 - Woher entscheiden sich Sandra und Conny ? | Fragewort WO + Präposition

Lecture 39 - Alles über Fragewörter: mit und ohne Präpositionen

Lecture 40 - Eine Stadt entdecken | Wir beginnen Lektion 9

Lecture 41 - Lektion 9 | Interessante Häuser und Wohnungen

Lecture 42 - Lektion 9 | Die lieben Nachbarn

Lecture 43 - Lektion 9 | Höfliche Bitte | wenn und als

Lecture 44 - Lektion 9 | Wir üben als und wenn. | Sätze und Wortgruppen

Lecture 45 - Die Deutschen und ihre Haustiere

Lecture 46 - Wir beginnen Lektion 10 | Der Superlativ

Lecture 47 - Welche/r/s und Was für ein/e...

Lecture 48 - Lektion 10 | etwas, man, niemand, jemand...

Lecture 49 - Der Relativsatz | Wir machen Lektion 10 zu Ende

Lecture 50 - Wir machen Lektion 11. | K 2 - Verben und W-Fragen mit Präpositionen

Lecture 51 - Lektion 12 | Wir sind mit unserem Kurs fertig!

Lecture 1 - Herzlich willkommen!

Lecture 2 - Wie ist dein Name ?

Lecture 3 - Ich trinke gern Kaffee

Lecture 4 - Wir konjugieren die Verben

Lecture 5 - A bit of history and ZAHLEN

Lecture 6 - Verben, W-Fragen, Ja-Nein Fragen, Imperativ

Lecture 7 - das Alphabet, die Woche, das Jahr

Lecture 8 - Was sind deine Hobbys ? Formular ausfüllen

Lecture 9 - Mein Lehrbuch | Meine persönlichen Daten

Lecture 10 - Mein Arbeitsbuch

Lecture 11 - Wir beginnen Lektion 3

Lecture 12 - Wir lesen Lektion 3

Lecture 13 - Kein | Unregelmäßige Verben | Ein Lied

Lecture 14 - Wer ist das? | ich-mein; du-dein

Lecture 15 - Lektion 4 Guten Appetit!

Lecture 16 - Das Essen | Some revision

Lecture 17 - mag oder möchte | der Akkusativ

Lecture 18 - Ein Lesetext | die Uhr

Lecture 19 - die Uhrzeit | trennbare Verben

Lecture 20 - Familie und Possessiv

Lecture 21 - Wir machen Lektion 6 | Ordinalzahlen

Lecture 22 - Wie feierst du deinen Geburtstag?

Lecture 23 - der Akkusativ | ein Würfelspiel

Lecture 24 - das Kaffeehaus | die Kneipe | der Biergarten

Lecture 25 - Lektion 6: Freizeitprogramm

Lecture 26 - Sprache, Bundesländer, Städte | Wir beginnen Lektion 7

Lecture 27 - Akkusativ-Dativ | Annika im Büro | Wir machen Kaffee

Lecture 28 - Lektion 7 -- formeller Brief

Lecture 29 - Wie lernst du Deutsch ? Wir hören ein deutsches Lied

Lecture 30 - Wir lernen die Präpositionen

Lecture 31 - Hörverständnis | Wir beginnen Lektion 8

[Lecture 32 - Lektion 8 -- Haus-Wohnung-Möbel-Geräte](#)

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[Lecture 35 - Warum ist die Miete so hoch ? | Vorteile und Nachteile](#)

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[Lecture 43 - Im Kaufhaus | Welche/Diese](#)

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[Lecture 46 - Ab in den Urlaub | Wir machen Lektion 12](#)

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Lecture 2 - Medical Model of Disability

Lecture 3 - Social Model of Disability - Part 1

Lecture 4 - Social Model of Disability - Part 2

Lecture 5 - Stigma: A Universal Phenomenon

Lecture 6 - Stigma and Disability: What can we learn?

Lecture 7 - Ableism - Part 1

Lecture 8 - Ableism - Part 2

Lecture 9 - Disability Activism

Lecture 10 - Models of Disability Activism

Lecture 11 - Dependency

Lecture 12 - Interdependence

Lecture 13 - Blindness

Lecture 14 - Blindness as metaphor

Lecture 15 - Eugenics

Lecture 16 - Disability Pride

Lecture 17 - Disability Resilience

Lecture 18 - Disability Passing: The musings of the blue Jackal

Lecture 19 - Coming out: A performance in disability inhabitation

Lecture 20 - Assistive Technology: An interview with Prof. Madhusudan Rao

Lecture 21 - Disability and Ethnography: An Interview with Prof. James Staple

Lecture 22 - Schizophrenia: A Personal Account - An interview with Reshma Valliappan

Lecture 23 - Autism and the Indian Family: An interview with Dr. Shubhangi Vaidhya

Lecture 24 - Dyslexia and the Modern University: An Interview with Prof. Tanya Titchkosky

Lecture 25 - Gender and Disability: Interviews with Prof. Anita Ghai

Lecture 26 - Gender and Disability: Interviews with Prof. Nandini Ghosh

Lecture 27 - Lennard Davis, hemachandran karah, normal, normalcy, disability studies

Lecture 28 - The Normal and its End: Part 2

Lecture 29 - Literary Disability Studies: An Interview with Dr. Shilpa Anand

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- Lecture 19 - Intertextuality - Casablanca (1942) - Part 1
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- Lecture 21 - Intertextuality - Blade Runner (1982) - Part 1
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- Lecture 28 - Guest Lecture by Sudhish Kamath (Film Critic and Film Maker)
- Lecture 29 - The French Masters - Jean Renoir - Part 1
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Lecture 24 - Inflammation and Signature of Inflammation

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:United Nations Sustainable Development Goals (Humanities and Social Sciences)

Co-ordinators : Prof. Shiva Ji

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Lecture 7 - Scope and Inclusion and Agenda 2030

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Lecture 24 - Gender Equality - Part 2

Lecture 25 - Clean Water and Sanitation

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Lecture 16 - Cholera and Plague

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Lecture 29 - Association of Medical Women in India; Lock Hospitals; Regulation of Dais

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- Lecture 4 - Carbohydrate manipulation for sports performance
- Lecture 5 - Myths around carbohydrates
- Lecture 6 - Dr Sola Athletes with celiac disease and gluten sensitivity
- Lecture 7 - Importance of proteins in performance
- Lecture 8 - Introduction to protein and protein supplements
- Lecture 9 - Introduction to fats and its importance in performance
- Lecture 10 - Hydration and electrolytes
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- Lecture 19 - Introduction to nutrient periodization
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- Lecture 24 - Travel guidelines for athletes
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Lecture 3 - Lessons from the field Learning Sport Science - An integrated approach to learning Sport Psychology

Lecture 4 - Becoming a Sport Psychologist: Lessons from the field Challenges faced by sport psychologists

Lecture 5 - Becoming a Sport Psychologist: Lessons from the field Sport psychology - Working with coaches

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Lecture 22 - Intracommunication with self: instinct and animal lessons, body language and tactile communication

Lecture 23 - Discussion on communication and performance

Lecture 24 - Resilience in Sports Teams and Organizations

Lecture 25 - Resilience and Mindfulness in sports

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- Lecture 2 - Major Components of Fitness
- Lecture 3 - Difference between Fitness and Sport
- Lecture 4 - Defining S&C and Sports S&C
- Lecture 5 - Defining S&C and Physios Roles and Responsibilities
- Lecture 6 - Player Interview - Lakshya Sen
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- Lecture 8 - Principle of Individuality
- Lecture 9 - Principle of Progressive Overload
- Lecture 10 - Principle of Specificity
- Lecture 11 - Principle of -Indianization-
- Lecture 12 - Principle of Reversibility
- Lecture 13 - Sports Specific Training
- Lecture 14 - Safety in the Gym
- Lecture 15 - Exercise and the Female Athlete
- Lecture 16 - Working with Female Athletes - Do's and Dont's
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- Lecture 19 - Training Masters Athletes
- Lecture 20 - Training Para Athletes
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- Lecture 22 - Powerlifting
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- Lecture 55 - Assessments- How, When, Why
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- Lecture 57 - Training Celebrities/Elite Athletes
- Lecture 58 - Role of Social Media in Sport
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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Essentials of Sports Injury Prevention and Rehabilitation (Humanities and Social Sciences)

Co-ordinators : Prof. Col (Dr) Anup Krishnan (Retd), Prof. Wg Cdr (Dr) CS Guru, Prof. Lt Col (Dr) Atul Sharma

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Lecture 2 - Rehabilitation and Reconditioning

Lecture 3 - Joints of the Upper Limb

Lecture 4 - Joints of the Lower Limb

Lecture 5 - The Back In Sports

Lecture 6 - Pre Medical Examination

Lecture 7 - Lab Investigations

Lecture 8 - Flexibility

Lecture 9 - Conditioning

Lecture 10 - Anatomy of Upper Limb

Lecture 11 - Anatomy of Lower Limb

Lecture 12 - Common Injuries Of Lower Limb

Lecture 13 - Common Causes of Upper Limb and Lower Limb

Lecture 14 - Treatments for Various Injuries

Lecture 15 - Head, Face and Neck Injuries

Lecture 16 - Spine Injuries

Lecture 17 - Concussion in Sports

Lecture 18 - Management of Sports Concussion

Lecture 19 - Emergency Action Plan

Lecture 20 - Risk Factors in Injury

Lecture 21 - Prehabilitation and Rehabilitation

Lecture 22 - Periodisation of Rehabilitation - I

Lecture 23 - Periodisation of Rehabilitation - II

Lecture 24 - Team Roles in Sports Injuries

Lecture 25 - Sport-Specific Rehabilitation, Principles and Techniques - I

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Lecture 27 - Sport-Specific Rehabilitation, Principles and Techniques - III

Lecture 28 - Rehabilitation

Lecture 29 - Management of common sports injuries

Lecture 30 - Injury prevention in adolescent athletes and Women athletes - Part 1

Lecture 31 - Injury prevention in adolescent athletes and Women athletes - Part 2

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[Lecture 35 - Psychological aspects of injury and Rehabilitation - Part 1](#)

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[Lecture 37 - Return to sports and long term injury prevention - Part 1](#)

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Introduction to Exercise Physiology and Sports Performance (Humanities and Social Sciences)

Co-ordinators : Prof. Col (Dr) Anup Krishnan (Retd), Prof. Wg Cdr (Dr) CS Guru, Prof. Lt Col (Dr) Atul Sharma

- Lecture 1 - Focus of Exercise and Sports Physiology
- Lecture 2 - Evolution of Exercise Physiology
- Lecture 3 - Acute and Chronic response to Exercise
- Lecture 4 - Functional Anatomy of Skeletal muscle
- Lecture 5 - Skeletal muscle and Exercise
- Lecture 6 - Bioenergetics - Part 1
- Lecture 7 - Bioenergetics - Part 2
- Lecture 8 - Cardiovascular System and Exercise - Part 1
- Lecture 9 - Cardiovascular System and Exercise - Part 2
- Lecture 10 - Cardiovascular System and Exercise - Part 3
- Lecture 11 - Respiratory System and Exercise - Part 1
- Lecture 12 - Respiratory System and Exercise - Part 2
- Lecture 13 - Respiratory System and Exercise - Part 3
- Lecture 14 - Neurophysiology and Exercise - Part 1
- Lecture 15 - Neurophysiology and Exercise - Part 2
- Lecture 16 - Endocrine responses to Exercise - Part 1
- Lecture 17 - Endocrine responses to Exercise - Part 2
- Lecture 18 - Endocrine responses to Exercise - Part 3
- Lecture 19 - Exercise in Children and Adolescents - Part 1
- Lecture 20 - Exercise in Children and Adolescents - Part 2
- Lecture 21 - Exercise Prescription and Training principles - Part 1
- Lecture 22 - Exercise Prescription and Training principles - Part 2
- Lecture 23 - Adaptations to aerobic and anaerobic training - Part 1
- Lecture 24 - Adaptations to aerobic and anaerobic training - Part 2
- Lecture 25 - Adaptations to aerobic and anaerobic training - Part 3
- Lecture 26 - Body temperature regulation
- Lecture 27 - Physiological response to Exercise in Heat and Cold
- Lecture 28 - Acclimation to Heat and Cold
- Lecture 29 - Health Risks during Exercise in Heat and Cold
- Lecture 30 - Exercise and Sports performance at Altitude
- Lecture 31 - Hydration and Fluid Balance - Part 1

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[Lecture 38 - Performance testing in anaerobic sports](#)

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Lecture 3 - Health Specific Fitness Acute Training variables - Part 1

Lecture 4 - Health Specific Fitness Acute Training variables - Part 2

Lecture 5 - Application of Acute Training variables

Lecture 6 - Principle of Training - 1

Lecture 7 - Principle of Training - 2

Lecture 8 - Principle of Training - 3

Lecture 9 - Periodization in sports - 1

Lecture 10 - Periodization in sports - 2

Lecture 11 - Concept of Load Training - 1

Lecture 12 - Concept of Load Training - 2

Lecture 13 - Concept of Load Training - 3

Lecture 14 - Load monitoring in Sports - 1

Lecture 15 - Load monitoring in Sports - 2

Lecture 16 - Aerobic Training Methods - 1

Lecture 17 - Aerobic Training Methods - 2

Lecture 18 - Aerobic Training Methods - 3

Lecture 19 - Anaerobic Training Method - 1

Lecture 20 - Anaerobic Training Method - 2

Lecture 21 - Load Monitoring Methods in HSF - 1

Lecture 22 - Load Monitoring Methods in HSF - 2

Lecture 23 - Load Monitoring Methods in SSF - 1

Lecture 24 - Load Monitoring Methods in SSF - 2

Lecture 25 - Load Monitoring Methods in SSF - 3

Lecture 26 - Fatigue in Sports Training

Lecture 27 - Overtraining and Overreaching

Lecture 28 - Diagnosis and management of OTS

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Lecture 30 - Recovery Technique

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[Lecture 36 - Technoloy in Performance Analysis](#)

[Lecture 37 - Technoloy in Performance Enchanmnet](#)

[Lecture 38 - Waerables in Sports](#)

[Lecture 39 - Future of technology in sports](#)

[Lecture 40 - Sports Training Technology and Innovation](#)

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Lecture 2 - Evolution and concept of Linguistics

Lecture 3 - Defining Linguistics and its branches

Lecture 4 - The role of linguistics in understanding human communication

Lecture 5 - Application of linguistic theories in various fields

Lecture 6 - The Crucial Role of Linguistic Analysis in Legal Settings

Lecture 7 - Impact of Forensic Linguistics and Case Studie

Lecture 8 - Current Trends and Emerging Areas in Forensic Linguistics

Lecture 9 - Introduction to Week 2 - The Confluence of Language and Law

Lecture 10 - Exploring the Interplay Between Language and Law

Lecture 11 - Analysis of Courtroom Discourse

Lecture 12 - Impact of Linguistic Diversity on Legal Processes

Lecture 13 - Interdisciplinary Nature of Forensic Linguistics

Lecture 14 - Ethical Considerations in Forensic Linguistic Analysis

Lecture 15 - Impact on Understanding Legal and Cultural Contexts

Lecture 16 - Analysing Language as Vital Evidence in Legal Contexts

Lecture 17 - Challenges in Presenting Linguistic Evidence in Court

Lecture 18 - Introduction to Week 3

Lecture 19 - Illuminating Authorship Analysis and Its Nuances

Lecture 20 - Navigating Through Forensic Phonetics

Lecture 21 - Discourse Analysis: A Journey through Linguistic Structures

Lecture 22 - Exploring the Depths of Threat and Deception Analysis

Lecture 23 - Unveiling the Secrets of Language Profiling

Lecture 24 - Introduction to Week 4

Lecture 25 - Investigating Real-World Case Studies in Forensic Linguistics

Lecture 26 - Tackling the Challenges and Obstacles Within Forensic Linguistics

Lecture 27 - Upholding Ethics and Professionalism in Forensic Linguistics

Lecture 28 - Envisioning the Future: Prospective Pathways in Forensic Linguistics

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Lecture 2 - Interest Rate

Lecture 3 - Simple interest

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Lecture 5 - Discrete annually compounding - I & II

Lecture 6 - Continuous compounding

Lecture 7 - Comparison of all compounding methods

Lecture 8 - Present value

Lecture 9 - Future Value

Lecture 10 - Annuities - I & II

Lecture 11 - Perpetuity

Lecture 12 - Amortization

Lecture 13 - Multiple cash flow - I & II

Lecture 14 - Valuation of bond - I & II

Lecture 15 - Valuation of ordinary shares

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Lecture 2 - Introduction to depreciation and Straight line method

Lecture 3 - Declining balance method

Lecture 4 - Double-declining balance method

Lecture 5 - Sum-of-the-digits method

Lecture 6 - Sinking fund method and Repair provision method

Lecture 7 - Accelerated cost recovery method - I

Lecture 8 - Accelerated cost recovery method - II

Lecture 9 - Introduction to alternate investment: Annual cost method-I

Lecture 10 - Introduction to alternate investment: Annual cost method

Lecture 11 - Present worth method

Lecture 12 - Rate of return method

Lecture 13 - Incremental rate of return

Lecture 14 - Perpetuity method

Lecture 15 - Minimum return as cost

Lecture 16 - Introduction to profitability analysis and Payback period

Lecture 17 - Return on investment

Lecture 18 - Net Return

Lecture 19 - Discounted cash flow - I

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- Lecture 3 - Effective Communication Skills
- Lecture 4 - Classification of Communication
- Lecture 5 - Personality Development
- Lecture 6 - Positive Thinking
- Lecture 7 - Telephonic Communication Skills - Part I
- Lecture 8 - Telephonic Communication Skills - Part II
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- Lecture 10 - Paralanguage
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- Lecture 12 - Haptics: The Language of Touch
- Lecture 13 - Meta-communication
- Lecture 14 - Listening Skills
- Lecture 15 - Types of Listening
- Lecture 16 - Negotiation Skills - I
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- Lecture 18 - Culture as Communication
- Lecture 19 - Communicating across Cultures
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- Lecture 21 - Communication Breakdown - Part I
- Lecture 22 - Communication Breakdown - Part II
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- Lecture 38 - Report Style - Part I
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- Lecture 45 - Adaptability and Work Ethics
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- Lecture 48 - Combating Nervousness
- Lecture 49 - Patterns and Methods of Presentation
- Lecture 50 - Oral Presentation: Planning and Preparation
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- Lecture 54 - Planning and Preparation - Part I
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- Lecture 3 - History of Science: Thomas Kuhn
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- Lecture 5 - HSS in Technology Institutes: Ravinder Kaur - Part 2
- Lecture 6 - Ethos of Science - I
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- Lecture 8 - Science and Economy of 17th Century England
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- Lecture 16 - Scientist as Indexical Reasoner - Part 1
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- Lecture 18 - Science technology and Colonial Power - Part 1
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- Lecture 20 - Large Community but Few Peers: E Haribabu

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Lecture 3 - NLP Communicating Model

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Lecture 8 - Rapport

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Lecture 10 - Useful NLP Techniques

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Lecture 13 - Business Letters and Memos

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- Lecture 2 - Introduction to Protectionism and Strategic Trade
- Lecture 3 - India's International Trade: Latest Facts and Figures
- Lecture 4 - Facts on Trade Policies and Facilitations
- Lecture 5 - Introduction to Trade Theories: What, Why and for Whom?
- Lecture 6 - Mercantilism
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- Lecture 8 - Theory of Comparative Cost Advantage
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- Lecture 46 - Monetary Approach to the Balance of Payments and Exchange Rates
- Lecture 47 - Exchange Rate Dynamics
- Lecture 48 - Exchange Rate in the Short run
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- Lecture 50 - Capital Mobility and the Trilemma of the Exchange Rate Regime
- Lecture 51 - Adjustment with Fixed and Flexible Exchange Rates
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- Lecture 53 - J-Curve Effect
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- Lecture 56 - Import Substitution versus Export Orientation
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Co-ordinators : Dr. Varadraj Bapat

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Co-ordinators : Dr. Trupti Mishra

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- Lecture 16 - Managing OD and Change through Restructuring Organizations
- Lecture 17 - Different Types of Organization Designs
- Lecture 18 - New Forms of Organization Design
- Lecture 19 - Change in the Organization Design
- Lecture 20 - Change in Organization Culture
- Lecture 21 - Can Organization Culture be Managed?: A Case Analysis
- Lecture 22 - Organization Development in Digital Transformation
- Lecture 23 - Mergers and Acquisitions - A Special Case of OD
- Lecture 24 - Stages of Mergers and Acquisitions: A Case Study
- Lecture 25 - Transorganizational OD Intervention
- Lecture 26 - OD Interventions through Human Resource Functions
- Lecture 27 - Talent Management as OD Intervention
- Lecture 28 - Organization Learning - Relevance and Possibility
- Lecture 29 - Learning Organization - Experimentation, Knowledge Management and Innovation
- Lecture 30 - Organizational Development - Cultural and Economic Contexts
- Lecture 31 - Organization Development - Global and Trans-organizational Setting

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Lecture 2 - Introduction to the Managerial Economics- Economics and Managerial economics, Review of Economic Terms and Economic Rationality

Lecture 3 - Introduction to the Managerial Economics- Opportunity Cost, Measuring and Maximizing Profit

Lecture 4 - Introduction to the Managerial Economics- Understanding Incentive and Marginal Analysis

Lecture 5 - Introduction to the Managerial Economics- Marginal and Incremental Analysis, Model of an Economy

Lecture 6 - Basic Tools of Economic Analysis and Optimization Techniques- Functional relationship between economic variables, Important Economic functions

Lecture 7 - Basic Tools of Economic Analysis and Optimization Techniques- Important Economic Function (Continued...)

Lecture 8 - Basic Tools of Economic Analysis and Optimization Techniques- Slope and its use in Economic Analysis, Derivatives of various functions

Lecture 9 - Basic Tools of Economic Analysis and Optimization Techniques- Derivative of various functions

Lecture 10 - Basic Tools of Economic Analysis and Optimization Techniques- Optimization Technique

Lecture 11 - Basic Tools of Economic Analysis and Optimization Techniques- Constrained optimization

Lecture 12 - Basic Tools of Economic Analysis and Optimization Techniques- Regression Technique

Lecture 13 - Basic Tools of Economic Analysis and Optimization Techniques- Regression Technique (Continued...)

Lecture 14 - Basic Tools of Economic Analysis and Optimization Techniques- Ordinary Least Square (OLS) method

Lecture 15 - Theory of Demand- Defining Demand, Law of Demand

Lecture 16 - Theory of Demand- Demand Schedule/Demand Curve/ Demand Function, Factors affecting Demand, Market Demand

Lecture 17 - Theory of Demand- Change in Demand Curve, Supply/ Law of Supply, Factors affecting Supply

Lecture 18 - Theory of Demand- Change/Shift in the Supply, Market Equilibrium, Change in Equilibrium

Lecture 19 - Theory of Demand- A Shift in both Supply and Demand, Elasticity of Demand, Types of Elasticity of Demand

Lecture 20 - Theory of Demand- Price elasticity of demand, Degree of price elasticity of demand, Elasticity and revenue, Factors influencing price elasticity of demand

Lecture 21 - Theory of Demand- Income Elasticity of Demand, Cross-Price Elasticity of Demand, Advertising Elasticity of Demand

Lecture 22 - Theory of Demand- Numerical for each Elasticity of Demand

Lecture 23 - Consumer Behaviour- Consumer Preferences, Utility Analysis (Total and Marginal Utility)

Lecture 24 - Consumer Behaviour- Numerical for Utility analysis, Law of Diminishing Marginal Utility, Indifference Curve Analysis

Lecture 25 - Consumer Behaviour- Budget line and Consumer equilibrium, Law of Equi-Marginal utility

Lecture 26 - Consumer Behaviour- Price, Income and Substitution Effects, Consumer Surplus

Lecture 27 - Elasticity of Supply- Numerical example to understand Consumer Surplus, Elasticity of Supply

Lecture 28 - Elasticity of Supply- Impact of Tax on Price and Quantity, Price fixed by Law

Lecture 29 - Demand Forecasting

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- Lecture 30 - Methods of Demand Forecasting- Subjective methods of demand forecasting
- Lecture 31 - Demand Forecasting-Quantitative method of Demand forecasting
- Lecture 32 - Demand Forecasting- Quantitative method of Demand forecasting (Continued...)
- Lecture 33 - Theory of Production- Introduction
- Lecture 34 - Theory of Production- Law of Diminishing Return
- Lecture 35 - Theory of Production- long Run Production Analysis, Return to Scale, Isoquants
- Lecture 36 - Theory of Production- Isocost, Optimal Combination of Inputs, Expansion path, Economic Region of Production
- Lecture 37 - Theory of Production- Different kind of Production Functions: Cobb Douglas Production function, Optimal input combination
- Lecture 38 - Theory of Production- Effect of Changes in Input Prices, Law of Diminishing returns, Return to Scale
- Lecture 39 - Theory of Cost- Cost of Production, Types of Cost: Accounting/Economic Analysis
- Lecture 40 - Theory of Cost- Cost-Output Relationship, Short run cost Analysis
- Lecture 41 - Long Run Cost Analysis
- Lecture 42 - Long-Run Marginal Cost Curve
- Lecture 43 - Theory of Cost: Breakeven Analysis and Contribution Analysis
- Lecture 44 - Theory of Cost: Profit Volume Ratio, Margin of Safety and Learning Curve
- Lecture 45 - Theory of Cost: Application of Cost Analysis & Economies of Scale
- Lecture 46 - Theory of Cost: Production Economies
- Lecture 47 - Theory of Cost: Managerial and Transport Economies of Scale
- Lecture 48 - Theory of Market: Introduction
- Lecture 49 - Theory of Market: Perfect Competition
- Lecture 50 - Theory of Market: Short-run Profit Maximization under Perfect Competition
- Lecture 51 - Theory of Market: Short-run Market Supply and Firm Supply under Perfect Competition
- Lecture 52 - Theory of Market: Long-run Profit Maximization under Perfect Competition
- Lecture 53 - Theory of Market: Real World Application of Perfect Competition & Introduction to Monopoly
- Lecture 54 - Theory of Market: Types of Monopoly
- Lecture 55 - Theory of Market: Supply Curve of Monopoly Firm
- Lecture 56 - Theory of Market: Effect of shift of Cost in case of Monopoly
- Lecture 57 - Theory of Market: Social cost of Monopoly Power
- Lecture 58 - Theory of Market: Regulation of Monopoly Power and Monopsony
- Lecture 59 - Theory of Market: Bilateral Monopoly
- Lecture 60 - Theory of Market: Monopolistic Competition
- Lecture 61 - Theory of Market: Monopolistic Competition- Non-Price Competition and Introduction to Oligopoly

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- [Lecture 63 - Theory of Market: Oligopoly Market \(Continued...\)](#)
- [Lecture 64 - Theory of Market: Oligopoly Market- Stackelberg's Model](#)
- [Lecture 65 - Theory of Market: Collusive Oligopoly](#)
- [Lecture 66 - Theory of Market: Collusive Oligopoly \(Continued...\)](#)
- [Lecture 67 - Theory of Market: Collusive Oligopoly \(Continued...\)](#)
- [Lecture 68 - Theory of Market: Collusive Oligopoly-Price Leadership Model](#)
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- [Lecture 71 - Oligopoly and Game Theory- Nash Equilibrium](#)
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- [Lecture 74 - Product pricing- Price Discrimination](#)
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Lecture 8 - Introduction to Statistical Process Control

Lecture 9 - X-bar and R Chart

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Lecture 18 - One-sample t Test

Lecture 19 - Two-sample t Test

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Lecture 22 - One-way ANOVA (Continued...)

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Lecture 27 - Multicollinearity, Best Subset Regression, Multiple Regression, Basics on Design of Experiment

Lecture 28 - Design of Experiment, One-factor-at-a-time experiment

Lecture 29 - Two-factor asymmetric Design, Symmetric Factorial Design, Two-way ANOVA

Lecture 30 - Two-factor symmetric Design, Robust setting, Two-way ANOVA

Lecture 31 - Measurement System Analysis

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Lecture 9 - Cleaner Production

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Lecture 12 - Understanding LCA Through Examples

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Lecture 15 - Current Status of ESG in Indian Companies

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Lecture 18 - Eco-Branding

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Lecture 22 - Sustainability Standards

Lecture 23 - Sustainability Standards

Lecture 24 - Green Supply Chain

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Lecture 30 - Sustainable financial product and services

Lecture 31 - Sustainable Value Framework

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- Lecture 2 - Evolution and Nature of Strategic Human Resource Management
- Lecture 3 - Contributions of and Trends in HR Function
- Lecture 4 - Measuring Effectiveness of HR Function
- Lecture 5 - Competence Maturity Model and People Competence Maturity Model
- Lecture 6 - Organizational Healing: An Introduction
- Lecture 7 - Working with Remote Teams
- Lecture 8 - Restoring Social and Psychological Well-being
- Lecture 9 - Employee Assistance Program
- Lecture 10 - Talent Management: An Introduction
- Lecture 11 - Potential Matrix: A Tool for Talent Management
- Lecture 12 - HR Digitization for Talent Management
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- Lecture 14 - Positive Work Practices in Organization
- Lecture 15 - Humanistic Management Model
- Lecture 16 - Link of Humanistic Model and HR Processes
- Lecture 17 - Process to make organization great place to work
- Lecture 18 - Diversity Management: The Introduction
- Lecture 19 - Significance of a Diverse and Inclusive Workplace
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- Lecture 25 - Ways of Synergizing Across Generations
- Lecture 26 - Ways of enhancing Intergeneration Synergy
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NPTEL : NOC:Yoga and Positive Psychology for Managing Career and Life (Management)

Co-ordinators : Prof. Ashish Pandey

Lecture 1 - Why the Course on Managing Self and Career

Lecture 2 - Present Context of Professional Work

Lecture 3 - State of Wellbeing of Indian Youth

Lecture 4 - Link between Self-Management and Career Management

Lecture 5 - Journey of Positive Psychology

Lecture 6 - Can there be a Universal Positive Psychology ?

Lecture 7 - Difference in Good Life and Life Satisfaction

Lecture 8 - Why Yoga with Positive Psychology ?

Lecture 9 - Genesis of this Course

Lecture 10 - Using Stories to Understand Optimal Experiences

Lecture 11 - Fundamental Questions in Positive Psychology

Lecture 12 - What Positive Psychology is Not

Lecture 13 - Positive-Negative Dialects of Well-Being

Lecture 14 - Positive Psychology: The Second Wave

Lecture 15 - Positivity and Human Potential in Yogic Traditions

Lecture 16 - Holistic Life Goals

Lecture 17 - Embracing Emotions and Positive Behavior

Lecture 18 - Discovering Dharma

Lecture 19 - Distinction with Negative Human Potential

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Lecture 21 - Four Ashrams or Stations in Life

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Lecture 23 - Positive Institutions

Lecture 24 - Family - A Positive Institution

Lecture 25 - Yoga and Governance

Lecture 26 - Positive Governance

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[Lecture 32 - Yogic Perspectives of Health and Wellbeing](#)

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- Lecture 65 - Seasons with Revolving Sun and Impact on Physiology
- Lecture 66 - Contemporary Knowledge about Food and Mental Health
- Lecture 67 - Food and Activities during the Cycle of the Day
- Lecture 68 - Yogasanas to Integrate Body and Emotions
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- Lecture 78 - Guidelines for Pranayama
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- Lecture 3 - Supply Chain Drivers
- Lecture 4 - Supply Chain Processes - I
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- Lecture 6 - Supply Chain Challenges
- Lecture 7 - Need/Strategies
- Lecture 8 - Push Vs Pull
- Lecture 9 - Case Study on Product Segmentation
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- Lecture 11 - Link between Corporate and Supply Chain Strategy
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- Lecture 21 - Newsvendor Case (Probabilistic Setting and Contracts) - I and II
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- Lecture 23 - Channel Structure Designs in Supply Chains (Brick and Mortar)
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- Lecture 26 - Introduction to Analytics and Big Data
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- Lecture 28 - Predictive Analytics: Case Study on Predictive Maintenance
- Lecture 29 - Predictive Analytics: Classification Tree Model
- Lecture 30 - Predictive Analytics: Building Classification Tree Model using Python
- Lecture 31 - Role of AI/ML in Forecasting and Demand Analytics

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- Lecture 33 - Demand Forecasting using AI/ML: Regression Tree Model
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- Lecture 46 - Role of Product Tracking and Traceability
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- Lecture 49 - ERP, WMS and TMS - I and II
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- Lecture 51 - Introduction to Supply Chain Digital Twin
- Lecture 52 - Supply Chain Digital Twin: Greenfield Analysis - A Case Study - I
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- Lecture 55 - Network Optimization with Capacity Constraints and Control Tower
- Lecture 56 - Digital Infrastructure for Supply Chains: Industry 4.0
- Lecture 57 - Industry 4.0 - IIoT, Cloud Computing, Horizontal and Vertical System Integration
- Lecture 58 - Industry 4.0 - Cybersecurity, Big Data Analytics, Simulation, AR, Robots, AM
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Lecture 2 - Data Driven Decision Making and Essentials of Predictive Analytics

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Lecture 4 - Types of Forecasting: Qualitative Approaches and Quantitative Approaches

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Lecture 6 - Components of a Time Series and Measures of Forecast Accuracy

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Lecture 8 - Moving Average Methods: Simple, Weighted, and Exponential Moving Average

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Lecture 18 - Seasonality, Seasonal Index, and Quarterly Average Method

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Lecture 20 - Seasonality and Trend: Winter's Holt Method

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Lecture 24 - ARIMA: Moving Average (MA) Process

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NPTEL : NOC:Business Fundamentals for Entrepreneurs (Part 2: External Operation) (Management)

Co-ordinators : Prof. Devdip Purkayastha

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NPTEL : Organisation Management (Management)

Co-ordinators : Prof. Vinayshil Gautam

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- Lecture 2 - Longitudinal thinking and legacy factor:Organizational Growth
- Lecture 3 - Longitudinal thinking and legacy factor:Organizational Growth (Continued...)
- Lecture 4 - Longitudinal thinking and legacy factor:Organizational Growth (Continued...)
- Lecture 5 - Theory and majors schools of Thought and Framework of Organizational Analysis
- Lecture 6 - Theory and majors schools of thought and framework of organizational analysis (Continued...)
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- Lecture 11 - Theory of organizational structures - nature and consequence of structure
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- Lecture 13 - Socio-culture dimension of work and behavior
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- Lecture 21 - Intervention strategies for organization development - individual, Group and Interpersonal Interventions
- Lecture 22 - Intervention strategies for organization development - individual, Group & interpersonal interventions (Continued...)
- Lecture 23 - Intervention strategies for organization development - individual, Group & interpersonal interventions (Continued...)
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- Lecture 25 - Total System Intervention & Stabilizing Change Management by Objectives (Continued...)
- Lecture 26 - Total System Intervention & Stabilizing Change Management by Objectives (Continued...)
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Co-ordinators : Prof. Jayanta Chatterjee

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Co-ordinators : Prof. Raghunandan Sengupta

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Co-ordinators : Prof. Jayanta Chatterjee

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- Lecture 10 - Reliability BEM (Continued...1)
- Lecture 11 - Reliability BEM (Continued...2)
- Lecture 12 - ANOVA for Bivariate Econometric Modelling
- Lecture 13 - Trivariate Econometric Modelling
- Lecture 14 - Trivariate Econometric Modelling (Continued...)
- Lecture 15 - Reliability of Trivariate Econometric Modelling
- Lecture 16 - Multivariate Econometric Modelling
- Lecture 17 - Multivariate Econometric Modelling (Continued...)
- Lecture 18 - Matrix Approach to Econometric Modelling
- Lecture 19 - Matrix Approach to Econometric Modelling (Continued...)
- Lecture 20 - Multicollinearity Problem
- Lecture 21 - Multicollinearity Problem (Continued...)
- Lecture 22 - Autocorrelation Problem
- Lecture 23 - Autocorrelation Problem (Continued...)
- Lecture 24 - Heteroscedasticity Problem
- Lecture 25 - Heteroscedasticity Problem (Continued...)
- Lecture 26 - Dummy Modelling
- Lecture 27 - Dummy Modelling (Continued...)
- Lecture 28 - LOGIT and PROBIT Model
- Lecture 29 - LOGIT and PROBIT Model (Continued...)
- Lecture 30 - Panel Data Modelling
- Lecture 31 - Panel Data Modelling (Continued...)

[Lecture 32 - Simultaneous Equation Modelling](#)

[Lecture 33 - Simultaneous Equation Modelling \(Continued...\)](#)

[Lecture 34 - Structural Equation Modelling](#)

[Lecture 35 - Structural Equation Modelling \(Continued...\)](#)

[Lecture 36 - Time Series Modelling](#)

[Lecture 37 - Time Series Modelling \(Continued...\)](#)

[Lecture 38 - Unit Root](#)

[Lecture 39 - Cointegration](#)

[Lecture 40 - Concluding Remarks](#)

NPTEL : Organizational Behaviour (Management)

Co-ordinators : Dr. Susmita Mukhopadhyay

- Lecture 1 - Understanding Organizational Behaviour
- Lecture 2 - Effectiveness in Organizations
- Lecture 3 - Social System and Organizational Culture
- Lecture 4 - Social System and Organizational Culture (Continued...)
- Lecture 5 - Individual differences and work behaviour
- Lecture 6 - Personality
- Lecture 7 - Personality (Continued...)
- Lecture 8 - Attitudes
- Lecture 9 - Attitudes (Continued...)
- Lecture 10 - Attitudes (Continued...)
- Lecture 11 - Perceptions and Attributions
- Lecture 12 - Perceptions and Attributions (Continued...)
- Lecture 13 - Motivation
- Lecture 14 - Motivation (Continued...)
- Lecture 15 - Job Design, Work and Motivation
- Lecture 16 - Job Design, Work and Motivation (Continued...)
- Lecture 17 - Evaluation, Feedback and Rewards
- Lecture 18 - Evaluation, Feedback and Rewards (Continued...)
- Lecture 19 - Managing Misbehaviour
- Lecture 20 - Stress
- Lecture 21 - Counseling
- Lecture 22 - Informal and Formal Groups
- Lecture 23 - Teams and Teambuilding
- Lecture 24 - Managing Conflict and Negotiation
- Lecture 25 - Managing Conflict and Negotiation (Continued...)
- Lecture 26 - Power and Politics
- Lecture 27 - Empowerment and Participation
- Lecture 28 - Assertive Behaviour and Transactional Analysis
- Lecture 29 - Communication
- Lecture 30 - Communication (Continued...)
- Lecture 31 - Decision Making

[Lecture 32 - Decision Making \(Continued...\)](#)

[Lecture 33 - Leadership](#)

[Lecture 34 - Leadership \(Continued...\)](#)

[Lecture 35 - Leadership \(Continued...\)](#)

[Lecture 36 - Organizational structure and Design](#)

[Lecture 37 - Organizational structure and Design \(Continued...\)](#)

[Lecture 38 - Organizational structure and Design \(Continued...\)](#)

[Lecture 39 - Change and Innovation](#)

[Lecture 40 - Change and Innovation \(Continued...\)](#)

[Lecture 41 - Organizational behaviour across cultures](#)

- Lecture 1 - Introduction to Investment Management
- Lecture 2 - Markets for Investment
- Lecture 3 - Risk and Return
- Lecture 4 - Risk and Return (Continued...)
- Lecture 5 - Organization and Function of Equity and Debt Markets
- Lecture 6 - Mutual Funds
- Lecture 7 - Market Efficiency - Concepts and forms of efficiency
- Lecture 8 - Testing Market Efficiency
- Lecture 9 - Financial Statement Analysis
- Lecture 10 - Financial Statement Analysis (Continued...)
- Lecture 11 - Valuation of Equity Shares - I
- Lecture 12 - Valuation of Equity Shares - II
- Lecture 13 - Economic Analysis - I
- Lecture 14 - Economic Analysis - II
- Lecture 15 - Industry Analysis - I
- Lecture 16 - Industry Analysis - II
- Lecture 17 - Company Analysis - I
- Lecture 18 - Company Analysis - II
- Lecture 19 - Technical Analysis - I
- Lecture 20 - Technical Analysis - II
- Lecture 21 - Introduction to Portfolio Management
- Lecture 22 - Introduction to Portfolio Management (Continued...)
- Lecture 23 - Capital Market Theory - I
- Lecture 24 - Capital Market Theory - II
- Lecture 25 - Arbitrage Pricing Theory
- Lecture 26 - Multifactor Pricing Model
- Lecture 27 - Markowitz Optimal Portfolio Selection Model
- Lecture 28 - Other Optimal Portfolio Selection Models
- Lecture 29 - Equity Portfolio Management Strategies - I
- Lecture 30 - Equity Portfolio Management Strategies - II
- Lecture 31 - Introduction to Bond Analysis

[Lecture 32 - Bond Pricing and Yield](#)

[Lecture 33 - Interest Rate: Determination & Structure](#)

[Lecture 34 - Bond Price Volatility](#)

[Lecture 35 - Bond Portfolio Management Strategies - I](#)

[Lecture 36 - Bond Portfolio Management Strategies - II](#)

[Lecture 37 - Derivatives - I](#)

[Lecture 38 - Derivatives - II](#)

[Lecture 39 - Portfolio Performance Evaluation - I](#)

[Lecture 40 - Portfolio Performance Evaluation - II](#)

NPTEL : Six Sigma (Management)

Co-ordinators : Prof. Tapan P. Bagchi

Lecture 1 - Concepts in Quality Management - I

Lecture 2 - Concepts in Quality Management - II

Lecture 3 - Concepts in Quality Management - III

Lecture 4 - Initiating Six Sigma

Lecture 5 - Review of Probability and Statistics - I

Lecture 6 - Review of Probability and Statistics - II

Lecture 7 - Review of Probability and Statistics - III

Lecture 8 - Review of Probability and Statistics - IV

Lecture 9 - QM Systems Overview

Lecture 10 - Cost of Quality and TQM Tools

Lecture 11 - QFD and ISO 9000

Lecture 12 - QS 9000 and Awards

Lecture 13 - Competing Through Service Quality

Lecture 14 - Introduction to Project Management

Lecture 15 - Project Life Cycle

Lecture 16 - Critical Path Method

Lecture 17 - Measurement System Analysis

Lecture 18 - Acceptance Sampling

Lecture 19 - Design of Sampling Plans

Lecture 20 - MIL-STD-105E Sampling Plan

Lecture 21 - Introduction to SPC

Lecture 22 - Control Chart Examples

Lecture 23 - Control Charts by Excel

Lecture 24 - Process Capability

Lecture 25 - Quality Function Deployment

Lecture 26 - Design of Experiments - Overview

Lecture 27 - Planning for DOE

Lecture 28 - Factor Effect Calculations

Lecture 29 - ANOVA in DOE

Lecture 30 - Benchmarking in Six Sigma

Lecture 31 - How to Benchmark

[Lecture 32 - Six Sigma in Supply Chains](#)

[Lecture 33 - Taguchi Methods](#)

[Lecture 34 - Robust Design](#)

[Lecture 35 - The Journey to Six Sigma](#)

[Lecture 36 - A Case Study of Defect Reduction](#)

[Lecture 37 - DFM & Reliability](#)

[Lecture 38 - Failure Modes & Effects Analysis \(FMEA\)](#)

[Lecture 39 - Implementing Six Sigma](#)

[Lecture 40 - Getting Results From Six Sigma](#)

Lecture 1 - Introduction

Lecture 2 - Definitions & Concepts

Lecture 3 - Communicative Competence - I

Lecture 4 - Communicative Competence - II

Lecture 5 - Communicative Competence - III

Lecture 6 - Intercultural Communication - I

Lecture 7 - Intercultural Communication - II

Lecture 8 - Intercultural Communication - III

Lecture 9 - Intercultural Communication - Thought and Speech

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Lecture 11 - Intercultural Communication: Translation as Problematic Discourse

Lecture 12 - Nonverbal Communication

Lecture 13 - Barriers to Communication

Lecture 14 - Barriers to Communication (Continued...)

Lecture 15 - Barriers to Communication (Continued...) & Listening

Lecture 16 - Listening (Continued...)

Lecture 17 - Communication Rules

Lecture 18 - Communication Style

Lecture 19 - Interpersonal Communication

Lecture 20 - Interpersonal Communication (Continued...)

Lecture 21 - Relational Communication

Lecture 22 - Relational Communication (Continued...)

Lecture 23 - Organizational Communication

Lecture 24 - Organizational Communication (Continued...)

Lecture 25 - Collaboration

Lecture 26 - Communication in Groups and Teams

Lecture 27 - Communication in Groups and Teams (Continued...1)

Lecture 28 - Communication in Groups and Teams (Continued...2)

Lecture 29 - Persuasive Communication

Lecture 30 - Persuasive Communication (Continued...)

Lecture 31 - Negotiation and Conflict Management

[Lecture 32 - Negotiation and Conflict Management \(Continued...\)](#)

[Lecture 33 - Leadership](#)

[Lecture 34 - Written Communication in International Business](#)

[Lecture 35 - Role of Technology in international Business Communication](#)

[Lecture 36 - Moving to Another Culture](#)

[Lecture 37 - Re-entry](#)

[Lecture 38 - Crisis Communication](#)

[Lecture 39 - Ethics in Business Communication](#)

[Lecture 40 - Conclusion](#)

NPTEL : Consumer Behaviour (Management)

Co-ordinators : Dr. Sangeeta Sahney

[Lecture 1 - Introduction to the Study of Consumer Behaviour](#)

[Lecture 2 - Introduction to the Study of Consumer Behaviour \(Continued...\)](#)

[Lecture 3 - Market Research and Consumer Behaviour](#)

[Lecture 4 - Market Research and Consumer Behaviour \(Continued...\)](#)

[Lecture 5 - Market Segmentation and Positioning](#)

[Lecture 6 - Market Segmentation and Positioning \(Continued...\)](#)

[Lecture 7 - The Consumer Decision Making Process](#)

[Lecture 8 - The Consumer Decision Making Process \(Continued...\)](#)

[Lecture 9 - Models of Consumers and Models of Consumer Behaviour](#)

[Lecture 10 - Models of Consumers and Models of Consumer Behaviour \(Continued...\)](#)

[Lecture 11 - Models of Consumers and Models of Consumer Behaviour \(Continued...\)](#)

[Lecture 12 - Models of Consumers and Models of Consumer Behaviour \(Continued...\)](#)

[Lecture 13 - Consumer Needs and Motivation, Emotions and Mood, Consumer Involvement](#)

[Lecture 14 - Consumer Needs and Motivation, Emotions and Mood, Consumer Involvement \(Continued...\)](#)

[Lecture 15 - Consumer Needs and Motivation, Emotions and Mood, Consumer Involvement \(Continued...\)](#)

[Lecture 16 - Consumer Needs and Motivation, Emotions and Mood, Consumer Involvement \(Continued...\)](#)

[Lecture 17 - Consumer Needs and Motivation, Emotions and Mood, Consumer Involvement \(Continued...\)](#)

[Lecture 18 - Consumer Learning](#)

[Lecture 19 - Consumer Learning \(Continued...\)](#)

[Lecture 20 - Consumer Learning \(Continued...\)](#)

[Lecture 21 - Consumer Learning \(Continued...\)](#)

[Lecture 22 - Personality, Self Concept and Self Image](#)

[Lecture 23 - Personality, Self Concept and Self Image \(Continued...\)](#)

[Lecture 24 - Consumer Perception, Risk and Imagery](#)

[Lecture 25 - Consumer Perception, Risk and Imagery \(Continued...\)](#)

[Lecture 26 - Consumer Perception, Risk and Imagery \(Continued...\)](#)

[Lecture 27 - Consumer Attitudes](#)

[Lecture 28 - Consumer Attitudes \(Continued...\)](#)

[Lecture 29 - Consumer Attitudes \(Continued...\)](#)

[Lecture 30 - Consumer Communication](#)

[Lecture 31 - Consumer Communication \(Continued...\)](#)

[Lecture 32 - Consumer Groups and Reference Groups](#)

[Lecture 33 - Family and Family Life Cycle](#)

[Lecture 34 - Social Class and Mobility, Lifestyle Analysis](#)

[Lecture 35 - Culture, Sub-Culture and Cross-Culture](#)

[Lecture 36 - Culture, Sub-Culture and Cross-Culture \(Continued...\)](#)

[Lecture 37 - Interpersonal Communication and Influence](#)

[Lecture 38 - Opinion Leadership](#)

[Lecture 39 - Diffusion of Innovation](#)

[Lecture 40 - Diffusion of Innovation \(Continued...\)](#)

NPTEL : International Finance (Management)

Co-ordinators : Dr. Arun K. Misra

Lecture 1 - International Financial Environment

Lecture 2 - International Financial Transactions

Lecture 3 - Gold Standard

Lecture 4 - Purchasing Power Parity

Lecture 5 - Floating and Fixed Exchange Rate Regimes

Lecture 6 - Currency Boards and Currency Basket Systems

Lecture 7 - Features of Foreign Exchange Market

Lecture 8 - Exchange Rate Arithmetic

Lecture 9 - Understanding Merchant Rates

Lecture 10 - Foreign Exchange Forward Contracts

Lecture 11 - Value at Risk for Foreign Exchange Market

Lecture 12 - International Parity Conditions and Movement Exchange Rate

Lecture 13 - Exchange Rate Determination and Forecasting

Lecture 14 - Development of Foreign Exchange Market in India

Lecture 15 - Foreign Exchange Exposures : Transaction Exposure

Lecture 16 - Transaction Exposure Management

Lecture 17 - Foreign Exchange Futures Market for Transaction Exposure Management

Lecture 18 - Foreign Currency Options : Transaction Exposure Management

Lecture 19 - Interest Rate Swaps

Lecture 20 - Currency Swaps

Lecture 21 - Operating Exposure Assessment

Lecture 22 - Operating Exposure Management

Lecture 23 - International Capital Structure and Capital Assets Pricing Model

Lecture 24 - International Capital Budgeting

Lecture 25 - Evaluation of Foreign Direct Investment

Lecture 26 - Cross Listing of Shares : Depository Receipts

Lecture 27 - International Financial Integration

Lecture 28 - World Trade Organisation

Lecture 29 - India's Forex Reserves Composition and Determinants of Optimum Reserves

Lecture 30 - Movement of Exchange Rates in India

Lecture 31 - International Trade Theory

[Lecture 32 - International Bond Market](#)

[Lecture 33 - India's Foreign Trade - Direction and Composition](#)

[Lecture 34 - Financial Stability](#)

[Lecture 35 - Test-1](#)

[Lecture 36 - Money and Forex Market Interaction : Indian Experience](#)

[Lecture 37 - Test-2](#)

[Lecture 38 - Characteristics of Indian Foreign Exchange Market](#)

[Lecture 39 - Test-3](#)

[Lecture 40 - Test-4](#)

- Lecture 1 - Introduction to multivariate statistical modeling
- Lecture 2 - Introduction to multivariate statistical modeling (Continued...)
- Lecture 3 - Univariate descriptive statistics
- Lecture 4 - Sampling distribution
- Lecture 5 - Estimation
- Lecture 6 - Estimation (Continued...)
- Lecture 7 - Hypothesis testing
- Lecture 8 - Multivariate descriptive statistics
- Lecture 9 - Multivariate descriptive statistics (Continued...)
- Lecture 10 - Multivariate normal distribution
- Lecture 11 - Multivariate normal distribution (Continued...)
- Lecture 12 - Multivariate Inferential Statistics
- Lecture 13 - Multivariate Inferential Statistics (Continued...)
- Lecture 14 - ANOVA (Analysis of Variance)
- Lecture 15 - Analysis of Variance (Continued...)
- Lecture 16 - Multivariate Analysis of Variance (MANOVA)
- Lecture 17 - MANOVA (Continued...)
- Lecture 18 - Tutorial - ANOVA
- Lecture 19 - Tutorial ANOVA (Continued...)
- Lecture 20 - MANOVA - Case Study
- Lecture 21 - Multiple Regression – Introduction
- Lecture 22 - MLR - Sampling distribution of regression coefficients
- Lecture 23 - MLR - Model adequacy tests
- Lecture 24 - MLR - Test of assumptions
- Lecture 25 - MLR - Model diagnostics
- Lecture 26 - MLR - Case Study
- Lecture 27 - Multivariate Linear Regression
- Lecture 28 - Multivariate Linear Regression - Estimation
- Lecture 29 - Multivariate Linear Regression - Model Adequacy tests
- Lecture 30 - Principal Component Analysis (PCA)
- Lecture 31 - PCA - Model Adequacy & Interpretation

[Lecture 32 - Regression Modeling using SPSS](#)

[Lecture 33 - Factor Analysis](#)

[Lecture 34 - Factor Analysis - Estimation & Model Adequacy testing](#)

[Lecture 35 - Factor Analysis - Model Adequacy, rotation, factor scores & case study](#)

[Lecture 36 - Cluster Analysis](#)

[Lecture 37 - Cluster Analysis \(Continued...\)](#)

[Lecture 38 - Introduction to Structural Equation Modeling \(SEM\)](#)

[Lecture 39 - SEM - Measurement Model](#)

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[Lecture 41 - Correspondence Analysis](#)

[Lecture 42 - Correspondence Analysis \(Continued...\)](#)

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Lecture 2 - Market Equilibrium : Demand and Supply

Lecture 3 - Elasticity of Demand

Lecture 4 - Demand Forecasting

Lecture 5 - Production

Lecture 6 - Exercises on Economics

Lecture 7 - Cost - Volume - Profit Relationships

Lecture 8 - Cost Management Systems and Activity Costing Systems

Lecture 9 - Relevant Information and Decision Making

Lecture 10 - Cost Allocation

Lecture 11 - Exercises on Economics (Continued...)

Lecture 12 - Double - Entry Bookkeeping

Lecture 13 - Job Costing

Lecture 14 - Process Costing

Lecture 15 - The Master Budget

Lecture 16 - Flexible Budget and Variance Analysis

Lecture 17 - Financial Statements

Lecture 18 - Financial Statements (Continued...)

Lecture 19 - Analysis of Financial Statements

Lecture 20 - Exercises (Continued...)

Lecture 21 - Time Value of Money

Lecture 22 - Comparison of Alternatives

Lecture 23 - Comparison of Alternatives (Continued...)

Lecture 24 - Comparison of Alternatives (Continued...)

Lecture 25 - Depreciation Accounting

Lecture 26 - Depreciation Accounting (Continued...)

Lecture 27 - Exercises

Lecture 28 - Evolution of Management Thoughts

Lecture 29 - Functions of Management

Lecture 30 - Functions of Management (Continued...)

Lecture 31 - Functions of Management (Continued...)

[Lecture 32 - Directing](#)

[Lecture 33 - Product Development](#)

[Lecture 34 - Forecasting Revisited](#)

[Lecture 35 - Forecasting Revisited \(Continued...\)](#)

[Lecture 36 - Forecasting Revisited \(Continued...\)](#)

[Lecture 37 - Capacity Planning](#)

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[Lecture 39 - Product Service Strategies and Plant Layout](#)

[Lecture 40 - Plant Lauout \(Continued...\) and Production Planning and Control](#)

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[Lecture 42 - Inventory Management](#)

[Lecture 43 - Inventory Management \(Continued...\)](#)

[Lecture 44 - Supply Chain Management](#)

[Lecture 45 - Supply Chain Management \(Continued...\) and Marketing Management](#)

[Lecture 46 - Marketing Management \(Continued...\)](#)

[Lecture 47 - Forms of Ownership](#)

[Lecture 48 - Starting a New Company and Small - scale Industrial Undertakings](#)

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Lecture 2 - Job Analysis and Design

Lecture 3 - Employee testing and selection

Lecture 4 - Performance appraisal

Lecture 5 - Performance evaluation and feedback

Lecture 6 - The Training process: Assessment of training needs and Training methods

Lecture 7 - General and Specific Training and Evaluation of Training

Lecture 8 - Career Management and planning

Lecture 9 - Career Development

Lecture 10 - Compensation

Lecture 11 - Pay for performance systems

Lecture 12 - Pay and Reward systems

Lecture 13 - Benefits

Lecture 14 - Separation and Administration of Benefits

Lecture 15 - Business Ethics

Lecture 16 - Ethical Aspects of HRM Activities

Lecture 17 - Employee Health

Lecture 18 - Employee Wellbeing in the Workplace

Lecture 19 - Organized Labor

Lecture 20 - Managing the Labor Relations Process

Lecture 21 - International HRM

Lecture 22 - Global Employment Law, Industrial Relations and International Ethics

Lecture 23 - Challenges to International HRM

Lecture 24 - Strategic HRM

Lecture 25 - Multilevel Model of Strategic HRM

Lecture 26 - Strategic HRM in a Networked World

Lecture 27 - Sustainable HRM

Lecture 28 - HR Measurement and Accountability

Lecture 29 - Types of Score Cards

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- Lecture 2 - Introduction to Commodity Derivatives and Risk Management (Continued...)
- Lecture 3 - Futures Contract Specifications
- Lecture 4 - Futures Contract Specifications (Continued...)
- Lecture 5 - Futures Contract - Mark-to-Market Margin
- Lecture 6 - Commodity Options and Commodity Spreads
- Lecture 7 - Pricing and Valuations of Futures Contract
- Lecture 8 - Pricing and Valuations of Futures Contract (Continued...)
- Lecture 9 - Convenience Yield, Contango-Backwardation
- Lecture 10 - Commodity Basis Risk - Part I
- Lecture 11 - Commodity Basis Risk - Part II
- Lecture 12 - Minimum Variance Hedge Ratio - Part I
- Lecture 13 - Minimum Variance Hedge Ratio - Part II
- Lecture 14 - Commodity Indexes - Part I
- Lecture 15 - Commodity Indexes - Part II
- Lecture 16 - Agri-Commodity Price Risk Management - Part I
- Lecture 17 - Agri-Commodity Price Risk Management - Part II
- Lecture 18 - Seasonality in Agri-Commodity, Contango and Backwardation - Part I
- Lecture 19 - Seasonality in Agri-Commodity, Contango and Backwardation - Part II
- Lecture 20 - Commodity Prices Determination - Part I
- Lecture 21 - Commodity Prices Determination - Part II
- Lecture 22 - Crude Oil Derivatives - Part I
- Lecture 23 - Crude Oil Price Determination
- Lecture 24 - Spot-Futures Relationship in Crude Oil - Part I
- Lecture 25 - Spot-Futures Relationship in Crude Oil - Part II
- Lecture 26 - Hedging of Crude Oil and Refined Product Price Risk - Part I
- Lecture 27 - Hedging of Crude Oil and Refined Product Price Risk - Part II
- Lecture 28 - Introduction to Gold and Gold Derivatives
- Lecture 29 - LBMA, Gold Spot Price and Gold Derivatives
- Lecture 30 - OTC Contracts on Gold and Gold Dehedge
- Lecture 31 - Spot Trading of Electricity in India - Part I

[Lecture 32 - Spot Trading of Electricity in India - Part II](#)

[Lecture 33 - Weather Derivatives - Part I](#)

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[Lecture 35 - Introduction to Carbon Credit Market](#)

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[Lecture 37 - Physical Market for Freight, Freight Exchanges, Freight Indexes](#)

[Lecture 38 - Hedging Freight rate Risk with Freight Rate Derivatives](#)

[Lecture 39 - Metal Derivatives and London Metal Exchange \(LME\)](#)

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Lecture 2 - Models for Public Participation in Sustainable Development

Lecture 3 - Role of Communication in Sustainable Development

Lecture 4 - Sustainability Communication

Lecture 5 - Approaches to Sustainability Communication : Strong Sustainability

Lecture 6 - Approaches to Sustainability Communication : Integrative Approach

Lecture 7 - Sociological Perspectives on Sustainability Communication

Lecture 8 - Psychological Perspectives on Sustainability Communication

Lecture 9 - Psychological Perspectives on Sustainability Communication (Continued...)

Lecture 10 - Steyn and Puth's Model for Communication Strategy

Lecture 11 - Application of Steyn and Puth's Model to Development

Lecture 12 - Tools of Strategic Communication for Sustainable Development

Lecture 13 - Role of Strategic Communication for Sustainable Development

Lecture 14 - Role of Stakeholders in Strategic Communication for Sustainable Development

Lecture 15 - Systems Approach to Identifying Decisive Information

Lecture 16 - Adapting CSR Communication Strategies to Sustainable Development

Lecture 17 - Strategic Conversations

Lecture 18 - Creating a Strategic Communication Plan

Lecture 19 - Communication for Behavioral Impact (COMBI) for Sustainable Development

Lecture 20 - Media and Sustainability Communication

Lecture 21 - ICTs in Sustainable Development

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Lecture 23 - Challenges to the use of ICTs in Sustainable Development Efforts

Lecture 24 - Wrap up and Conclusion

- Lecture 1 - Introduction to Consumer Behaviour
- Lecture 2 - The Changing Patterns of Consumer Behaviour
- Lecture 3 - Dimensions of Consumerism
- Lecture 4 - Use of Market Segmentation in Consumer Behaviour
- Lecture 5 - Process of Motivation
- Lecture 6 - Theories of Motivation
- Lecture 7 - Consumer Involvement
- Lecture 8 - Case Study on Motivation and Involvement
- Lecture 9 - Concept and Levels of Perception
- Lecture 10 - Process of Perception
- Lecture 11 - Theories of Personality - I
- Lecture 12 - Theories of Personality - II
- Lecture 13 - Brand Personality and Self concept
- Lecture 14 - Theories of Learning
- Lecture 15 - Attitude Formation - I
- Lecture 16 - Attitude Formation - II
- Lecture 17 - Changing Attitude
- Lecture 18 - Exercise on Attitude Formation and Change
- Lecture 19 - Values
- Lecture 20 - AIO Classification
- Lecture 21 - VALS - I Typology
- Lecture 22 - VALS - TM Typology
- Lecture 23
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- Lecture 25 - Group Influences on Consumption
- Lecture 26 - Role of Celebrity Endorsement
- Lecture 27 - Concept of Family and Family Life Cycle
- Lecture 28 - Family Buying Decisions
- Lecture 29 - Diffusion of Innovations - I
- Lecture 30 - Diffusion of Innovations - II
- Lecture 31 - Influencing Factors for Adoption and Opinion Leadership

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- Lecture 2 - Demand - Supply Framework
- Lecture 3 - Determinants of Demand
- Lecture 4 - Supply Curve, Determinants of Supply Curve
- Lecture 5 - Demand Supply Equilibrium
- Lecture 6 - Elasticity of Demand and Supply
- Lecture 7 - Determinants of Elasticity of Demand
- Lecture 8 - Elasticity and Revenue
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- Lecture 10 - Demand Supply and Government Policies
- Lecture 11 - Demand Supply and Government Policies (Continued...)
- Lecture 12 - Taxes and Demand and Supply Framework
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- Lecture 15 - Production and Cost
- Lecture 16 - Costs
- Lecture 17 - Cost Curves
- Lecture 18 - LR and SR Cost Curves
- Lecture 19 - Market Structures
- Lecture 20 - Perfect Competition
- Lecture 21 - Perfect Competition and Profit Maximization
- Lecture 22 - Supply Curve of Firm in Perfect Competition
- Lecture 23 - Supply Curve of Market in Perfect Competition
- Lecture 24 - Market Supply (Continued...)
- Lecture 25 - Monopoly
- Lecture 26 - Monopoly - Determination of Price and Quality
- Lecture 27 - Monopoly - Supply and Efficiency
- Lecture 28 - Price Discrimination
- Lecture 29 - Public Policy and Regulation
- Lecture 30 - Monopolistic Competition
- Lecture 31 - Monopolistic Competition - Determining P and K

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- Lecture 2 - Introduction to KM (Continued...)
- Lecture 3 - Why KM ?
- Lecture 4 - KM System Life Cycle (KSLC)
- Lecture 5 - Aligning KM and business strategy
- Lecture 6 - Process and models of KM cycle
- Lecture 7 - Process and models of KM cycle (Continued...)
- Lecture 8 - Knowledge creation and architecture
- Lecture 9 - Capturing tacit knowledge
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- Lecture 11 - Knowledge codification
- Lecture 12 - Knowledge codification
- Lecture 13 - System development: system testing and deployment
- Lecture 14 - System development: system testing and deployment (Continued...)
- Lecture 15 - Knowledge transfer and knowledge sharing
- Lecture 16 - Knowledge infrastructure
- Lecture 17 - Knowledge infrastructure (Continued...)
- Lecture 18 - Knowledge audit
- Lecture 19 - The knowledge team
- Lecture 20 - The knowledge team (Continued...)
- Lecture 21 - Analysis, design of KM system
- Lecture 22 - Analysis, design of KM system
- Lecture 23 - Developing the KM system
- Lecture 24 - Prototyping and deployment
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- Lecture 26 - Inferences from data
- Lecture 27 - Inferences from data
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- Lecture 29 - Data Management
- Lecture 30 - Knowledge portals
- Lecture 31 - Evaluation of KM effectiveness: Tools and

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NPTEL : NOC:Performance and Reward Management (Management)

Co-ordinators : Dr. Susmita Mukhopadhyay

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Lecture 3 - Understanding meaning of performance management and reward systems management with performance management process (Continued...)

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Lecture 6 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning

Lecture 7 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 8 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 9 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 10 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

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Lecture 12 - Implementation of a performance management system, defining performance and choosing a measurement approach and understanding the meaning of results (Continued...)

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Lecture 22 - Role of performance management in employee development, addressing performance management skills and team reward management (Continued...)

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Lecture 23 - Role of performance management in employee development, addressing performance management skills and team reward management (Continued...)

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Lecture 26 - Overview, reward system, understanding total, strategic and international reward

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Lecture 29 - Overview, reward system, understanding total, strategic and international reward (Continued...)

Lecture 30 - Overview, reward system, understanding total, strategic and international reward (Continued...)

Lecture 31 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 32 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

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Lecture 36 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 37 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure

Lecture 38 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

Lecture 39 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

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Lecture 41 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

Lecture 42 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers

Lecture 43 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 44 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 45 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 46 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

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Co-ordinators : Prof. Chhanda Chakraborti

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- Lecture 32 - Self Actualisation Needs, Rural Marketing Challenges
- Lecture 33 - Rural Marketing; Balanced ScoreCard
- Lecture 34 - Evaluating Investment Proposals : NPV, IRR
- Lecture 35 - Costing and Pricing for Public Transport
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- Lecture 41 - Taxation and the Distribution Network
- Lecture 42 - Transshipment; Flexibility and Six Sigma
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- Lecture 48 - Roadmap to Six Sigma; Ishikawa Diagram and SIPOC
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- Lecture 58 - Decision Support Systems for Operations Management (Continued...)
- Lecture 59 - Decision Support Systems for Operations Management (Continued...)
- Lecture 60 - DSS for Multi - Item Production - Distribution Planning

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Lecture 4 - Information Management in the digital world

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Lecture 7 - Data warehouse and business intelligence

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Lecture 21 - Information Systems for manufacturing management (Continued...)

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- Lecture 38 - Unique E-Commerce Business Models
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- Lecture 49 - Expert Systems
- Lecture 50 - Learning Management Systems (LMS)
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- Lecture 56 - Managing Global Organization - Globalization - Part 1
- Lecture 57 - Global Strategies and Business Organization
- Lecture 58 - Shared Services
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Lecture 4 - Correlation and Causality (Continued...)

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NPTEL : NOC:Retail Management (Management)

Co-ordinators : Prof. Swagato Chatterjee

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- Lecture 53 - Risk Based Maintenance - I
- Lecture 54 - Risk Based Maintenance - II
- Lecture 55 - Introduction to Behavioral Safety
- Lecture 56 - Behavioral Safety Data Collection and Preliminary Analysis
- Lecture 57 - Causal Modelling - I
- Lecture 58 - Causal Modelling - II: Application of Path Model
- Lecture 59 - Injury Epidemiology
- Lecture 60 - Occupational Safety, Health and Working Conditions Code, 2020 Analytics

Lecture 1 - Introduction and Concept - I

Lecture 2 - Introduction and Concept - II

Lecture 3 - Analysis of micro and macro environment - I

Lecture 4 - Analysis of micro and macro environment - II

Lecture 5 - Competition and Competitive Advantage - I

Lecture 6 - Competition and Competitive Advantage - II

Lecture 7 - Competition and Competitive Advantage - III

Lecture 8 - Framework for Internal Analysis of Firm - I

Lecture 9 - Framework for Internal Analysis of Firm - II

Lecture 10 - Value Chain Analysis

Lecture 11 - Resource-based view of firm and sustainability

Lecture 12 - Strategy Formulation - I

Lecture 13 - Strategy Formulation - II

Lecture 14 - Strategy Formulation - III

Lecture 15 - Diversification - I

Lecture 16 - Diversification - II

Lecture 17 - Mergers and Acquisitions - I

Lecture 18 - Mergers and Acquisitions - II

Lecture 19 - Portfolio Analysis and Display Matrices - I

Lecture 20 - Portfolio Analysis and Display Matrices - II

Lecture 21 - Operating and Financial Analysis

Lecture 22 - Complexities and Challenges of Competing in Global Markets - I

Lecture 23 - Complexities and Challenges of Competing in Global Markets - II

Lecture 24 - Entry Mode Strategies and Main Approaches for International Business

Lecture 25 - Building Competitive Advantage in International Markets

Lecture 26 - Strategies for competing in developing markets, and defending against global giants

Lecture 27 - Resource Allocation

Lecture 28 - 7-S Framework for Organizational Change

Lecture 29 - Strategy Implementation Issues

Lecture 30 - Matching organization structure to strategy

Lecture 31 - Forms of Organization

- Lecture 32 - Boundaryless Organization
- Lecture 33 - Strategic Leadership - I
- Lecture 34 - Strategic Leadership - II
- Lecture 35 - Universal Inner Structure of Effective Leaders
- Lecture 36 - Strategic Leadership - IV
- Lecture 37 - Business and Operational Excellence
- Lecture 38 - Strategic and Operational Control
- Lecture 39 - Balanced Scorecard Approach
- Lecture 40 - Roles and Responsibilities of Board of Directors
- Lecture 41 - Strategic Management Role and Style of the Board
- Lecture 42 - Composition, structure and other requirements of Board
- Lecture 43 - Improve Board Effectiveness, Board and Directorsâ€™ Performance Evaluation
- Lecture 44 - Corporate Governance Code
- Lecture 45 - Corporate Social Responsibility and Sustainability
- Lecture 46 - Social Auditing
- Lecture 47 - Innovation for Survival and Growth - I
- Lecture 48 - Innovation for Survival and Growth - II
- Lecture 49 - Entrepreneurship and Intrapreneurship
- Lecture 50 - Technology Management - I
- Lecture 51 - Technology Management - II
- Lecture 52 - In-house Development of Technology
- Lecture 53 - Strategic Importance of Knowledge and Organizational Learning
- Lecture 54 - Strategies for Knowledge Management
- Lecture 55 - Developing Strategic Plan of a Major Oil Company - I
- Lecture 56 - Developing Strategic Plan of a Major Oil Company - II
- Lecture 57 - Developing Strategic Plan of a Major Oil Company - III
- Lecture 58 - Summary of Modules 1-6
- Lecture 59 - Summary of Modules 7-11
- Lecture 60 - Summary of Modules 12-18

- Lecture 1 - Definition, purpose, and development of Human Factors and Ergonomics
- Lecture 2 - Types and components of worksystems, their interactions and evaluations
- Lecture 3 - Human components, machine components and environment components of worksystems
- Lecture 4 - Modern worksystems, FMJ vs FJM
- Lecture 5 - Contribution of human factors in systems design, engineering and management
- Lecture 6 - Anthropometry in product/process design, MHD, anthropometric design motto
- Lecture 7 - Types of anthropometric data, principles of applied anthropometry
- Lecture 8 - Examples of anthropometric design, numerical exercises
- Lecture 9 - Working Posture Analysis, Postural Triangle, Design for Seated and Standing Workers - Part 1
- Lecture 10 - Working Posture Analysis, Postural Triangle, Design for Seated and Standing Workers - Part 2
- Lecture 11 - Metabolism during work, Aerobic and anaerobic work, oxygen uptake
- Lecture 12 - Physical work capacity and energy expenditure, Individual differences, RWL, MOW
- Lecture 13 - MOE expenditure, Subjective measures of physical effort, Borg RPE scale, Factors
- Lecture 14 - EE of various operations in agriculture, construction and manufacturing industry - I
- Lecture 15 - EE of various operations in agriculture, construction and manufacturing industry - II
- Lecture 16 - Types of Injury Problems in Manual Handling Tasks, Types of Activities and Body Movements
- Lecture 17 - Biomechanical Modelling and Analysis of Manual Lifting
- Lecture 18 - Definitions and Standards of Lifting: NIOSH Lifting Equation
- Lecture 19 - EC Guidelines, UK Health and Safety Commission Guidelines
- Lecture 20 - Use of Material Handling Aids, Types of Material Handling Devices, Numerical Problems
- Lecture 21 - Ergonomic Problems in Computer Workstations, Design Elements of Computer Workstation
- Lecture 22 - Specifications of Computer Workstation Design Elements
- Lecture 23 - Methods to Reduce Glare/Reflection on Screen
- Lecture 24 - Design of Human-Computer Interaction
- Lecture 25 - Evolution of Technology in Computer Screen, Numerical Problems
- Lecture 26 - Work Postures and Related Complaints, Work Postures for Different Tasks, Task Analysis
- Lecture 27 - Power Law of Practice, Learning Curve, Numerical Pro
- Lecture 28 - Work Posture Assessment, Rapid Entire Body Assessment (REBA), MSDs/RMIs
- Lecture 29 - Hand tool design: Fitting the task, user and hand, Usage of hand tools and types of
- Lecture 30 - Design guidelines for hand tools
- Lecture 31 - Environment Component in Worksystems, Ergonomic Design of Physical Environment

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- Lecture 32 - Ergonomic Design Framework for Environment, Importance of Illumination
- Lecture 33 - Measurement of Illuminance, Luminance, and Contrast
- Lecture 34 - Measures of Contrast, Contrast Ratio under Different Work Situations
- Lecture 35 - Direct and Indirect Glare or Reflection, Illumination for Inspection and Quality
- Lecture 36 - Problem of Heat Stress at Workplaces, Thermoregulation Process, Acclimation and
- Lecture 37 - Thermal Balance Equation and Heat Stress
- Lecture 38 - Quality of Thermal Environment, Evaluation of Thermal Environment
- Lecture 39 - Whole Body Vibration and Sources of Vibration Discomfort
- Lecture 40 - Design guidelines for hand tools
- Lecture 41 - Auditory Environment and Human Performance, Measurement of Sound and Noise Exposure
- Lecture 42 - Noise Exposure and Hearing Loss, Noise Analysis and Noise Reduction using Engineering
- Lecture 43 - Effects of Noise on Performance, Broadbent and Poulton Theories, Interference of Noise
- Lecture 44 - Octave bands and examples
- Lecture 45 - Ergonomic design of auditory environment in different workplaces
- Lecture 46 - Concepts of Design for Manufacturing (DFM), Design for Assembly (DHA), and Design
- Lecture 47 - Product Design Assessment and Important Measures, Manual Assembly Design Efficiency
- Lecture 48 - Assembly Time Determination with PMTS Methods, Human Factors Principles in DHA
- Lecture 49 - Maintenance in Manufacturing/Production System - Important Ergonomic Design Issues - Part I
- Lecture 50 - Maintenance in Manufacturing/Production System - Important Ergonomic Design Issues - Part II
- Lecture 51 - Definition of Shift Work, Problems with Shift Work, Effect on Circadian Rhythms
- Lecture 52 - Problems of shift workers, Shift Work and Human Performance
- Lecture 53 - Recommended Shift Work Schedules
- Lecture 54 - Major Ergonomic Issues and Problems in Shift Work Design - Part 1
- Lecture 55 - Major Ergonomic Issues and Problems in Shift Work Design - Part 2
- Lecture 56 - Concepts of Ergonomic Performance and its Indicators
- Lecture 57 - EPI Assessment Tool Development
- Lecture 58 - Factors and their level of assessment
- Lecture 59 - Application of EPI Model in Different Worksystems
- Lecture 60 - Epilogue

Lecture 1 - Introduction to Organizational Design

Lecture 2 - Introduction to Organizational Design

Lecture 3 - Introduction to Organizational Design

Lecture 4 - Introduction to Organizational Design

Lecture 5 - Introduction to Organizational Design

Lecture 6 - Organizational Environment

Lecture 7 - Organizational Environment

Lecture 8 - Organizational Environment

Lecture 9 - Organizational Environment

Lecture 10 - Organizational Environment

Lecture 11 - Organizational Structure

Lecture 12 - Organizational Structure

Lecture 13 - Organizational Structure

Lecture 14 - Organizational Structure

Lecture 15 - Organizational Structure

Lecture 16 - Organizational Design and Strategy in a changing Global environment

Lecture 17 - Organizational Design and Strategy in a changing Global environment

Lecture 18 - Organizational Design and Strategy in a changing Global environment

Lecture 19 - Organizational Design and Strategy in a changing Global environment

Lecture 20 - Organizational Design and Strategy in a changing Global environment

Lecture 21 - Organizational Change

Lecture 22 - Organizational Change

Lecture 23 - Organizational Change

Lecture 24 - Organizational Change

Lecture 25 - Organizational Change

Lecture 26 - Managing Conflict, Power, and Politics

Lecture 27 - Managing Conflict, Power, and Politics

Lecture 28 - Managing Conflict, Power, and Politics

Lecture 29 - Managing Conflict, Power, and Politics

Lecture 30 - Managing Conflict, Power, and Politics

Lecture 31 - Organizational culture

- Lecture 32 - Organizational culture and socialization
- Lecture 33 - Organizational culture and climate
- Lecture 34 - Managing organizational culture
- Lecture 35 - International aspects of organizational culture
- Lecture 36 - Organizational design and technology
- Lecture 37 - Technologies and organizational structure
- Lecture 38 - Technological theories and organizational design
- Lecture 39 - Organizational design and technology: Challenges
- Lecture 40 - Organizational competencies
- Lecture 41 - Decision making
- Lecture 42 - Learning
- Lecture 43 - Knowledge management
- Lecture 44 - IT and IS
- Lecture 45 - IT in Management and Organization
- Lecture 46 - Organizational Birth and Growth
- Lecture 47 - Organizational Decline and Death
- Lecture 48 - Organizational Inertia and Resilience
- Lecture 49 - Organizational Transformation
- Lecture 50 - Organizational Development and Intervention
- Lecture 51 - Innovation: Concept, Types
- Lecture 52 - Innovation Framework Model
- Lecture 53 - Intrapreneurship
- Lecture 54 - Creativity
- Lecture 55 - Creativity and Related Issues
- Lecture 56 - Creativity and Design Thinking
- Lecture 57 - Turnaround Situation: Strategic, Operational and Cultural
- Lecture 58 - IT and ICT Intervention
- Lecture 59 - Human Resource Intervention
- Lecture 60 - Organizational Culture, Transformation and Ethical Values
- Lecture 61 - Future Trends for Organizational Transformation

- Lecture 1 - Introduction to Mergers and Acquisitions - I
- Lecture 2 - Introduction to Mergers and Acquisitions - II
- Lecture 3 - Theories of Mergers and Acquisitions
- Lecture 4 - Legal Environment of M and A in India
- Lecture 5 - Case Studies - DO M and A PAY ?
- Lecture 6 - Takeover Tactics and Anti-takeover Defenses - 1
- Lecture 7 - Takeover Tactics and Anti-takeover Defenses - 1
- Lecture 8 - Takeover Tactics and Anti-takeover Defenses - 2
- Lecture 9 - Takeover Tactics and Anti-takeover Defenses - 3
- Lecture 10 - Acquisition Search and Due Diligence - 1
- Lecture 11 - Acquisition Search and Due Diligence - 2
- Lecture 12 - Valuation in M and A: Cash Flow Based Approach - 1
- Lecture 13 - Valuation in M and A: Cash Flow Based Approach - 3 (Cost of Capital)
- Lecture 14 - Valuation in M and A: Cash Flow Based Approach - 4 (Dividend Discount Model)
- Lecture 15 - Valuation in M and A: Cash Flow Based Approach - 4 (Dividend Discount Model)
- Lecture 16 - Valuation in M and A: Cash Flow Based Approach - 5 (Free Cash Flow Models)
- Lecture 17 - Valuation in M and A: Cash Flow Based Approach - 6 (Free Cash Flow Models) (Continued...)
- Lecture 18 - Valuation in M and A: Valuation of Synergies - 1
- Lecture 19 - Valuation in M and A: Valuation of Synergies - 2
- Lecture 20 - Valuation in M and A: Asset Based Valuation
- Lecture 21 - Valuation in M and A: Relative Valuation - 1
- Lecture 22 - Valuation in M and A: Relative Valuation - 2
- Lecture 23 - Alternative Exit and Restructuring Strategies - 1
- Lecture 24 - Alternative Exit and Restructuring Strategies - 2
- Lecture 25 - Alternative Exit and Restructuring Strategies - 3
- Lecture 26 - M and A Deal Structuring - 1
- Lecture 27 - M and A Deal Structuring - 2
- Lecture 28 - M and A Deal Structuring - 3
- Lecture 29 - M and A Deal Structuring - 4
- Lecture 30 - M and A Deal Structuring - 5
- Lecture 31 - Legal Aspects of M and A - 1

[Lecture 32 - Legal Aspects of M and A - 2](#)

[Lecture 33 - Legal Aspects of M and A - 3](#)

[Lecture 34 - Accounting Aspects of M and A - I](#)

[Lecture 35 - Accounting Aspects of M and A - II](#)

[Lecture 36 - Alternative Exit and Restructuring Strategies - 1](#)

[Lecture 37 - Alternative Exit and Restructuring Strategies - 2](#)

[Lecture 38 - Alternative Exit and Restructuring Strategies - 3](#)

[Lecture 39 - Leveraged Buyouts](#)

[Lecture 40 - Alternative Exit and Restructuring Strategies - Insolvency and Bankruptcy](#)

- Lecture 1 - Investment Management as a Process
- Lecture 2 - Role of Financial Markets and Institutions
- Lecture 3 - Types of Investments
- Lecture 4 - Ecology of Financial Markets
- Lecture 5 - Investment Philosophies
- Lecture 6 - Present and Future Values of Investments
- Lecture 7 - Bonds as an Investment
- Lecture 8 - Pricing and Valuation of Bonds
- Lecture 9 - Pricing and Valuation of Bonds (Continued...)
- Lecture 10 - Prices, Yields, and Duration of Bonds
- Lecture 11 - Equity as an Asset Class
- Lecture 12 - Equity Valuation Models
- Lecture 13 - Equity Valuation Models (Continued...)
- Lecture 14 - Equity Valuation Ratios
- Lecture 15 - Equity Investment Strategies
- Lecture 16 - Portfolio Theory - Primer
- Lecture 17 - Capital Asset Pricing Model
- Lecture 18 - The CAPM and Index Models
- Lecture 19 - The CAPM and Index Models (Continued...)
- Lecture 20 - Consumption-Based Asset Pricing
- Lecture 21 - Two-fund Theorem
- Lecture 22 - Mutual Fund Basics
- Lecture 23 - Mutual Fund Basics (Continued...)
- Lecture 24 - Risk Indicator of a Mutual Fund
- Lecture 25 - Risk Indicator of a Mutual Fund (Continued...)
- Lecture 26 - Market Efficiency
- Lecture 27 - Market Efficiency (Continued...)
- Lecture 28 - Fundamental Analysis of Securities
- Lecture 29 - Value Investing using PV Models
- Lecture 30 - Asset Allocation and Portfolio Strategies
- Lecture 31 - Exchange Traded Funds (ETFs)

[Lecture 32 - Forming Portfolio with ETFs](#)

[Lecture 33 - Forming Portfolio with ETFs \(Continued...\)](#)

[Lecture 34 - Cryptocurrencies](#)

[Lecture 35 - Cryptocurrencies \(Continued...\)](#)

[Lecture 36 - Behavioral Anomalies in Investments](#)

[Lecture 37 - Behavioral Anomalies in Investments \(Continued...\)](#)

[Lecture 38 - Portfolio Evaluation](#)

[Lecture 39 - Portfolio Evaluation \(Continued...\)](#)

[Lecture 40 - Wrapping up](#)

- Lecture 1 - Basic Concepts and Introduction
- Lecture 2 - Drivers of Project Management
- Lecture 3 - Linkages between Organization Strategy and Projects
- Lecture 4 - Project Governance and Design of Project Portfolio System
- Lecture 5 - Non-Financial and Multi-Criteria Project Selection Models
- Lecture 6 - Organization Structure
- Lecture 7 - Organization Culture
- Lecture 8 - Project Scope of Work and Deliverables
- Lecture 9 - Responsibility Matrices and Project Communication Plan
- Lecture 10 - Estimating Guidelines and Methods, Top-down Estimation
- Lecture 11 - Level of Details, Type of Costs and Refining Estimates
- Lecture 12 - Concept of Project Network and Development Rules
- Lecture 13 - Construction of Network and Computation Process
- Lecture 14 - Extended Network Techniques to Represent Reality
- Lecture 15 - Probability of Completion of Project on Time
- Lecture 16 - Managing Risk and Risk Identification
- Lecture 17 - Risk Assessment
- Lecture 18 - Risk Response Development and Contingency Planning
- Lecture 19 - Risk Response Control and Change Control Management
- Lecture 20 - Risk Assessment of Capital projects
- Lecture 21 - Classification of Scheduling Problems: Time-constrained Project
- Lecture 22 - Resource-constrained Project
- Lecture 23 - Time-phased Budget, Critical Chain Project Management
- Lecture 24 - Rationale and Options for Project Crashing
- Lecture 25 - Crashing - Reducing Project Duration
- Lecture 26 - Reducing Project Duration - Solving Numerical
- Lecture 27 - Project Monitoring and Control Process
- Lecture 28 - Development of Performance Indexes for Monitoring
- Lecture 29 - Forecasting Project Completion Time and Cost
- Lecture 30 - Strategic Dimensions and Decision Logic of Outsourcing
- Lecture 31 - Best Practices in Outsourcing Project Work

[Lecture 32 - Partnering and Traditional Approaches for Managing Relations](#)

[Lecture 33 - The Art of Negotiating](#)

[Lecture 34 - Customer's Satisfaction and Managing Customer Relations](#)

[Lecture 35 - Types of Contract and their Salient Features](#)

[Lecture 36 - Preparation and Evaluation of RFP: Best Practices](#)

[Lecture 37 - Project Closure Activities and Post-Implementation Evaluation](#)

[Lecture 38 - Retrospectives](#)

[Lecture 39 - Oversight Activities and Levels](#)

[Lecture 40 - Phase Gate System, Project Management Maturity Model](#)

Lecture 1 - Introduction to Commodity Market

Lecture 2 - Commodity Spot Market and Different Types of Auction

Lecture 3 - Commodity Spot Market and Different Types of Auction

Lecture 4 - Introduction to forward contract

Lecture 5 - Introduction to Futures Contract

Lecture 6 - Futures Contract Specification

Lecture 7 - Futures Contract Specification (Continued...)

Lecture 8 - Futures Contract Specification (Continued...)

Lecture 9 - Futures Contract (Different Types of Margins)

Lecture 10 - Futures Contract (Mark-to-Market/MTM Margin)

Lecture 11 - Hedgers Vs. Speculators

Lecture 12 - Measures of Speculation

Lecture 13 - Spot Price, Futures Price and Basis Risk

Lecture 14 - Spot Price, Futures Price and Basis Risk (Continued...)

Lecture 15 - Pricing of Futures

Lecture 16 - Pricing of Futures (Continued...)

Lecture 17 - Convenience Yield, Minimum Variance Hedge Ratio

Lecture 18 - Hedge Effectiveness, Cross Hedge, Stack and Roll Vs. Strip Hedge

Lecture 19 - Calendar Spread, Valuation of Futures vs. Forwards, Commodity Swaps

Lecture 20 - Commodity Swaps

Lecture 21 - Commodity Index

Lecture 22 - Commodity Index (Continued...)

Lecture 23 - Commodity options

Lecture 24 - Introduction to Commodity Options (Continued...), Hedgers vs. Speculators

Lecture 25 - Pricing of Commodity Options

Lecture 26 - Commodity Options (Continued...), Put-Call Parity and Put-Call Ratio

Lecture 27 - Put-Call Parity, Implied Volatility, Swaptions

Lecture 28 - Commodity Swaption (Continued...) and Asian Options on Commodities

Lecture 29 - Commodity Derivatives Market : Value Proposition

Lecture 30 - Commodity Derivatives Market : Value Proposition

Lecture 31 - Agricultural Commodity Price Risk Management

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- Lecture 32 - Agricultural Commodity Price Risk Management (Continued...)
- Lecture 33 - Agricommodities Price Risk, Seasonality, Crush Spread Futures
- Lecture 34 - Agri-commodity Seasonality, Crush Spread Futures, Salmon Futures
- Lecture 35 - Crush Spread Futures, Salmon Futures, Agri-commodity risk Management Practices
- Lecture 36 - Gold and other Precious Metal Derivatives
- Lecture 37 - Gold as Asset, LBMA Spot Price Fix
- Lecture 38 - Gold as Asset, ETF, Gold-Silver Ratio
- Lecture 39 - Gold Price Risk Management, Dehedge, Zero Cost Derivatives
- Lecture 40 - Gold Quanto Futures, Delta Hedge Trap
- Lecture 41 - Crude oil and Crude oil Derivatives Price Risk Management
- Lecture 42 - Crude oil and Crude oil Derivatives Price Risk Management (Continued...)
- Lecture 43 - Crack Spread Futures, Spread Options and Crude Oil Price Risk
- Lecture 44 - Crude Oil Price Risk Management: 3-Way Collar, Spread Options and Swaps
- Lecture 45 - Swaps, Calendar Spreads: Crude Oil and Natural Gas Risk Management
- Lecture 46 - Weather Derivatives
- Lecture 47 - Weather Derivatives (Continued...)
- Lecture 48 - Weather Derivatives (Snowfall, Rainfall and Hurricane)
- Lecture 49 - Weather Derivatives (Rainfall and Hurricane)
- Lecture 50 - Spot and Derivatives Contracts on Electricity
- Lecture 51 - Electricity Trading in Day Ahead Market (DAM)
- Lecture 52 - Spot and Derivatives in Electricity (System Price and Area Clearing Price)
- Lecture 53 - Spot and Derivatives in Electricity (Green DAM, Duck Curve, Dark/Spark Spread)
- Lecture 54 - Carbon Credits and Carbon Credit Derivatives Market
- Lecture 55 - Carbon Credits (CDM, JI, RGGI, REC, ESCerts)
- Lecture 56 - Carbon Credits (REC, ESCerts, CORSIA) and Carbon Derivatives
- Lecture 57 - Freight Rates Derivatives
- Lecture 58 - Freight Rates Derivatives (Continued...)
- Lecture 59 - Water Derivatives
- Lecture 60 - Real Estate Derivatives and Derivatives Losses

- Lecture 1 - Introduction
- Lecture 2 - Overview on Infrastructure Financing Sources
- Lecture 3 - Basics of Financial Management - Part-1
- Lecture 4 - Basics of Financial Management - Part-2
- Lecture 5 - Basics of Financial Management - Part-3
- Lecture 6 - Basics of Financial Management - Part-4
- Lecture 7 - Analysis of company Performance - Part-1
- Lecture 8 - Analysis of company Performance - Part-2
- Lecture 9 - Analysis of Project Viability Time value of money
- Lecture 10 - Analysis of Project Viability Cost of Capital
- Lecture 11 - Analysis of Project Viability Capital Budgeting Techniques - I
- Lecture 12 - Analysis of Project Viability Capital Budgeting Guidelines - II
- Lecture 13 - Analysis of Project Viability Capital Budgeting Guidelines - III
- Lecture 14 - Analysis of Project Viability Capital Budgeting Guidelines - IV
- Lecture 15 - Overview and introduction to project finance
- Lecture 16 - Project Financing Attributes and Motivations - I
- Lecture 17 - Project Financing Attributes and Motivations - II
- Lecture 18 - Project Finance Markets - I
- Lecture 19 - Project Finance Markets - II
- Lecture 20 - Project Finance Markets - III
- Lecture 21 - Project Finance Markets Mezzanine / Sub-ordinated Debt
- Lecture 22 - Project Finance Markets - Type of Debt and Leasing
- Lecture 23 - Project Finance Markets - Financial Intermediation
- Lecture 24 - Project Finance Markets - Loan Refinancing
- Lecture 25 - Project Finance Markets - Project Bonds - I
- Lecture 26 - Project Finance Markets - Project Bonds - II
- Lecture 27 - Public Private Partnerships
- Lecture 28 - Risk Management - I
- Lecture 29 - Risk Management - II
- Lecture 30 - Risk Management - III
- Lecture 31 - Risk Management - Market Risks

[Lecture 32 - Risk Management - Country / Political risks - I](#)

[Lecture 33 - Risk Management - Country / Political risks - II](#)

[Lecture 34 - Risk Management - Country / Political risks - III](#)

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[Lecture 36 - Context of infrastructure development - I](#)

[Lecture 37 - Context of infrastructure development - II](#)

[Lecture 38 - Context of infrastructure development - III](#)

[Lecture 39 - Context of infrastructure development - IV](#)

[Lecture 40 - Context of infrastructure development - V](#)

- Lecture 1 - Introduction to Manufacturing Systems Management
- Lecture 2 - Different types of Manufacturing Systems
- Lecture 3 - Introduction to Cellular Manufacturing
- Lecture 4 - Cellular Manufacturing Applications, Production Flow Analysis
- Lecture 5 - Production Flow Analysis
- Lecture 6 - Cellular Manufacturing - Unidirectional flow, Capacity Planning, Layout
- Lecture 7 - Exercise on Production Flow Analysis
- Lecture 8 - Rank Order Clustering, Similarity Coefficient based algorithm
- Lecture 9 - Similarity Coefficient based clustering algorithm
- Lecture 10 - Hierarchical and Non hierarchical clustering algorithms
- Lecture 11 - Optimization based algorithms
- Lecture 12 - Optimization based algorithms, Assignment based algorithm
- Lecture 13 - Assignment model, Algorithm considering sequence of visit of machines
- Lecture 14 - Algorithm considering sequence of visit of machines
- Lecture 15 - Algorithm considering cell load data, alternate process plans
- Lecture 16 - Reducing Intercell moves
- Lecture 17 - Part subcontracting, Incremental cell formation
- Lecture 18 - Product based cells
- Lecture 19 - Branching algorithm for product based cells, Operator and task assignment
- Lecture 20 - Operator and task assignment
- Lecture 21 - Operator and task assignment continued
- Lecture 22 - Static and dynamic Operator allocation, Multiple products and incremental cells
- Lecture 23 - Cell scheduling and sequencing
- Lecture 24 - Cell scheduling and sequencing continued
- Lecture 25 - Single piece transportation
- Lecture 26 - Cell Layout, Introduction to Just-in-time manufacturing
- Lecture 27 - Cell control and JIT
- Lecture 28 - Basic elements of JIT, Kanban systems
- Lecture 29 - Role of basic elements, Critical success factors
- Lecture 30 - Models in JIT
- Lecture 31 - Models in JIT continued

- Lecture 32 - CONWIP, Introduction to synchronous manufacturing
- Lecture 33 - Theory of constraints, Product mix problem
- Lecture 34 - Statistical Fluctuations, Random events, principles of SM
- Lecture 35 - Scheduling in SM
- Lecture 36 - Drum Buffer Rope system
- Lecture 37 - Flexible Manufacturing System, Part selection problem
- Lecture 38 - FMS Loading problem
- Lecture 39 - FMS Loading, multiple batches and changeover times
- Lecture 40 - FMS Loading and scheduling, Summary of the course contents

- Lecture 1 - Introduction - (Challenges, Methodologies)
- Lecture 2 - Forecasting - Time series models - Simple Exponential smoothing
- Lecture 3 - Forecasting - Linear Models, Regression, Holt's , seasonality
- Lecture 4 - Forecasting - Winter's model, causal models, Goodness of forecast, Aggregate Planning, Tabular method
- Lecture 5 - Aggregate Planning, Tabular method, Linear Programming
- Lecture 6 - Aggregate Planning, Transportation model
- Lecture 7 - Aggregate Planning, Dynamic Programming, backordering
- Lecture 8 - Aggregate Planning, Quadratic model, Demand and capacity planning
- Lecture 9 - Inventory Models - Costs, EOQ model
- Lecture 10 - Inventory - EOQ model graphs, with backordering
- Lecture 11 - Inventory - Models for all quantity and marginal quantity Discount
- Lecture 12 - Multiple Quantity Discount, Multiple item inventory - Constraint on numbers of orders
- Lecture 13 - Multiple item inventory - Constraint on money value, space, equal number of orders
- Lecture 14 - Multiple item inventory - combining orders, production consumption model
- Lecture 15 - Inventory - Production consumption model with backordering, Economic lot scheduling problem
- Lecture 16 - Economic lot scheduling problem, Supply Chain inventory
- Lecture 17 - Lot sizing
- Lecture 18 - Lot sizing - heuristics
- Lecture 19 - Disaggregation
- Lecture 20 - Disaggregation - time varying demand, Safety stock - ROL for discrete demand distribution
- Lecture 21 - Safety stock - ROL for normal distribution of lead time demand
- Lecture 22 - Integrated model, ROL for normal distribution of LTD and given mean
- Lecture 23 - Safety stock reduction - delayed Product differentiation, substitution. MOM
- Lecture 24 - Sequencing and scheduling - Assumptions, objectives and shop settings
- Lecture 25 - Single machine sequencing. Two machine flow shop - Johnson's algorithm
- Lecture 26 - Flow shop scheduling - Three machines, Johnson's algorithm and Branch and bound algorithm
- Lecture 27 - Flow shop scheduling - heuristics - Palmer, Campbell Dudek Smith algorithm
- Lecture 28 - Job shop scheduling - Gantt chart, Different dispatching rules
- Lecture 29 - Job shop scheduling - Shifting bottleneck heuristic
- Lecture 30 - Job shop scheduling - Shifting bottleneck heuristic. Line Balancing
- Lecture 31 - Line Balancing

[Lecture 32 - Location problems - p median problem, Fixed charge problem](#)

[Lecture 33 - Location allocation problems in supply chain. Layout](#)

[Lecture 34 - Quantitative models for layout, Summary](#)

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[Lecture 39 - Bin Packing and Travelling Salesman Problems](#)

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- Lecture 1 - Introduction to Business Analysis for Engineers
- Lecture 2 - Introduction to Accounting
- Lecture 3 - Accounting Principles - 1
- Lecture 4 - Balance Sheet Fundamentals
- Lecture 5 - Balance Sheet Fundamentals
- Lecture 6 - Accounting Principles - 2
- Lecture 7 - Introduction to Income Statement & Double Entry
- Lecture 8 - Double Entry Examples - 1
- Lecture 9 - Double Entry Examples - 2
- Lecture 10 - Preparation of Financial Statement
- Lecture 11 - Cash Flow Statement - 1
- Lecture 12 - Cash Flow Statement - 2
- Lecture 13 - Special Accounts Illustrations
- Lecture 14 - Final Illustrative Example
- Lecture 15 - Summary of Financial Accounting
- Lecture 16 - Introduction to Management Accounting & Behaviour of Cost
- Lecture 17 - Cost-Volume Relationship
- Lecture 18 - Cost-Objects & Variance
- Lecture 19 - Labour & Over Heads Variance Analysis
- Lecture 20 - Cash Conversion Cycle
- Lecture 21 - Inventory Management
- Lecture 22 - What is Strategy?
- Lecture 23 - Porter's Diamond Model
- Lecture 24 - Industry Analysis
- Lecture 25 - Industry Analysis & Sources of Strategy
- Lecture 26 - The Need for Value
- Lecture 27 - Value Chain Analysis
- Lecture 28 - Corporate Portfolio Analysis
- Lecture 29 - External & Internal Environ Analysis
- Lecture 30 - Models for Strategy,Ansoff matrix
- Lecture 31 - Porter's Generic Strategy

[Lecture 32 - Prahlad's Core Competency](#)

[Lecture 33 - Case study to understand strategy](#)

[Lecture 34 - Case study to understand strategy](#)

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Lecture 1 - Linear Programming Introduction and formulations - Product Mix problem and Notations

Lecture 2 - Linear Programming Introduction and formulations - Manpower and Production planning formulations

Lecture 3 - Linear Programming Introduction and formulations - Media selection problem and Bicycle problem

Lecture 4 - Linear Programming Introduction and formulations - Caterer problem

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Co-ordinators : Prof. C Bhaktavatsala Rao

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Co-ordinators : Prof. R. K. Amit, Prof. U. Chandrasekhar

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- Lecture 77 - Tutorial - Profitability Ratios - Part 2
- Lecture 78 - Efficiency Ratios
- Lecture 79 - Tutorial - Efficiency Ratios
- Lecture 80 - Validating the learning - Walkthrough of RIL's Annual Report
- Lecture 81 - Online Resources for Financial Analysis
- Lecture 82 - Practice Problem - Liquidity Position
- Lecture 83 - Practice Problem - Solvency Position
- Lecture 84 - Practice Problem - Profitability Position
- Lecture 85 - Practice Problem - Profitability Position
- Lecture 86 - Practice Problem - Interpretation of Ratios
- Lecture 87 - Practice Problem - Arithmetic problems
- Lecture 88 - Recap and way forward
- Lecture 89 - Types of Cash Flows
- Lecture 90 - Tutorial - Types of Cash Flows
- Lecture 91 - Walkthrough of Cash Flow Statement of RIL
- Lecture 92 - Profit and Loss Appropriation Account
- Lecture 93 - Cash Flows from Operating Activities - Part 1
- Lecture 94 - Cash Flows from Operating Activities - Part 2
- Lecture 95 - Tutorial - Changes in working capital
- Lecture 96 - Tutorial - Cash Flows from Operating Activities - Part 1
- Lecture 97 - Cash Flows from Investing Activities

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[Lecture 101 - Preparing Cash Flow Statement](#)

[Lecture 102 - Identifying hidden information - Part 1](#)

[Lecture 103 - Identifying hidden information - Part 2](#)

[Lecture 104 - Identifying hidden information - Part 3](#)

[Lecture 105 - Practice Problem - Part 1](#)

[Lecture 106 - Practice Problem - Part 2](#)

[Lecture 107 - Need of Break Even Analysis](#)

[Lecture 108 - Understanding the nature of costs](#)

[Lecture 109 - Contribution Margin](#)

[Lecture 110 - Tutorial - Contribution](#)

[Lecture 111 - Break Even Point](#)

[Lecture 112 - Tutorial - Break Even Point](#)

[Lecture 113 - Tutorial - Break Even Point](#)

[Lecture 114 - Visualizing the Break Even Point](#)

[Lecture 115 - Tutorial - Break Even Analysis](#)

[Lecture 116 - Case - Break Even Analysis](#)

[Lecture 117 - Introduction to Inventory Management](#)

[Lecture 118 - Economic Order Quantity](#)

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Technology Forecasting for Strategic Decision Making - An Introduction (Management)

Co-ordinators : Prof. Dmitry Kucharavy, Prof. Bala Ramadurai

Lecture 1 - Introduction to Tech Forecasting for Strategic Decision Making

Lecture 2 - Famous forecasts which missed the mark

Lecture 3 - Why do we need technology forecasts? - Innovation vs Invention Efficiency vs Effectiveness

Lecture 5 - Why do we need technology forecasts? - Limiting Resources

Lecture 6 - Why do we need technology forecasts? - Why is it difficult to forecast?

Lecture 7 - Why do we need technology forecasts? - General stages of forecasting?

Lecture 9 - Failure and Success Startup Stories

Lecture 10 - Strategic, Tactical and Operational Decision Making

Lecture 11 - Quiz about Strategic, Tactical and Operational decision making

Lecture 12 - Answer to the quiz on Strategic, Tactical and operational decision making

Lecture 13 - Introduction to Vacuum forming case study and FORMAT handbook

Lecture 14 - Quiz on systems and set

Lecture 15 - Quiz on functions

Lecture 16 - Technology Lifecycle - Example case study - Transportation

Lecture 17 - Technology Lifecycle - Seasons, Clockspeed - Part 1

Lecture 18 - Technology Lifecycle - Seasons, Clockspeed - Part 2

Lecture 19 - Technology Lifecycle - Seasons, Clockspeed - Part 3

Lecture 20 - Technology Lifecycle - Seasons, Clockspeed - Part 4

Lecture 21 - Technology Lifecycle - Seasons, Clockspeed - Part 5

Lecture 22 - Aryabhata's experience in modeling and Live Solar Eclipse

Lecture 23 - Alternatives to forecasting in scope of technology management

Lecture 24 - Alternatives to forecasting in scope of technology management - Q&A

Lecture 25 - Element-Name-Value Model

Lecture 26 - System Operator

Lecture 27 - How to collect problems for mapping

Lecture 28 - How to formalize our knowledge about problems?

Lecture 29 - System function - What's function 1 Energy for cooking

Lecture 30 - System function - What's the function 2 Mosquito repellent

Lecture 31 - System function - What's the function 3 Pancake (Dosa) batter

Lecture 32 - Technological roadmaps

Lecture 33 - Maps of contradiction for forecasting

[Lecture 34 - Quantitative forecasting](#)

[Lecture 35 - Demo of S-curve fitting software](#)

[Lecture 36 - Forecasting and Forecast](#)

- Lecture 1 - Leadership: Business Context
- Lecture 2 - Leadership and Management
- Lecture 3 - Management Thought - 1
- Lecture 4 - Management Thought - 2
- Lecture 5 - Management Thought - 3
- Lecture 6 - Trait Theory
- Lecture 7 - Behavioural Theory
- Lecture 8 - Situational Theory
- Lecture 9 - Path-Goal Theory
- Lecture 10 - Leader-Member Exchange Theory
- Lecture 11 - Technology Leadership
- Lecture 12 - Climate Leadership
- Lecture 13 - Resource Leadership
- Lecture 14 - Global Leadership
- Lecture 15 - Crisis Leadership
- Lecture 16 - Leadership Attributes
- Lecture 17 - Apex Leadership Attributes
- Lecture 18 - Leadership Essentials
- Lecture 19 - Learning to Lead
- Lecture 20 - Indian Leader Competencies
- Lecture 21 - Self-actualization
- Lecture 22 - Leadership Balance
- Lecture 23 - Paradox Management
- Lecture 24 - Agile and Precise
- Lecture 25 - Adaptive Processes
- Lecture 26 - Stature versus Title
- Lecture 27 - Vision, Strategy, Structure and Execution
- Lecture 28 - Organization Structures
- Lecture 29 - Effective Execution
- Lecture 30 - Building Perpetual Corporations
- Lecture 31 - Enablement as Development

[Lecture 32 - Instilling Development Passion](#)

[Lecture 33 - CEO Succession](#)

[Lecture 34 - Success Factors for Succession](#)

[Lecture 35 - Stage and Stature](#)

[Lecture 36 - R&D Leadership](#)

[Lecture 37 - Operations Leadership](#)

[Lecture 38 - Marketing Leadership](#)

[Lecture 39 - Finance Leadership](#)

[Lecture 40 - Human Resources Leadership](#)

[Lecture 41 - Pioneering Leadership Model](#)

[Lecture 42 - Performance Leadership Model](#)

[Lecture 43 - Corporate Longevity Model](#)

[Lecture 44 - Intellectual Leadership Model](#)

[Lecture 45 - Leadership Accountability Model](#)

[Lecture 46 - Charismatic Leadership Model](#)

[Lecture 47 - People Leadership Model](#)

[Lecture 48 - Follower Leadership Model](#)

[Lecture 49 - Dependence-Independence Model](#)

[Lecture 50 - Connected Leadership Model](#)

[Lecture 51 - Leadership Sensibilities](#)

[Lecture 52 - Leadership Mistakes](#)

[Lecture 53 - Lonely at the Top](#)

[Lecture 54 - Leadership Emotions](#)

[Lecture 55 - Organizational Totalitarianism](#)

[Lecture 56 - Dr A P J Abdul Kalam President without Precedent](#)

[Lecture 57 - Dr C K Prahalad Timeless in Strategy, Tireless in Creativity](#)

[Lecture 58 - Steve Jobs Technology Visionary Par Excellence](#)

[Lecture 59 - Dr KallamAnjiReddy Game Changing Pharma Entrepreneur](#)

[Lecture 60 - J R D Tata Conglomerate Leadership Beyond Compare](#)

[Lecture 61 - Mahatma Gandhi Leadership Beyond Compare](#)

[Lecture 62 - In Closing](#)

- Lecture 1 - External analysis
- Lecture 2 - Industry evolution
- Lecture 3 - Five forces model
- Lecture 4 - Generic competitive strategies
- Lecture 5 - Position analyses
- Lecture 6 - Competitive Dynamics
- Lecture 7 - Business Portfolio Analysis
- Lecture 8 - Global Strategy
- Lecture 9 - Creative Strategy
- Lecture 10 - Balanced Scorecard
- Lecture 11 - Execution overview
- Lecture 12 - Structure as enabler
- Lecture 13 - Execution
- Lecture 14 - Execution case study
- Lecture 15 - Strategic management
- Lecture 16 - Competitive strategy overview
- Lecture 17 - Economic forces
- Lecture 18 - Liquidity as the sixth force
- Lecture 19 - The six forces model
- Lecture 20 - Strategic groups
- Lecture 21 - Buyer power
- Lecture 22 - Supplier power
- Lecture 23 - Competitive moves
- Lecture 24 - Market signaling
- Lecture 25 - Competitor clusters and analysis
- Lecture 26 - Generic strategies
- Lecture 27 - Structural analysis and competitive strategy
- Lecture 28 - Quality, Cost and value
- Lecture 29 - Differentiation and De-commoditization
- Lecture 30 - Niche as a core competence
- Lecture 31 - Generic industry environments

Lecture 32 - Integration, Expansion, and Diversification

Lecture 33 - Comparators and responders

Lecture 34 - Strategic balance

Lecture 35 - Technology and collaboration

Lecture 36 - Technology strategy

Lecture 37 - Competition in technology prism

Lecture 38 - Technological competence

Lecture 39 - Generic technology strategies

Lecture 40 - Innovation and generic strategies

Lecture 41 - Technology and Differentiation

Lecture 42 - Technology and Followership

Lecture 43 - Technology in five forces prism

Lecture 44 - Technology and Patenting

Lecture 45 - Technology and Change

Lecture 46 - Customised product design

Lecture 47 - Technology and functionality

Lecture 48 - Technological behaviour

Lecture 49 - Technology and public policy

Lecture 50 - Technology and transformation

Lecture 51 - Strategic shifts

Lecture 52 - Business models

Lecture 53 - Retro - Futurism

Lecture 54 - Innovation strategy and process

Lecture 55 - High technology business companies

Lecture 56 - Renewables and electric vehicles

Lecture 57 - Dyson and 3M

Lecture 58 - GE and DuPont

Lecture 59 - NVIDIA and Bose

Lecture 60 - Fitbit and apple

Lecture 61 - In closing

- Lecture 1 - Understanding Business Development
- Lecture 2 - Marketing and Business Development
- Lecture 3 - Markets and Marketing
- Lecture 4 - Strategy Formulation
- Lecture 5 - Business Development Cases
- Lecture 6 - Successful Business
- Lecture 7 - Industry and Market
- Lecture 8 - Vision, Mission and Strategy
- Lecture 9 - Goals
- Lecture 10 - Case Study of Business Development Excellence
- Lecture 11 - Industry and Business
- Lecture 12 - Porter's Five Forces Theory
- Lecture 13 - Industrial Transformations
- Lecture 14 - Competitive Strategies
- Lecture 15 - Company Analysis
- Lecture 16 - Industry, Market and Business
- Lecture 17 - Industry and Market Analysis
- Lecture 18 - Market Structures
- Lecture 19 - Demand Forecasting
- Lecture 20 - Competitor Analysis
- Lecture 21 - Customer Characteristics
- Lecture 22 - Customer Typologies
- Lecture 23 - Market Research and Design Thinking
- Lecture 24 - Customer Bonding
- Lecture 25 - Customer Relationship Management
- Lecture 26 - Market and Market Descriptors
- Lecture 27 - Market and Product Segmentation
- Lecture 28 - Product-Market Segmentation
- Lecture 29 - Segmentation Deep Dive
- Lecture 30 - Market Attractiveness and competitive positioning
- Lecture 31 - Branding

Lecture 32 - Brand Organization

Lecture 33 - Advertising and Communication

Lecture 34 - Servitization

Lecture 35 - Pricing

Lecture 36 - A New IT Start-up

Lecture 37 - An FMCG Start-up

Lecture 38 - A logistics start-up

Lecture 39 - A Nutraceuticals Start-up

Lecture 40 - A Telecom Fightback

Lecture 41 - Collaborations

Lecture 42 - Strategic Alliances

Lecture 43 - Joint Ventures

Lecture 44 - Subsidiaries

Lecture 45 - Mergers and Acquisitions

Lecture 46 - Value Chain Competencies

Lecture 47 - Functional Competencies

Lecture 48 - Negotiating Skills

Lecture 49 - Cultural Skills

Lecture 50 - Leadership Attributes

Lecture 51 - Growth Strategies

Lecture 52 - Growth Examples

Lecture 53 - Fragmented Industries and Emerging Industries

Lecture 54 - Mature Industries and Declining Industries

Lecture 55 - Global Industries and New Businesses

Lecture 56 - A Pharma Transformation

Lecture 57 - Pharma Strategic Alliances

Lecture 58 - Business Turbulence

Lecture 59 - Creating Value

Lecture 60 - From Starting to scale in Closing

- Lecture 1 - Instrumental Variable Estimation - Part I
- Lecture 2 - Instrumental Variable Estimation - Part II
- Lecture 3 - Instrumental Variable Estimation - Part III
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- Lecture 5 - Instrumental Variable Estimation - Part V
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- Lecture 11 - Instrumental Variable Estimation - Part XI
- Lecture 12 - Simultaneous Equation Model - Part I
- Lecture 13 - Simultaneous Equation Model - Part II
- Lecture 14 - Simultaneous Equation Model - Part III
- Lecture 15 - Simultaneous Equation Model - Part IV
- Lecture 16 - Simultaneous Equation Model - Part V
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- Lecture 18 - Simultaneous Equation Model - Part VII
- Lecture 19 - Simultaneous Equation Model - Part VIII
- Lecture 20 - Pooled Data and Panel Data Model Estimation - Part I
- Lecture 21 - Pooled Data and Panel Data Model Estimation - Part II
- Lecture 22 - Pooled Data and Panel Data Model Estimation - Part III
- Lecture 23 - Pooled Data and Panel Data Model Estimation - Part IV
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- Lecture 25 - Pooled Data and Panel Data Model Estimation - Part VI
- Lecture 26 - Panel Data Model Estimation - Part VII
- Lecture 27 - Panel Data Model Estimation - Part IX
- Lecture 28 - Qualitative Response Model - Part I
- Lecture 29 - Qualitative Response Model - Part II
- Lecture 30 - Qualitative Response Model - Part III
- Lecture 31 - Qualitative Response Model - Part IV

- [Lecture 32 - Qualitative Response Model - Part V](#)
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- [Lecture 34 - Multinomial Regression Model - Part I](#)
- [Lecture 35 - Multinomial Regression Model - Part II](#)
- [Lecture 36 - Multinomial Regression Model - Part III](#)
- [Lecture 37 - Multinomial Regression Model - Part IV](#)
- [Lecture 38 - Dynamic Panel data Model - Part I](#)
- [Lecture 39 - Dynamic Panel data Model - Part II](#)
- [Lecture 40 - Dynamic Panel data Model - Part III](#)
- [Lecture 41 - Dynamic Panel data Model - Part IV](#)
- [Lecture 42 - Dynamic Panel data Model - Part V](#)
- [Lecture 43 - Dynamic Panel data Model - Part VI](#)
- [Lecture 44 - Dynamic Panel data Model - Part VII](#)
- [Lecture 45 - Dynamic Panel data Model - Part VIII](#)
- [Lecture 46 - Dynamic Panel data Model - Part IX](#)
- [Lecture 47 - Dynamic Panel data Model - Part X](#)
- [Lecture 48 - Dynamic Panel data Model - Part XI](#)
- [Lecture 49 - Dynamic Panel data Model - Part XII](#)
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- [Lecture 52 - Dynamic Panel data Model - Part XV](#)
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- [Lecture 54 - Dynamic Panel data Model - Part XVII](#)
- [Lecture 55 - Dynamic Panel data Model - Part XVIII](#)
- [Lecture 56 - Dynamic Panel data Model - Part XIX](#)
- [Lecture 57 - Dynamic Panel data Model - Part XX](#)
- [Lecture 58 - Course outline for Applied Econometrics](#)

Lecture 1 - Introduction to contemporary teams

Lecture 2 - Introduction to virtual teams

Lecture 3 - Virtual teams

Lecture 4 - Factors affecting virtual teams

Lecture 5 - Managing virtualness

Lecture 6 - Cross-cultural teams

Lecture 7 - Factors affecting cross-cultural teams

Lecture 8 - Introduction to start-up teams

Lecture 9 - Factors affecting start-up teams

Lecture 10 - Introduction to IPO model in teams

Lecture 11 - Introduction to Human-AI teams

Lecture 12 - Inputs and Processes in Human-AI teams

Lecture 13 - States and Outcomes in Human-AI teams

Lecture 14 - Multiple Team Membership and Multi-team Systems

Lecture 15 - Introduction to Agile teams

Lecture 16 - Team Dynamics in Agile teams

Lecture 17 - Remote work teams

- Lecture 1 - Introduction to Financial Accounting and Cost Accounting
- Lecture 2 - Introduction to Corporate Finance
- Lecture 3 - Contents of Income Statement and Balance Sheet - Part I
- Lecture 4 - Contents of Income Statement and Balance Sheet - Part II
- Lecture 5 - Interaction between Income Statement and Balance Sheet
- Lecture 6 - Preparation of Income Statement and Balance Sheet: Example - Part I
- Lecture 7 - Preparation of Income Statement and Balance Sheet: Example - Part II
- Lecture 8 - Preparation of Income Statement and Balance Sheet: Example - Part III
- Lecture 9 - Preparation of Balance Sheet: Lone Pine Cafe A - Part I
- Lecture 10 - Preparation of Balance Sheet: Lone Pine Cafe A - Part II
- Lecture 11 - Preparation of Income Statement: Lone Pine Cafe B
- Lecture 12 - Cash Flow Statement: Concept and Example (Direct Method) - Lone Pine Cafe
- Lecture 13 - Classification of Balance Sheet Items: Maynard Company A
- Lecture 14 - Preparation of Income Statement: Maynard Company B
- Lecture 15 - Preparation of Cash Flow Statement: Lone Pine Cafe (Indirect Method)
- Lecture 16 - Preparation of Cash Flow Statement: Lori Crump (Indirect Method)
- Lecture 17 - Preparation of cash flow statement: An example (Direct Method)
- Lecture 18 - Preparation of cash flow statement: An example (Indirect Method)
- Lecture 19 - Ratio Analysis - Part I - Analysis of financial statements
- Lecture 20 - Ratio Analysis - Part II - Profitability Ratios
- Lecture 21 - Ratio Analysis - Part III - Dividend and Liquidity Ratios
- Lecture 22 - Ratio Analysis - Part IV - Efficiency Ratios
- Lecture 23 - Cost, Costing and Cost Accounting
- Lecture 24 - Classification of Costs
- Lecture 25 - Preparation of Cost Sheet - Part I
- Lecture 26 - Preparation of Cost Sheet - Part II
- Lecture 27 - Allocation and Apportionment of Cost
- Lecture 28 - Primary and Secondary Distribution of Overhead
- Lecture 29 - Activity Based Costing - Part I
- Lecture 30 - Activity Based Costing - Part II
- Lecture 31 - Break-Even Analysis

- Lecture 32 - Decision Making using Cost Accounting Informations - Examples - Part I
- Lecture 33 - Decision Making using Cost Accounting Informations - Examples - Part II
- Lecture 34 - Decision Making using Cost Accounting Informations - Examples - Part III
- Lecture 35 - Decision Making using Cost Accounting Informations - Examples - Part IV
- Lecture 36 - Decision Making using Cost Accounting Informations - Examples - Part V
- Lecture 37 - Introduction to Budgeting: Preparation of Budgets - Part I
- Lecture 38 - Introduction to Budgeting: Preparation of Budgets - Part II
- Lecture 39 - Introduction to Budgeting: Preparation of Budgets - Part III
- Lecture 40 - Flexible Budget and Variance Analysis
- Lecture 41 - Foundations of Corporate Finance - Part I
- Lecture 42 - Foundations of Corporate Finance - Part II
- Lecture 43 - Time Value of Money: Present Value and Future Value in Single and Multiperiod case
- Lecture 44 - Simplification of Cash Flows: Annuity, Growing Annuity, Perpetuity and Growing Perpetuity
- Lecture 45 - Bond Valuation - Part I
- Lecture 46 - Bond Valuation - Part II
- Lecture 47 - Stock Valuation
- Lecture 48 - Numericals on Bond and Stock Valuation
- Lecture 49 - Technique of Evaluating Capital Investment Decisions
- Lecture 50 - Numericals on Technique of Evaluating Capital Investment Decisions
- Lecture 51 - Risk and Return - Part I
- Lecture 52 - Risk and Return - Part II
- Lecture 53 - Risk and Return: Individual Securities
- Lecture 54 - Risk and Return: Portfolio
- Lecture 55 - Cost of Capital and Valuation - Part I
- Lecture 56 - Cost of Capital and Valuation - Part II
- Lecture 57 - Valuation and Capital Structure
- Lecture 58 - Dividend and Other Payouts

NPTEL : NOC:Strategic Sourcing (Management)

Co-ordinators : Prof. Arshinder Kaur

- Lecture 1 - Evolution of Sourcing and changing paradigms
- Lecture 2 - Changing Expectations leading to Supply Management and Strategic Sourcing
- Lecture 3 - Supply Chains and Supply Networks
- Lecture 4 - Return on Assets
- Lecture 5 - Strategic sourcing and Organisation's Strategy Importance of supply management
- Lecture 6 - Procure to Pay cycle
- Lecture 7 - Recognition of need
- Lecture 8 - Purchasing and supply process - 1
- Lecture 9 - Purchasing and supply process - 2
- Lecture 10 - Need identification and types - 1
- Lecture 11 - Need identification and types - 2
- Lecture 12 - Indirect contributions of Supply
- Lecture 13 - Aligning supply objectives with organisation's strategy
- Lecture 14 - Procurement in Organizations - 1
- Lecture 15 - Procurement in Organizations - 2
- Lecture 16 - Developing supply strategy - 1
- Lecture 17 - Developing Sourcing/Supply strategy - 1
- Lecture 18 - Developing Sourcing/Supply strategy - 2
- Lecture 19 - Technology in Sourcing
- Lecture 20 - Reverse Auctions
- Lecture 21 - Success stories about technologies in Sourcing
- Lecture 22 - Strategic cost management - 1
- Lecture 23 - Strategic cost management - 2
- Lecture 24 - Strategic cost management - Cost analysis
- Lecture 25 - Sustainability in Supply management - 1
- Lecture 26 - Sustainability in Supply management - 2
- Lecture 27 - Science Based Targets
- Lecture 28 - Negotiation supply management
- Lecture 29 - Planning for negotiation
- Lecture 30 - Negotiation strategy
- Lecture 31 - Negotiation strategy (Continued...)

[Lecture 32 - Supply Contracts](#)

[Lecture 33 - Types of supply contracts - 1](#)

[Lecture 34 - Types of supply contracts - 2](#)

[Lecture 35 - Supplier selection and evaluation - 1](#)

[Lecture 36 - Supplier selection and evaluation - 2](#)

[Lecture 37 - Supplier selection and evaluation - 3](#)

[Lecture 38 - Outsourcing decisions - 1](#)

[Lecture 39 - Outsourcing decisions - 2](#)

[Lecture 40 - TOPSIS](#)

[Lecture 41 - Goal Programming](#)

[Lecture 42 - Interpretive structural model - 1](#)

[Lecture 43 - Interpretive structural model - 2](#)

[Lecture 44 - Supply risk management](#)

[Lecture 45 - Risk management framework](#)

[Lecture 46 - Supply risk examples](#)

[Lecture 47 - Assessment of risk](#)

[Lecture 48 - Risk metrics](#)

Lecture 1 - Introduction

Lecture 2 - Accounting Process

Lecture 3 - Accounting Concepts

Lecture 4 - Trial Balance and its Relevance

Lecture 5 - Relevant Accounting Statements

Lecture 6 - Journal (Part-I) - The first and original book of accounting

Lecture 7 - Journal (Part-II) - The first and original book of accounting

Lecture 8 - Ledger-The second book of accounts

Lecture 9 - Financial Statements

Lecture 10 - Financial Statements - Income Statement

Lecture 11 - Financial Statements - Balance Sheet

Lecture 12 - Financial Statements with Adjustments (Part-1)

Lecture 13 - Financial Statements with Adjustments (Part-2)

Lecture 14 - Financial Statements with Adjustments (Part-3)

Lecture 15 - Financial Statements with Adjustments (Part-4)

Lecture 16 - Financial Statements with Adjustments (Part-5)

Lecture 17 - Financial Statements with Adjustments (Part-6)

Lecture 18 - Financial Statements with Adjustments (Part-7)

Lecture 19 - Financial Statements with Adjustments (Part-8)

Lecture 20 - Financial Statements with Adjustments (Part-9)

Lecture 21 - Financial Statements with Adjustments (Part-10)

Lecture 22 - Financial Statements with Adjustments (Part-11)

Lecture 23 - Financial Statements with Adjustments (Part-12)

Lecture 24 - Financial Statements with Adjustments (Part-13)

Lecture 25 - Corporate Financial Statements (Part-1)

Lecture 26 - Corporate Financial Statements (Part-2)

Lecture 27 - Corporate Financial Statements (Part-3)

Lecture 28 - Corporate Financial Statements (Part-4)

Lecture 29 - Corporate Financial Statements (Part-5)

Lecture 30 - Corporate Financial Statements (Part-6)

Lecture 31 - Corporate Financial Statements (Part-7)

- Lecture 32 - Corporate Financial Statements (Part-8)
- Lecture 33 - Corporate Financial Statements (Part-9)
- Lecture 34 - Financial Statement Analysis
- Lecture 35 - Ratio Analysis (Part-1)
- Lecture 36 - Ratio Analysis (Part-2)
- Lecture 37 - Ratio Analysis (Part-3)
- Lecture 38 - Different Sets of Ratios (Part-1)
- Lecture 39 - Different Sets of Ratios (Part-2)
- Lecture 40 - Ratio Analysis - A case of Grasim Industries (Part-1)
- Lecture 41 - Ratio Analysis - A case of Grasim Industries (Part-2)
- Lecture 42 - Liquidity Ratios - Grasim Industries (Part-1)
- Lecture 43 - Liquidity Ratios - Grasim Industries (Part-2)
- Lecture 44 - Liquidity Ratios - Grasim Industries (Part-3)
- Lecture 45 - Profitability Ratios- Grasim Industries (Part-1)
- Lecture 46 - Profitability Ratios- Grasim Industries (Part-2)
- Lecture 47 - Profitability Ratios- Grasim Industries (Part-3)
- Lecture 48 - DuPont Ratios (Part-1)
- Lecture 49 - DuPont Ratios (Part-2)
- Lecture 50 - Valuation or Capital Market Ratios (Part-1)
- Lecture 51 - Valuation or Capital Market Ratios (Part-2)
- Lecture 52 - Cash Flow Statement - Introduction (Part-1)
- Lecture 53 - Cash Flow Statement (Part-2)
- Lecture 54 - Preparation of Cash Flow Statement- Basic Cash Flow Statement
- Lecture 55 - Cash Flow Statement - Further Analysis (Part-1)
- Lecture 56 - Cash Flow Statement - Further Analysis (Part-2)
- Lecture 57 - Final Cash Flow Statement (Part-1)
- Lecture 58 - Final Cash Flow Statement (Part-2)
- Lecture 59 - Financial Reporting (Part-1)
- Lecture 60 - Financial Reporting (Part-2)

NPTEL : NOC:Supply Chain Analytics (Management)

Co-ordinators : Prof. Rajat Agrawal

- Lecture 1 - Introduction to Supply Chain Management
- Lecture 2 - Evolution of Supply Chain Management
- Lecture 3 - Analytics in Supply Chain Management
- Lecture 4 - Supply Chain Planning
- Lecture 5 - Different views of Supply Chain
- Lecture 6 - Supply Chain Strategy
- Lecture 7 - Supply Chain Drivers
- Lecture 8 - Developing Supply Chain Strategy
- Lecture 9 - Strategic Fit in Supply Chain
- Lecture 10 - Demand Forecasting in Supply Chain
- Lecture 11 - Bullwhip Effect and Time Series Analysis
- Lecture 12 - Exponential Smoothing Method of Forecasting
- Lecture 13 - Measures of Forecasting Errors
- Lecture 14 - Tracking Signal and Seasonality Models
- Lecture 15 - Forecasting using multiple characteristics in Demand Data and Inventory Management in Supply Chain
- Lecture 16 - Inventory Management in Supply Chain
- Lecture 17 - Multi echelon Inventory Management
- Lecture 18 - Multi echelon Inventory Management (Continued...)
- Lecture 19 - Multi echelon Inventory Management for four stations
- Lecture 20 - Multi echelon Inventory Management for four stations (Numerical Example)
- Lecture 21 - Multi echelon Inventory Management for four stations (Numerical Example) (Continued...)
- Lecture 22 - Network Design in Supply Chain
- Lecture 23 - Network Design of Global Supply Chain
- Lecture 24 - Alternative channels of Distribution
- Lecture 25 - Location Decisions in Supply Chain
- Lecture 26 - Network Optimization Models
- Lecture 27 - Using Excel Solver for Network Optimization
- Lecture 28 - Uncertainty in Network Design
- Lecture 29 - Network Design in Uncertain Environment and Flexibility
- Lecture 30 - Flexibility in Supply Chain
- Lecture 31 - Optimal Level of Product Availability in Supply chain

[Lecture 32 - Time Value of money in Supply Chain](#)

[Lecture 33 - Different types of Analytics in Supply Chain](#)

[Lecture 34 - Predictive Modelling in Forecasting in Supply Chain](#)

[Lecture 35 - Representation on Uncertainty in Supply Chain](#)

[Lecture 36 - Using Decision Tree for handling Uncertainty](#)

[Lecture 37 - Example of using Decision Tree incorporating Uncertainty in Single Factor](#)

[Lecture 38 - Example of using Decision Tree incorporating Uncertainty in two Key Factors](#)

[Lecture 39 - Modelling Flexibility in Supply Chain](#)

[Lecture 40 - Trends, Challenges and Future of Supply Chain](#)

Lecture 1 - Introduction to Marketing Research

Lecture 2 - Defining Research Problem

Lecture 3 - Developing Research Approach and Developing Research Design: Non- Conclusive

Lecture 4 - Research Design: Conclusive

Lecture 5 - Qualitative Research: Nature and Approaches

Lecture 6 - Qualitative Research: Depth Interview, Focus Group Discussion

Lecture 7 - Projective Technique, Case Study

Lecture 8 - Case Study, Descriptive Research Design and Research Errors

Lecture 9 - Primary and Secondary Data, Research Error

Lecture 10 - Measurement and Scaling: Comparative and Non-comparative Scaling

Lecture 11 - Scale Development Process

Lecture 12 - Questionnaire and Form Design

Lecture 13 - Causal Research and Types

Lecture 14 - Experimental Design and Sampling

Lecture 15 - Sampling Design and Procedure

Lecture 16 - Sampling and Sample Size Determination

Lecture 17 - Hypothesis Development: Null and Alternate, Type I and Type II Errors

Lecture 18 - Data Preparation

Lecture 19 - Hypothesis Testing: T-Test, Z-Test

Lecture 20 - T, Z and F Test

Lecture 21 - Hypothesis Testing: Anova and Manova

Lecture 22 - Cross Tabulation and Chi Square Test

Lecture 23 - Correlation and Regression

Lecture 24 - Regression

Lecture 25 - Factor Analysis

Lecture 26 - Factor Analysis

Lecture 27 - SEM and CFA - 1

Lecture 28 - SEM and CFA - 2

Lecture 29 - SEM and CFA - 3

Lecture 30 - Cluster Analysis - I

Lecture 31 - Cluster Analysis - II

[Lecture 32 - Discriminant Analysis](#)

[Lecture 33 - Discriminant Analysis - 1](#)

[Lecture 34 - Researching Rural Market](#)

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NPTEL : NOC:Working Capital Management (Management)

Co-ordinators : Prof. Anil K. Sharma

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Lecture 25 - Formulating a Successful Retail Strategy

Lecture 26 - Formulating a Successful Retail Strategy (Continued...)

Lecture 27 - Formulating a Successful Retail Strategy (Continued...)

Lecture 28 - Formulating a Successful Retail Strategy (Continued...)

Lecture 29 - Formulating a Successful Retail Strategy (Continued...)

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- Lecture 5 - Some Important Concepts and Case Study
- Lecture 6 - Value Chain Analysis, Core Competence and Outsourcing
- Lecture 7 - Introduction to Organisational Buying Behaviour
- Lecture 8 - Howard's Seth Model
- Lecture 9 - Seth's Model
- Lecture 10 - Webster and Wind Model, Buying Center and Buygrid Framework
- Lecture 11 - Purchasing function Goals and Kraljic's Model
- Lecture 12 - Purchasing Cycle and Procurement Development Process
- Lecture 13 - Strategic Sourcing and Case Study
- Lecture 14 - E-Procurement and Supplier Assessment
- Lecture 15 - B2B Marketing Strategy Formulation
- Lecture 16 - B2B Marketing Strategy Formulation and Balance Scorecard
- Lecture 17 - Balance Scorecard, Strategy Maps and Case Study
- Lecture 18 - Managing Products in B2B Markets: PLC Approach
- Lecture 19 - Managing Products in B2B Markets: TA Life Cycle Approach
- Lecture 20 - Managing Services in B2B Markets
- Lecture 21 - Introduction to STP
- Lecture 22 - Segmentation in B2B Markets
- Lecture 23 - Bonama and Shapiro's Nested Approach and Targeting in B2B
- Lecture 24 - Target Market Strategies
- Lecture 25 - Positioning in B2B Markets
- Lecture 26 - B2B Positioning Strategies
- Lecture 27 - Business Market Communication: Personal Selling
- Lecture 28 - Business Market Communication: Sales Force Management
- Lecture 29 - Business Market Communication: Advertising
- Lecture 30 - Business Market Communication: Social Media, Trade shows and more
- Lecture 31 - Business Market Communication: Promotional Budgeting

- Lecture 32 - Demand Forecasting in B2B Markets: Introduction
- Lecture 33 - Demand Forecasting in B2B Markets: Qualitative Methods
- Lecture 34 - Demand Forecasting in B2B Markets: Quantitative Methods - 1
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- Lecture 36 - B2B Product Management: New Product Development
- Lecture 37 - B2B Product Management: Identifying New Products
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- Lecture 41 - B2B Pricing: Price Setting Process - 1
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- Lecture 43 - B2B Pricing: Pricing Methods
- Lecture 44 - B2B Pricing: Geographical and Value Based Pricing
- Lecture 45 - B2B Pricing: Competitive Bidding
- Lecture 46 - Introduction to Relationship Management in B2B Markets
- Lecture 47 - Types of Relationships in B2B Markets and Customer Profitability
- Lecture 48 - Customer Relationship Management
- Lecture 49 - Customer Lifetime Value
- Lecture 50 - B2B Marketing Research: Introduction
- Lecture 51 - B2B Marketing Research: Research Methods
- Lecture 52 - Business Marketing Channels: Introduction and its Types
- Lecture 53 - Business Marketing Channels: Types of Participants
- Lecture 54 - Business Marketing Channels: E-Commerce
- Lecture 55 - Supply Chain Management and its Drivers
- Lecture 56 - Approaches to SCM and Logistics Management
- Lecture 57 - Strategic Business Units (SBU) and BCG Matrix
- Lecture 58 - GE Matrix and McKinsey 7S Framework
- Lecture 59 - Marketing Techniques Implementation and Control
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- Lecture 2 - Evolution of Organization Theory and Design
- Lecture 3 - Approaches to Design Based on Different Models
- Lecture 4 - Role of Strategy in Organization Design
- Lecture 5 - A Framework for Selecting Strategy and Design
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- Lecture 26 - Designing Organizations for Competitive Success
- Lecture 27 - Understanding and Developing Organization culture
- Lecture 28 - Managing Culture by Design
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- Lecture 31 - Organizational Design Challenges

- Lecture 32 - Interdepartmental Conflict in Organization
- Lecture 33 - Power and Organization
- Lecture 34 - Political Processes in an organization
- Lecture 35 - Communications Structure of Organization
- Lecture 36 - Leadership in Organization Design
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- Lecture 41 - Innovation Management and its Principles
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- Lecture 52 - Designing Structure to Fit Global Strategy
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- Lecture 57 - Organization Building in Context of Employee Engagement
- Lecture 58 - The Experience-Centric Organization
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- Lecture 6 - Project Manager
- Lecture 7 - Attributes of Effective Project Manager
- Lecture 8 - Managing for Stakeholders
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- Lecture 11 - Project in the Organization structure
- Lecture 12 - Human factors and the Project Team
- Lecture 13 - Traditional Project Activity Planning
- Lecture 14 - Agile Project Planning, Project Charter
- Lecture 15 - Coordination through Integration Management
- Lecture 16 - Project Feasibility Analysis
- Lecture 17 - Estimating Project Budgets
- Lecture 18 - Project Risk Management
- Lecture 19 - Quantitative Risk Assessment Methodologies
- Lecture 20 - Critical Path Method (CPM)
- Lecture 21 - Programme Evaluation And Review Technique PERT
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- Lecture 23 - Gantt Chart and Scheduling with scrum
- Lecture 24 - Crashing a project
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- Lecture 26 - Resource Levelling
- Lecture 27 - Goldratt's critical chain
- Lecture 28 - Planning monitoring controlling cycle
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- Lecture 4 - Introduction to AI Algorithms
- Lecture 5 - Designs of AI, Transition process and AI matrix
- Lecture 6 - Customer value and Role of AI in Value Delivery Process
- Lecture 7 - Transforming Marketing Strategy using AI - I
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- Lecture 12 - Using AI for STP
- Lecture 13 - Application of AI in Marketing Mix - I
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- Lecture 15 - Marketing Information Systems and its Components
- Lecture 16 - What is Marketing Research - I
- Lecture 17 - What is Marketing Research - II
- Lecture 18 - Individual Dynamics and its influence on Consumer Behaviour
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- Lecture 20 - Understanding Customer Journey - I
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- Lecture 22 - Customer Experience: Meaning and Characteristics
- Lecture 23 - Personalization: Going Beyond Segmentation - I
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- Lecture 25 - Avatar marketing
- Lecture 26 - Standardization, Personalization and Relationalization of Brands using AI
- Lecture 27 - Understanding Networks and Brand Network Effect
- Lecture 28 - Understanding the Use of AI for Addressing Competition
- Lecture 29 - AI and Brand Equity
- Lecture 30 - AI and New Brand Realities - I
- Lecture 31 - AI and New Brand Realities - II

- Lecture 32 - AI for Value Creation and Product Development
- Lecture 33 - Personalization and hyper-personalization Using AI - I
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- Lecture 35 - Personalization and hyper-personalization Using AI - III
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- Lecture 38 - Implementation of AI by Product Managers
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- Lecture 40 - Pricing Strategies Using AI - I
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- Lecture 44 - Role of AI in Advertising - I
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- Lecture 46 - AI in Sales promotion and Direct Marketing
- Lecture 47 - AI in PR and Publicity and Social Media Marketing - I
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- Lecture 49 - Personal Selling using AI
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- Lecture 52 - Omnichannel Marketing and Retailing
- Lecture 53 - Changing face of Retailing in the age of AI
- Lecture 54 - AI in Logistics Management - I
- Lecture 55 - AI in Logistics Management - II
- Lecture 56 - Navigating Ethical Challenges in AI - I
- Lecture 57 - Navigating Ethical Challenges in AI - II
- Lecture 58 - Navigating Ethical Challenges in AI - III
- Lecture 59 - Navigating Ethical Challenges in AI - IV
- Lecture 60 - AI and Sustainability

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Lecture 3 - Innovations in Marketing and Marketing of Innovations

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Lecture 8 - Change in Consumer Behaviour - 2

Lecture 9 - Innovative Perspectives about 4Pâ€™s for Innovation

Lecture 10 - Innovator's Dilemma

Lecture 11 - Go-To-Market Strategy

Lecture 12 - Targeting - Evolutionary Perspective

Lecture 13 - Innovations in Targeting and Positioning

Lecture 14 - Changing Concepts in Marketing of Products and Services

Lecture 15 - Changing Concepts of Marketing and Innovations in Service Marketing

Lecture 16 - Countering Commoditization: An Innovative Perspective

Lecture 17 - Innovations and Branding

Lecture 18 - Innovation in Pricing and Factors Affecting Pricing Innovations

Lecture 19 - Innovation in Pricing

Lecture 20 - Innovation in Pricing Strategies - 1

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Lecture 23 - Innovation in Channel Management

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Lecture 31 - Innovative Marketing Communications: Sales Promotion and Public Relations

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

[Lecture 32 - Innovative Marketing Communications: Advertising - Print, Radio and Television](#)

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- Lecture 2 - Services in Modern Economy
- Lecture 3 - Trends and Challenges in Services Marketing
- Lecture 4 - Service Marketing Mix and Value Creation
- Lecture 5 - Services Ecosystem and Stakeholder Analysis
- Lecture 6 - Customer Journey Mapping and Touchpoint Analysis
- Lecture 7 - Designing memorable customer experiences
- Lecture 8 - Personalization and Customization in Services
- Lecture 9 - Emotional and Sensory marketing in Services
- Lecture 10 - Technology-enabled customer experiences
- Lecture 11 - Service Design Thinking and Design-driven Innovation
- Lecture 12 - Open Innovation and Collaboration in Services
- Lecture 13 - Crowdsourcing and customer involvement in service development
- Lecture 14 - Managing Service Failures and Service Recovery Strategies
- Lecture 15 - Leveraging Customer Feedback for Continuous Improvement
- Lecture 16 - Digitalization of Services and Digital Service Platforms
- Lecture 17 - Online Customer Engagement and Social Media Marketing
- Lecture 18 - Mobile Marketing and Location-based Services
- Lecture 19 - Artificial Intelligence and Chatbot Integration in Services
- Lecture 20 - Blockchain and its application in service industries
- Lecture 21 - Data-driven Decision-making in Services Marketing
- Lecture 22 - Customer Analytics and Segmentation Strategies
- Lecture 23 - Predictive Analytics for Personalized Marketing
- Lecture 24 - Sentiment Analysis and Social Listening in Services
- Lecture 25 - Ethical Considerations in Handling Customer Data
- Lecture 26 - Building a Strong Service Brand Identity
- Lecture 27 - Brand Positioning and Differentiation Strategies
- Lecture 28 - Online Brand Management and Reputation Monitoring
- Lecture 29 - Managing Brand Extensions and Brand Partnerships
- Lecture 30 - Internal Branding and Aligning Employees with the Brand
- Lecture 31 - Measuring and Improving Service Quality

- Lecture 32 - SERVQUAL and Other Service Quality Measurement Tools
- Lecture 33 - Service Guarantees and Service-level Agreements
- Lecture 34 - Service Recovery Strategies and Complaint Handling
- Lecture 35 - Cultivating a Culture of Service Excellence
- Lecture 36 - Pricing Strategies for Services and Value-based Pricing
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- Lecture 43 - Global Branding and Localization Strategies
- Lecture 44 - Managing Diversity and Inclusivity in Service Delivery
- Lecture 45 - Cross-cultural Communication and Customer Relationship Management
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- Lecture 47 - Environmental consciousness and green marketing
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- Lecture 50 - Consumer attitudes towards sustainable services
- Lecture 51 - Developing service leadership skills
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- Lecture 53 - Service culture and service-oriented organizational behaviour
- Lecture 54 - Training and development for service excellence
- Lecture 55 - Managing service teams and fostering collaboration
- Lecture 56 - Innovations in Service Delivery and Technology
- Lecture 57 - Augmented Reality and Virtual Reality in Services
- Lecture 58 - Internet of Things (IoT) in Service Ecosystem
- Lecture 59 - Servitization and Product-Service Systems
- Lecture 60 - Future Prospects and Challenges in Services Marketing

NPTEL : Strategic Management (Management)

Co-ordinators : Prof. R. Srinivasan

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Lecture 5 - The 7-S Framework

Lecture 6 - Corporate Policy and Planning in India

Lecture 7 - Board of Directors - Role and Functions

Lecture 8 - Board of Directors - Role and Functions, Top Management - Role and Skills, Board Functioning - Indian Context

Lecture 9 - Board Functioning - Indian Context and Environmental Scanning

Lecture 10 - Environmental Scanning and Industry Analysis

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NPTEL : Global Supply Chain Management (Management)

Co-ordinators : Prof. N. Viswanadham

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Lecture 3 - Zara - fast fashion

Lecture 4 - The Supply Chain Eco-System Framework

Lecture 5 - Supply Chain Eco-System Framework: Supply Chains & Resources

Lecture 6 - Supply Chain Eco-System Framework: Delivery services & Institutions

Lecture 7 - Metro Cash and Carry

Lecture 8 - Performance Analysis

Lecture 9 - Supply Chain Risk - Part-1

Lecture 10 - Supply Chain Risk - Part-2

Lecture 11 - Supply Chain Risk - Part-3

Lecture 12 - Mattel Toy Recalls and Supply Chain Management

Lecture 13 - Innovation in Emerging markets

Lecture 14 - Innovations in Supply Chain Ecosystem

Lecture 15 - Indian Telecom and Bharti Airtel

Lecture 16 - CEMEX - Part-1

Lecture 17 - CEMEX - Part-2

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Lecture 19 - Governance of networked organizations

Lecture 20 - The Orchestration Governance Model

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Lecture 24 - Supply Chain Design - Part-1

Lecture 25 - Supply Chain Design - Part-2

Lecture 26 - Green supply chain design - Part-1

Lecture 27 - Green supply chain design - Part-2

Lecture 28 - Green Supply Chain Ecosystem Analysis

Lecture 29 - GRIP Framework

Lecture 30 - Location Selection

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[Lecture 32 - Food supply chain in India](#)

[Lecture 33 - Food supply chain ecosystem - Grip frame work](#)

[Lecture 34 - Food Security in India](#)

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Lecture 8 - Marketing System

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Lecture 10 - Competition

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- Lecture 2 - Purpose, Mission, Goals
- Lecture 3 - Different types of Strategies
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- Lecture 5 - Strategic Management Process (SMP)
- Lecture 6 - Modes of Strategic decisions
- Lecture 7 - 7-S Frame work
- Lecture 8 - Director, powers
- Lecture 9 - Functions of BoD
- Lecture 10 - Responsibilities of Business
- Lecture 11 - Taxonomy of Company Environment
- Lecture 12 - Competitive Landscape
- Lecture 13 - Global Uncertainty Internal Corporate Analysis
- Lecture 14 - Industry structure, Competitor Analysis
- Lecture 15 - Firm's value chain
- Lecture 16 - Key factors of Success, Porter's Industry Competition Model
- Lecture 17 - S and W Profile Analysis
- Lecture 18 - Competitive Advantage(CA), IFAS,SFAS
- Lecture 19 - Case Analysis
- Lecture 20 - Case Analysis (Continued...)
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- Lecture 23 - Business Strategy
- Lecture 24 - BEA, Doom Loops, Corporate Strategy, Portfolio Analysis
- Lecture 25 - Corporate Strategy, Display Matrices
- Lecture 26 - Display Matrices
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Lecture 5 - Set function

Lecture 6 - The Length function and its properties

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Lecture 8 - Uniqueness Problem for Measure

Lecture 9 - Extension of measure

Lecture 10 - Outer measure and its properties

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Lecture 19 - Monotone convergence theorem & Fatou's Lemma

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NPTEL : Convex Optimization (Mathematics)

Co-ordinators : Dr. Joydeep Dutta

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NPTEL : Foundations of Optimization (Mathematics)

Co-ordinators : Dr. Joydeep Dutta

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- Lecture 52 - Variable Selection using LASSO Regression : Introduction and Basic Concepts
- Lecture 53 - Variable Selection using LASSO Regression : LASSO with R

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- Lecture 14 - Properties and Zeroth Order Characterization of Convex Function
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NPTEL : Probability and Statistics (Mathematics)

Co-ordinators : Prof. Somesh Kumar

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- Lecture 25 - Composition of Fuzzy Relations
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- Lecture 29 - Fuzzy Propositions: Some Interpretations
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Lecture 2 - Types of studies

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Lecture 1 - Introduction to the theory of sets

Lecture 2 - Set operation and laws of set operation

Lecture 3 - The principle of inclusion and exclusion

Lecture 4 - Application of the principle of inclusion and exclusion

Lecture 5 - Fundamentals of logic

Lecture 6 - Logical Inferences

Lecture 7 - Methods of proof of an implication

Lecture 8 - First order logic (1)

Lecture 9 - First order logic (2)

Lecture 10 - Rules of inference for quantified propositions

Lecture 11 - Mathematical Induction (1)

Lecture 12 - Mathematical Induction (2)

Lecture 13 - Sample space, events

Lecture 14 - Probability, conditional probability

Lecture 15 - Independent events, Bayes theorem

Lecture 16 - Information and mutual information

Lecture 17 - Basic definition

Lecture 18 - Isomorphism and sub graphs

Lecture 19 - Walks, paths and circuits operations on graphs

Lecture 20 - Euler graphs, Hamiltonian circuits

Lecture 21 - Shortest path problem

Lecture 22 - Planar graphs

Lecture 23 - Basic definition

Lecture 24 - Properties of relations

Lecture 25 - Graph of relations

Lecture 26 - Matrix of relation

Lecture 27 - Closure of relation (1)

Lecture 28 - Closure of relation (2)

Lecture 29 - Warshall's algorithm

Lecture 30 - Partially ordered relation

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[Lecture 34 - Boolean function \(1\)](#)

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[Lecture 38 - Introduction to recurrence relations](#)

[Lecture 39 - Second order recurrence relation with constant coefficients \(1\)](#)

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Lecture 1 - Introduction to linear differential equations

Lecture 2 - Linear dependence, independence and Wronskian of functions

Lecture 3 - Solution of second-order homogenous linear differential equations with constant coefficients - I

Lecture 4 - Solution of second-order homogenous linear differential equations with constant coefficients - II

Lecture 5 - Method of undetermined coefficients

Lecture 6 - Methods for finding Particular Integral for second-order linear differential equations with constant coefficients - I

Lecture 7 - Methods for finding Particular Integral for second-order linear differential equations with constant coefficients - II

Lecture 8 - Methods for finding Particular Integral for second-order linear differential equations with constant coefficients - III

Lecture 9 - Euler-Cauchy equations

Lecture 10 - Method of reduction for second-order linear differential equations

Lecture 11 - Method of variation of parameters

Lecture 12 - Solution of second order differential equations by changing dependent variable

Lecture 13 - Solution of second order differential equations by changing independent variable

Lecture 14 - Solution of higher-order homogenous linear differential equations with constant coefficients

Lecture 15 - Methods for finding Particular Integral for higher-order linear differential equations

Lecture 16 - Formulation of Partial differential equations

Lecture 17 - Solution of Lagrange's equation - I

Lecture 18 - Solution of Lagrange's equation - II

Lecture 19 - Solution of first order nonlinear equations - I

Lecture 20 - Solution of first order nonlinear equations - II

Lecture 21 - Solution of first order nonlinear equations - III

Lecture 22 - Solution of first order nonlinear equations - IV

Lecture 23 - Introduction to Laplace transforms

Lecture 24 - Laplace transforms of some standard functions

Lecture 25 - Existence theorem for Laplace transforms

Lecture 26 - Properties of Laplace transforms - I

Lecture 27 - Properties of Laplace transforms - II

Lecture 28 - Properties of Laplace transforms - III

Lecture 29 - Properties of Laplace transforms - IV

Lecture 30 - Convolution theorem for Laplace transforms - I

Lecture 31 - Convolution theorem for Laplace transforms - II

- Lecture 32 - Initial and final value theorems for Laplace transforms
- Lecture 33 - Laplace transforms of periodic functions
- Lecture 34 - Laplace transforms of Heaviside unit step function
- Lecture 35 - Laplace transforms of Dirac delta function
- Lecture 36 - Applications of Laplace transforms - I
- Lecture 37 - Applications of Laplace transforms - II
- Lecture 38 - Applications of Laplace transforms - III
- Lecture 39 - Z-transform and inverse Z-transform of elementary functions
- Lecture 40 - Properties of Z-transforms - I
- Lecture 41 - Properties of Z-transforms - II
- Lecture 42 - Initial and final value theorem for Z-transforms
- Lecture 43 - Convolution theorem for Z-transforms
- Lecture 44 - Applications of Z-transforms - I
- Lecture 45 - Applications of Z-transforms - II
- Lecture 46 - Applications of Z-transforms - III
- Lecture 47 - Fourier series and its convergence - I
- Lecture 48 - Fourier series and its convergence - II
- Lecture 49 - Fourier series of even and odd functions
- Lecture 50 - Fourier half-range series
- Lecture 51 - Parseval's Identity
- Lecture 52 - Complex form of Fourier series
- Lecture 53 - Fourier integrals
- Lecture 54 - Fourier sine and cosine integrals
- Lecture 55 - Fourier transforms
- Lecture 56 - Fourier sine and cosine transforms
- Lecture 57 - Convolution theorem for Fourier transforms
- Lecture 58 - Applications of Fourier transforms to BVP - I
- Lecture 59 - Applications of Fourier transforms to BVP - II
- Lecture 60 - Applications of Fourier transforms to BVP - III

Lecture 1 - Definition and classification of linear integral equations

Lecture 2 - Conversion of IVP into integral equations

Lecture 3 - Conversion of BVP into an integral equations

Lecture 4 - Conversion of integral equations into differential equations

Lecture 5 - Integro-differential equations

Lecture 6 - Fredholm integral equation with separable kernel: Theory

Lecture 7 - Fredholm integral equation with separable kernel: Examples

Lecture 8 - Solution of integral equations by successive substitutions

Lecture 9 - Solution of integral equations by successive approximations

Lecture 10 - Solution of integral equations by successive approximations: Resolvent kernel

Lecture 11 - Fredholm integral equations with symmetric kernels: Properties of eigenvalues and eigenfunctions

Lecture 12 - Fredholm integral equations with symmetric kernels: Hilbert Schmidt theory

Lecture 13 - Fredholm integral equations with symmetric kernels: Examples

Lecture 14 - Construction of Green function - I

Lecture 15 - Construction of Green function - II

Lecture 16 - Green function for self adjoint linear differential equations

Lecture 17 - Green function for non-homogeneous boundary value problem

Lecture 18 - Fredholm alternative theorem - I

Lecture 19 - Fredholm alternative theorem - II

Lecture 20 - Fredholm method of solutions

Lecture 21 - Classical Fredholm theory: Fredholm first theorem - I

Lecture 22 - Classical Fredholm theory: Fredholm first theorem - II

Lecture 23 - Classical Fredholm theory: Fredholm second theorem and third theorem

Lecture 24 - Method of successive approximations

Lecture 25 - Neumann series and resolvent kernels - I

Lecture 26 - Neumann series and resolvent kernels - II

Lecture 27 - Equations with convolution type kernels - I

Lecture 28 - Equations with convolution type kernels - II

Lecture 29 - Singular integral equations - I

Lecture 30 - Singular integral equations - II

Lecture 31 - Cauchy type integral equations - I

- Lecture 32 - Cauchy type integral equations - II
- Lecture 33 - Cauchy type integral equations - III
- Lecture 34 - Cauchy type integral equations - IV
- Lecture 35 - Cauchy type integral equations - V
- Lecture 36 - Solution of integral equations using Fourier transform
- Lecture 37 - Solution of integral equations using Hilbert transform - I
- Lecture 38 - Solution of integral equations using Hilbert transform - II
- Lecture 39 - Calculus of variations: Introduction
- Lecture 40 - Calculus of variations: Basic concepts - I
- Lecture 41 - Calculus of variations: Basic concepts - II
- Lecture 42 - Calculus of variations: Basic concepts and Euler equation
- Lecture 43 - Euler equation: Some particular cases
- Lecture 44 - Euler equation : A particular case and Geodesics
- Lecture 45 - Brachistochrone problem and Euler equation - I
- Lecture 46 - Euler's equation - II
- Lecture 47 - Functions of several independent variables
- Lecture 48 - Variational problems in parametric form
- Lecture 49 - Variational problems of general type
- Lecture 50 - Variational derivative and invariance of Euler's equation
- Lecture 51 - Invariance of Euler's equation and isoperimetric problem - I
- Lecture 52 - Isoperimetric problem - II
- Lecture 53 - Variational problem involving a conditional extremum - I
- Lecture 54 - Variational problem involving a conditional extremum - II
- Lecture 55 - Variational problems with moving boundaries - I
- Lecture 56 - Variational problems with moving boundaries - II
- Lecture 57 - Variational problems with moving boundaries - III
- Lecture 58 - Variational problems with moving boundaries; One sided variation
- Lecture 59 - Variational problem with a movable boundary for a functional dependent on two functions
- Lecture 60 - Hamilton's principle: Variational principle of least action

Lecture 1 - Convex Sets and Functions

Lecture 2 - Properties of Convex Functions - I

Lecture 3 - Properties of Convex Functions - II

Lecture 4 - Properties of Convex Functions- III

Lecture 5 - Convex Programming Problems

Lecture 6 - KKT optimality conditions

Lecture 7 - Quadratic Programming Problems - I

Lecture 8 - Quadratic Programming Problems - II

Lecture 9 - Separable Programming - I

Lecture 10 - Separable Programming - II

Lecture 11 - Geometric Programming - I

Lecture 12 - Geometric Programming - II

Lecture 13 - Geometric Programming - III

Lecture 14 - Dynamic Programming - I

Lecture 15 - Dynamic Programming - II

Lecture 16 - Dynamic programming approach to find shortest path in any network

Lecture 17 - Dynamic Programming - IV

Lecture 18 - Search Techniques - I

Lecture 19 - Search Techniques - II

Lecture 20 - Search Techniques - III

Lecture 1 - Introduction to error analysis and linear systems

Lecture 2 - Gaussian elimination with Partial pivoting

Lecture 3 - LU decomposition

Lecture 4 - Jacobi and Gauss Seidel methods

Lecture 5 - Iterative methods-II

Lecture 6 - Introduction to Non-linear equations and Bisection method

Lecture 7 - Regula Falsi and Secant methods

Lecture 8 - Newton-Raphson method

Lecture 9 - Fixed point iteration method

Lecture 10 - System of Nonlinear equations

Lecture 11 - Introduction to Eigenvalues and Eigenvectors

Lecture 12 - Similarity Transformations and Gershgorin Theorem

Lecture 13 - Jacobi's Method for Computing Eigenvalues

Lecture 14 - Power Method

Lecture 15 - Inverse Power Method

Lecture 16 - Interpolation - Part I (Introduction to Interpolation)

Lecture 17 - Interpolation - Part II (Some basic operators and their properties)

Lecture 18 - Interpolation - Part III (Newton's Forward/ Backward difference and derivation of general error)

Lecture 19 - Interpolation - Part IV (Error in approximating a function by a polynomial using Newton's Forward and Backward difference formula)

Lecture 20 - Interpolation - Part V (Solving problems using Newton's Forward and Backward difference formula)

Lecture 21 - Interpolation - Part VI (Central difference formula)

Lecture 22 - Interpolation - Part VII (Lagrange interpolation formula with examples)

Lecture 23 - Interpolation - Part VIII (Divided difference interpolation with examples)

Lecture 24 - Interpolation - Part IX (Hermite's interpolation with examples)

Lecture 25 - Numerical differentiation - Part I (Introduction to numerical differentiation by interpolation formula)

Lecture 26 - Numerical differentiation - Part II (Numerical differentiation based on Lagrange's interpolation with examples)

Lecture 27 - Numerical differentiation - Part III (Numerical differentiation based on Divided difference formula with examples)

Lecture 28 - Numerical differentiation - Part IV (Maxima and minima of a tabulated function and differentiation errors)

Lecture 29 - Numerical differentiation - Part V (Differentiation based on finite difference operators)

Lecture 30 - Numerical differentiation - Part VI (Method of undetermined coefficients and Derivatives with unequal intervals)

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[Lecture 31 - Numerical Integration - Part I \(Methodology of Numerical Integration and Rectangular rule \)](#)

[Lecture 32 - Numerical Integration - Part II \(Quadrature formula and Trapezoidal rule with associated errors\)merical Integration Part-I \(Methodology of Numerical Integration and Rectangular rule \)](#)

[Lecture 33 - Numerical Integration - Part III \(Simpsons 1/3rd rule with associated errors\)](#)

[Lecture 34 - Numerical Integration - Part IV \(Composite Simpsons 1/3rd rule and Simpsons 3/8th rule with examples\)](#)

[Lecture 35 - Numerical Integration - Part V \(Gauss Legendre 2-point and 3-point formula with examples\)](#)

[Lecture 36 - Introduction to Ordinary Differential equations](#)

[Lecture 37 - Numerical methods for ODE-1](#)

[Lecture 38 - Numerical Methods - II](#)

[Lecture 39 - R-K Methods for solving ODEs](#)

[Lecture 40 - Multi-step Method for solving ODEs](#)

Lecture 1 - Matrix Operations and Types of Matrices

Lecture 2 - Determinant of a Matrix

Lecture 3 - Rank of a Matrix

Lecture 4 - Vector Space - I

Lecture 5 - Vector Space - II

Lecture 6 - Linear dependence and independence

Lecture 7 - Bases and Dimension - I

Lecture 8 - Bases and Dimension - II

Lecture 9 - Linear Transformation - I

Lecture 10 - Linear Transformation - II

Lecture 11 - Orthogonal Subspaces

Lecture 12 - Row Space, Column Space and Null Space

Lecture 13 - Eigen Values and Eigen Vectors - I

Lecture 14 - Eigen Values and Eigen Vectors - II

Lecture 15 - Diagonalizable Matrices

Lecture 16 - Orthogonal Sets

Lecture 17 - Gram Schmidt orthogonalization and orthogonal bases

Lecture 18 - Introduction to Matlab

Lecture 19 - Sign Integer Representation

Lecture 20 - Computer Representation of Numbers

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- Lecture 59 - Parameter Projection in Adaptive Control - Part 3
- Lecture 60 - Sigma- Modification and Epsilon-Modification in Adaptive Control
- Lecture 61 - Initial Excitation in Adaptive Control - Part 1
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Lecture 9 - Stability - Part 2

Lecture 10 - Stability - Part 3

Lecture 11 - Stability - Part 4

Lecture 12 - Stability - Part 5

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Lecture 27 - La Salle's Invariance Principle - Part 5

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[Lecture 51 - Feedback Linearization - Part 3](#)

[Lecture 52 - Feedback Linearization - Part 4](#)

[Lecture 53 - Feedback Linearization - Part 5](#)

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Lecture 3 - Friction

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Lecture 14 - Hydrodynamic Lubrication

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Lecture 21 - Solution of Reynolds Equation

Lecture 22 - Hybrid Solution Approach (to solve Reynolds Equation)

Lecture 23 - Finite Difference Method to Solve Reynolds Equation

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Lecture 27 - Application of Tribology

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Lecture 5 - Polygon Filling

Lecture 6 - Windowing and Clipping

Lecture 7 - Clipping of Polygons

Lecture 8 - 2D Transformations

Lecture 9 - 3D Transformations and Projection

Lecture 10 - Perspective Projections

Lecture 11 - Projections and Hidden Surface Removal

Lecture 12 - Hidden Surface Removal

Lecture 13 - Hidden Surface Removal

Lecture 14 - Hidden Surface Removal

Lecture 15 - Finite Element Method : An Introduction

Lecture 16 - Galerkin's Approach

Lecture 17 - Galerkin's Method : 1D Finite Element Method

Lecture 18 - 1D Finite Element Problems

Lecture 19 - 1D Finite Element Problems

Lecture 20 - FE Problems : Solving for Q

Lecture 21 - 1D - FE Problems : Galerkin's Approach

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Lecture 23 - Quadratic Shape Functions

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Lecture 25 - 2D - FE Problems (Continued.)

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Lecture 27 - 3D - Tetrahedral and 2D - Quadrilateral Element

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[Lecture 50 - Solid Modeling](#)

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[Lecture 52 - Reverse Engineering](#)

NPTEL : Project and Production Management (Mechanical Engineering)

Co-ordinators : Prof. Arun Kanda

Lecture 1 - Project and Production Management - An Overview

Lecture 2 - Project Management: An Overview

Lecture 3 - Project Identification and Screening

Lecture 4 - Project Appraisal - Part I

Lecture 5 - Project Appraisal - Part II

Lecture 6 - Project Selection

Lecture 7 - Project Representation

Lecture 8 - Consistency and Redundancy in Project Networks

Lecture 9 - Basic scheduling with A-O-A Networks

Lecture 10 - Basic Scheduling with A-O-N Networks

Lecture 11 - Project Scheduling with Probabilistic Activity

Lecture 12 - Linear Time-Cost Tradeoffs in Projects

Lecture 13 - Project Crashing with Multiple Objectives

Lecture 14 - Resource Profiles and Leveling

Lecture 15 - Limited Resource Allocation

Lecture 16 - Project Monitoring and Control with PERT/Cost

Lecture 17 - Team Building and Leadership in Projects

Lecture 18 - Organizational and Behavioral Issues

Lecture 19 - Computers in Project Management

Lecture 20 - Project Completion and Review

Lecture 21 - Life Cycle of a Production System

Lecture 22 - Role of Models in Production Management

Lecture 23 - Financial Evaluation of capital Decisions

Lecture 24 - Decision Trees and Risk Evaluation

Lecture 25 - Introducing New Products & Services

Lecture 26 - Economic Evaluation of New Products & Services

Lecture 27 - Product Mix Decisions

Lecture 28 - Product & Process Design

Lecture 29 - Issues in Location of Facilities

Lecture 30 - Mathematical Models for Facility Location

Lecture 31 - Layout planning

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[Lecture 33 - Product Layouts and Assembly Line Balancing](#)

[Lecture 34 - Forecasting](#)

[Lecture 35 - The Analysis of Time Series](#)

[Lecture 36 - Aggregate Production Planning: Basic Concepts](#)

[Lecture 37 - Modelling Approaches](#)

[Lecture 38 - Basic Inventory Principles](#)

[Lecture 39 - Inventory Modelling](#)

[Lecture 40 - Material Requirements Planning](#)

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Lecture 1 - Introduction to Design

Lecture 2 - Design Considerations

Lecture 3 - Basic Concepts Psychrometry and Air-Conditioning

Lecture 4 - Refrigerants

Lecture 5 - Refrigerant Properties and Applications

Lecture 6 - Refrigeration Cycle and Components

Lecture 7 - Compressor Selection

Lecture 8 - Expansion Devices

Lecture 9 - Condensers and Evaporators

Lecture 10 - Types of Heat Exchangers and Air Conditioning Systems

Lecture 11 - Selection of Air Conditioning Systems for Hostels

Lecture 12 - Case Study on a Railway Air Conditioning System

Lecture 13 - Vibration and noise issues in railway AC systems

Lecture 14 - New product launch process

Lecture 15 - Case study on a telecom cooling system and Emerging technologies

Lecture 1 - Thermodynamic Concepts: Applications of thermodynamics

Lecture 2 - Thermodynamic Concepts: System definition, Heat, Work and Mass Flow

Lecture 3 - Thermodynamic Concepts: Questions and Answers

Lecture 4 - Thermodynamic Concepts: Properties, State and Equilibrium

Lecture 5 - Thermodynamic Concepts: Process, Cycles and Applications

Lecture 6 - Thermodynamic Concepts: Steady state, Reversible and Irreversible processes

Lecture 7 - Thermodynamic Concepts: Causes of irreversibility

Lecture 8 - Thermodynamic Concepts: Thermal reservoirs

Lecture 9 - Thermodynamic Concepts: Pressure and temperature

Lecture 10 - Thermodynamic Concepts: Revision and Summary

Lecture 11 - Laws Of Thermodynamics: Mass flow rate, Conservation of mass, Flow work

Lecture 12 - Laws Of Thermodynamics: Zeroth Law

Lecture 13 - Laws Of Thermodynamics: First Laws Of Thermodynamics, 1st law for Control Mass, Internal Energy, enthalpy

Lecture 14 - Laws Of Thermodynamics: 1st law for Control Volume

Lecture 15 - Laws Of Thermodynamics: Revision, Cycles, Second Law statements, Clausius inequality

Lecture 16 - Laws Of Thermodynamics: Introduction to Carnot Cycle

Lecture 17 - Laws Of Thermodynamics: Entropy, Entropy change for a system

Lecture 18 - Laws Of Thermodynamics: Thermodynamics relations, Bernoulli's equation

Lecture 19 - Laws Of Thermodynamics: Devices, Cycles

Lecture 20 - Properties of a Pure Substance: Thermodynamic behaviour of a pure substance

Lecture 21 - Properties of a Pure Substance: Saturated states, Subcooled liquid, Superheated vapour

Lecture 22 - Properties of a Pure Substance: Vapour pressure curve, Reference state

Lecture 23 - Properties of a Pure Substance: Saturated states

Lecture 24 - Properties of a Pure Substance: p-h diagram

Lecture 25 - Properties of a Pure Substance: T-s diagram, h-s diagram

Lecture 26 - Properties of a Pure Substance: Critical state, Compressibility factor

Lecture 27 - Properties of a Pure Substance: Ideal gas behaviour, Equations of state, Specific heat

Lecture 28 - Properties of a Pure Substance: Ideal gas processes

Lecture 29 - Properties of a Pure Substance: Gibbs energy, Helmholtz function, Property relations

Lecture 30 - Properties of a Pure Substance: Process analysis, Summary

Lecture 31 - Laws of Thermodynamics: Carnot Cycle Realization

Lecture 32 - Applications, Problem Solving: Devices, Schematic/Flow Diagrams

Lecture 33 - Applications, Problem Solving: Positive Displacement Devices

Lecture 34 - Applications, Problem Solving: Heat Exchangers

Lecture 35 - Applications, Problem Solving: Compressors, Fans and Blowers, Pumps

Lecture 36 - Applications, Problem Solving: Turbines

Lecture 37 - Applications, Problem Solving: Nozzle, Diffuser, Expansion Valve, Pipe/duct flow

Lecture 38 - Applications, Problem Solving: De-Superheater, Deaerator, Separation

Lecture 39 - Applications, Problem Solving: Unsteady processes, Filling, Evacuation

Lecture 40 - Applications, Problem Solving: Realization of Carnot cycle, Practical cycles, Air-standard cycles

Lecture 41 - Applications, Problem Solving: Materials, Compressible flow

Lecture 42 - Applications, Problem Solving: Otto cycle, Diesel cycle

Lecture 43 - Applications, Problem Solving: Closed system

Lecture 44 - Applications, Problem Solving: Open System

Lecture 45 - Properties of Ideal Gas Mixtures: Introduction to mixtures properties

Lecture 46 - Properties of Ideal Gas Mixtures: Equation of state, Conservation equations

Lecture 47 - Gas-Vapour Mixtures: Psychrometry, Moist air Properties,

Lecture 48 - Gas-Vapour Mixtures: Properties, Conservation of Mass and Energy

Lecture 49 - Gas-Vapour Mixtures: Psychrometric chart, Applications

Lecture 50 - Thermodynamics of Reacting systems: Introduction to reacting systems and combustion

Lecture 51 - Thermodynamics of Reacting systems: Flames, Stoichiometry

Lecture 52 - Thermodynamics of Reacting systems: Analysis of Closed and Open Systems, Enthalpy of Formation

Lecture 53 - Phase and Chemical Equilibrium: Introduction. Chemical equilibrium. Gibbs function

Lecture 54 - Phase and Chemical Equilibrium: Equilibrium constant. Phase equilibrium

- Lecture 1 - Mathematical Concepts: Working with Vectors and Tensors
- Lecture 2 - Traction Vector
- Lecture 3 - Stress Tensor and its Matrix Representation
- Lecture 4 - Transformation of Stress Matrix
- Lecture 5 - Stress Equilibrium Equations : Balance of Linear and Angular Momentum
- Lecture 6 - Balance of Angular Momentum (Continued...)
- Lecture 7 - Principal Planes and Principal stress components
- Lecture 8 - Maximizing the Shear Component of Traction
- Lecture 9 - Mohr's Circle
- Lecture 10 - Mohr's Circle (Continued...), Stress Invariants, Decomposition of the Stress Tensor
- Lecture 11 - Concept of Strain Tensor
- Lecture 12 - Longitudinal and Shear Strains
- Lecture 13 - Local Volumetric Strain and Local Infinitesimal Rotation
- Lecture 14 - Similarity in Properties of Stress and Strain Tensors
- Lecture 15 - Stress-Strain Relation
- Lecture 16 - Stress-Strain Relation for Isotropic Materials
- Lecture 17 - Linear Momentum Balance in Cylindrical Coordinate System
- Lecture 18 - Linear Momentum Balance in Cylindrical Coordinate System (Continued...)
- Lecture 19 - Strain Matrix Cylindrical Coordinate System
- Lecture 20 - Extension-Torsion-Inflation in a Hollow Cylinder
- Lecture 21 - Extension-Torsion-Inflation in a Hollow Cylinder (Continued...)
- Lecture 22 - Solving Problems Involving Torsion of Shafts
- Lecture 23 - Pure Bending of Rectangular Beams
- Lecture 24 - Bending of Beams (Continued...)
- Lecture 25 - Bending of Unsymmetrical Beams
- Lecture 26 - Concept of Shear Center
- Lecture 27 - Theory of Beams
- Lecture 28 - Theory of Beams (Continued...) and Beam Buckling
- Lecture 29 - Energy Methods
- Lecture 30 - Energy Methods (Continued...)
- Lecture 31 - Theories of Failure

[Lecture 32 - Theories of Failure \(Continued...\)](#)

- Lecture 1 - Course Outline, Introduction
- Lecture 2 - Experimentation Processes and Applications Overview
- Lecture 3 - Developments in Uncertainty Analysis, Approach
- Lecture 4 - Errors, Their Causes and Classification
- Lecture 5 - Errors to Uncertainty via Statistics
- Lecture 6 - Sources of Errors, Uncertainty Definitions
- Lecture 7 - Experimentation - I
- Lecture 8 - Experimentation Stages / Phases I
- Lecture 9 - Experimentation Stages / Phases II
- Lecture 10 - Uncertainty Analysis Processes
- Lecture 11 - Instrument ans DAS
- Lecture 12 - Basic procedure - I
- Lecture 13 - Basic procedure - II
- Lecture 14 - Evaluating systematic uncertainties
- Lecture 15 - Worksheets for uncertainty in a measurement, Examples
- Lecture 16 - Examples of uncertainty in a measurement
- Lecture 17 - Methodologies, Multiple tests method
- Lecture 18 - Single test, Basics of taylor Series Method
- Lecture 19 - Sensitivity coefficient, Result uncertainty from TSM
- Lecture 20 - Result uncertainty TSM: Special cases
- Lecture 21 - Method selection, Worksheets for result uncertainty
- Lecture 22 - Examples for result uncertainty - 1
- Lecture 23 - Examples for result uncertainty - 2
- Lecture 24 - Regression Introduction
- Lecture 25 - Regression analysis - Linear, single variable
- Lecture 26 - Correlation, Related topics
- Lecture 27 - Reporting uncertainties
- Lecture 28 - Validation and verification aspects, Data archiving
- Lecture 29 - Course overview

Lecture 1 - Introduction

Lecture 2 - Examples of visualization - 1

Lecture 3 - Examples of visualization - 2

Lecture 4 - Visualization and drawing

Lecture 5 - Sketch to engineering drawing

Lecture 6 - Types of projections

Lecture 7 - Multiview projections

Lecture 8 - 1st and 3rd angle projections

Lecture 9 - Sketching

Lecture 10 - Visualization

Lecture 11 - Drawing sheet

Lecture 12 - Lines

Lecture 13 - Dimensioning

Lecture 14 - Projection of a point line and plane

Lecture 15 - Projection of simple objects

Lecture 16 - Example Projection of a solid

Lecture 17 - Example Projection of an object

Lecture 18 - Types of Solids

Lecture 19 - Polygons Construction and Projections

Lecture 20 - Rotation of Solids

Lecture 21 - Example Rotation of Solids

Lecture 22 - Section views

Lecture 23 - Sectioning practices

Lecture 24 - Auxiliary views

Lecture 25 - Example Section View

Lecture 26 - Example Auxiliary View

Lecture 27 - Pictorial Drawings

Lecture 28 - Construction of Isometric Drawings

Lecture 29 - Example Isometric drawings

Lecture 30 - Working Drawing

Lecture 31 - Example Sectional View of Assembly

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[Lecture 33 - Autodesk Inventor Environment](#)

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[Lecture 36 - Example 2 Rib Mirror](#)

[Lecture 37 - Example 3](#)

[Lecture 38 - Revolve Loft Pattern](#)

[Lecture 39 - Example 4](#)

[Lecture 40 - Example 5](#)

[Lecture 41 - Spline Sweep Shell](#)

[Lecture 42 - Example 6](#)

[Lecture 43 - Example 7](#)

[Lecture 44 - Drawing from Solid Model](#)

[Lecture 45 - Assembly with constraints](#)

[Lecture 46 - Example 8](#)

[Lecture 47 - Example 9](#)

[Lecture 48 - Example 10](#)

[Lecture 49 - Example 11](#)

[Lecture 50 - Civil and architectural drawings](#)

Lecture 1 - Ideal fluids, Velocity potential, Potential flows

Lecture 2 - Stream function, Orthogonality of streamlines and equipotential lines

Lecture 3 - Complex variables, Analyticity, Cauchy - Riemann equations, Complex potential, Complex velocity

Lecture 4 - Elementary flows : Uniform flow, Source and Sink, Free vortex

Lecture 5 - Flow in a bend, Flow around a sharp edge

Lecture 6 - Superposition of source and sink : doublet flow

Lecture 7 - Superposition of uniform flow and doublet

Lecture 8 - Superposition of uniform flow, doublet and free vortex

Lecture 9 - Superposition of source and uniform flow

Lecture 10 - Problem solving session - 1

Lecture 11 - Problem solving session - 2

Lecture 12 - Method of images, Forces on a body, Blasius theorem

Lecture 13 - Calculation of forces using derived flow field

Lecture 14 - Introduction to conformal transformation

Lecture 15 - Singularities and their transformations

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- Lecture 1 - Introduction to polymers
- Lecture 2 - Polymer structure
- Lecture 3 - Polymer classification
- Lecture 4 - Polymer length, packing and tacticity
- Lecture 5 - Glass transition temperature
- Lecture 6 - Temperature effects, glassy regime
- Lecture 7 - Viscoelastic, rubbery, viscous, decomposition
- Lecture 8 - Relaxation and creep tests
- Lecture 9 - Failure of polymers
- Lecture 10 - Heaviside, Dirac delta, Laplace
- Lecture 11 - Introduction to linear viscoelasticity
- Lecture 12 - Phenomenological models for linear viscoelasticity
- Lecture 13 - Maxwell model
- Lecture 14 - Kelvin model
- Lecture 15 - Three and four parameter models
- Lecture 16 - Generalized Maxwell and Kelvin models
- Lecture 17 - Boltzman superposition principle
- Lecture 18 - Alfrey's correspondence principle
- Lecture 19 - Analysis of viscoelastic bars
- Lecture 20 - Analysis of viscoelastic beams
- Lecture 21 - Dynamic mechanical analysis (DMA)
- Lecture 22 - Dynamic mechanical thermal analysis (DMTA)
- Lecture 23 - Time temperature superposition principle (TTSP)
- Lecture 24 - Plastic design consideration and practices
- Lecture 25 - What are composites?
- Lecture 26 - Composite materials and types
- Lecture 27 - Composite advantages and applications
- Lecture 28 - Fabrication and other aspects of composites
- Lecture 29 - 3D stress and strain components
- Lecture 30 - Symmetry in stress, strain and stiffness matrix
- Lecture 31 - Monoclinic, orthotropic and isotropic materials

- Lecture 32 - 3D stress strain relation for orthotropic material
- Lecture 33 - Plane stress: Specially orthotropic material
- Lecture 34 - Plane stress: Generally orthotropic material
- Lecture 35 - Lamina engineering constants
- Lecture 36 - Lamina hygrothermal effects
- Lecture 37 - Lamina fundamental strengths
- Lecture 38 - Lamina failure criteria
- Lecture 39 - Tsai-Hill and Hoffman failure criteria
- Lecture 40 - Micromechanics: Assumptions, RVE
- Lecture 41 - Micromechanics: Stiffness prediction
- Lecture 42 - Micromechanics: Stiffness and strength
- Lecture 43 - Macromechanics of laminate
- Lecture 44 - Classical laminate theory
- Lecture 45 - Classical laminate theory - II
- Lecture 46 - Symmetric laminates, orthotropic laminates
- Lecture 47 - Angle-ply, cross-ply and quasi-isotropic laminates
- Lecture 48 - Hygrothermal stresses in laminates
- Lecture 49 - Laminate failure
- Lecture 50 - Design practices with laminates
- Lecture 51 - Sandwich structures
- Lecture 52 - Composites testing
- Lecture 53 - Joining of composites

- Lecture 1 - Introduction to Tribology
- Lecture 2 - Tribological Interfaces
- Lecture 3 - Fundamentals of Friction and Wear
- Lecture 4 - Adhesion, Abrasion, and Surface Fatigue Mechanisms
- Lecture 5 - Wear Measurement Techniques
- Lecture 6 - Principles of Lubrication, types of Lubricants and their properties
- Lecture 7 - Lubrication regimes and film thickness calculations
- Lecture 8 - Mixed Lubrication
- Lecture 9 - Hydrodynamic Lubrication Theory
- Lecture 10 - Design Considerations for Hydrodynamic Lubrication Systems
- Lecture 11 - Elastohydrodynamic Lubrication
- Lecture 12 - Solid Lubrication
- Lecture 13 - Surface modification techniques for tribological applications
- Lecture 14 - Thin film coatings and their tribological properties
- Lecture 15 - Nanotribology
- Lecture 16 - Tribocorrosion
- Lecture 17 - Wear testing techniques and standards
- Lecture 18 - Measurement and analysis of wear debris
- Lecture 19 - Experimental Design and Statistical Analysis
- Lecture 20 - Introduction to Data-Enabled Engineering
- Lecture 21 - Data Collection and Preprocessing
- Lecture 22 - Feature Extraction and Selection
- Lecture 23 - Introduction to Machine Learning Algorithms
- Lecture 24 - Regression and Classification Algorithms for Tribological Modeling
- Lecture 25 - Deep Learning for Tribological Engineering
- Lecture 26 - Data-Driven Models for Friction Prediction
- Lecture 27 - Data-Driven Models for Wear Prediction
- Lecture 28 - Data-Driven Models for Lubricant Optimization
- Lecture 29 - Data-Driven Models for Tribofilm Formation
- Lecture 30 - Data-Driven Models for Tribocorrosion Prediction
- Lecture 31 - Prediction of Coating and Surface Treatment Performance

[Lecture 32 - Optimization of Surface Engineering Processes using Machine Learning](#)

[Lecture 33 - Uncertainty Quantification and Sensitivity Analysis](#)

[Lecture 34 - Data Management and Ethics in Data-Enabled Engineering](#)

[Lecture 35 - Case Studies in Data-Enabled Tribological Engineering](#)

[Lecture 36 - Future Directions in Data-Enabled Tribological Engineering](#)

Lecture 1 - Introduction of Nonlinear systems

Lecture 2 - Review of Linear vibrating systems

Lecture 3 - Phenomena associated with Nonlinear systems

Lecture 4 - Commonly observed Phenomena in Nonlinear systems

Lecture 5 - Force and Moment based Approach

Lecture 6 - Energy based approach Extended Hamilton's principle and Lagrange Principle

Lecture 7 - Derivation of Equation of motion of nonlinear discrete system (More examples)

Lecture 8 - Derivation of Equation of motion of nonlinear continuous system - 1

Lecture 9 - Derivation of Equation of motion of nonlinear continuous system - 2

Lecture 10 - Ordering of nonlinear Equation of motion

Lecture 11 - Qualitative Analysis Straight forward expansion

Lecture 12 - Numerical method Straight forward expansion

Lecture 13 - Lindstedt Poincaré technique

Lecture 14 - Method of multiple scales

Lecture 15 - Method of Harmonic balance

Lecture 16 - Method of averaging

Lecture 17 - Generalized Method of averaging

Lecture 18 - Krylov-Bogoliubov-Mitropolski technique

Lecture 19 - Incremental harmonic balance method and Intrinsic multiple scale harmonic balance method

Lecture 20 - Modified Lindstedt Poincaré technique

Lecture 21 - Stability and Bifurcation of Fixed-point response - 1

Lecture 22 - Stability and Bifurcation of Fixed-point response - 2

Lecture 23 - Stability and Bifurcation of Fixed-point response - 3

Lecture 24 - Stability and Bifurcation of Fixed-point response - 4

Lecture 25 - Stability Analysis of Periodic response

Lecture 26 - Bifurcation of Periodic response And Introduction to quasi-periodic and Chaotic response

Lecture 27 - Quasi-Periodic and Chaotic response

Lecture 28 - Numerical methods to obtain roots of characteristic equation and time response

Lecture 29 - Numerical methods to obtain time response

Lecture 30 - Numerical methods to obtain frequency response

Lecture 31 - Free Vibration of Single degree of freedom Nonlinear systems with Cubic and quadratic nonlinearities

[Lecture 32 - Free Vibration of Single degree of freedom Nonlinear systems with Cubic and quadratic nonlinearities: effect of damping](#)

[Lecture 33 - Free Vibration of multi- degree of freedom Nonlinear systems with Cubic and quadratic nonlinearities](#)

[Lecture 34 - Forced nonlinear Vibration Single degree of freedom Nonlinear systems with Cubic nonlinearities:](#)

[Lecture 35 - Forced nonlinear Vibration Single and multi- degree of freedom Nonlinear systems](#)

[Lecture 36 - Nonlinear Forced-Vibration of Single and Multi Degree-of-Freedom System](#)

[Lecture 37 - Analysis of Multi- degree of freedom system](#)

[Lecture 38 - Nonlinear Vibration of Parametrically excited system: Axially loaded sandwich beam](#)

[Lecture 39 - Nonlinear Vibration of Parametrically excited system: Elastic and Magneto-elastic beam](#)

[Lecture 40 - Nonlinear Vibration of Parametrically excited system with internal resonance](#)

Lecture 1 - Introduction

Lecture 2 - A Brief History of Rotor Dynamics

Lecture 3 - The State of the Art of Rotor Dynamics

Lecture 4 - Simple Rotor Models with Rigid Bearings

Lecture 5 - Jeffcott Rotor Model

Lecture 6 - Variant of Jeffcott Rotor Model

Lecture 7 - Rigid Rotor Mounted on Simple Anisotropic Springs as Bearings

Lecture 8 - Rigid Rotor Mounted on Complex Anisotropic Bearings

Lecture 9 - Flexible Shaft with a Rigid Disc Mounted on Anisotropic Supports

Lecture 10 - Gyroscopic Effects : Synchronous whirl of a Rotor Systems with a thin Disc

Lecture 11 - Gyroscopic Effects : Synchronous and Asynchronous pure wobbling motions

Lecture 12 - Gyroscopic Effects : Asynchronous whirl of a Rotor system with a thin Disc

Lecture 13 - Gyroscopic Effects : Asynchronous whirl analysis with Dynamic Approach

Lecture 14 - Torsional Vibrations: Simple Rotor Systems

Lecture 15 - Three Disc Rotor System

Lecture 16 - Transfer Matrix Approach - Part I

Lecture 17 - Transfer Matrix Approach - Part II

Lecture 18 - Transfer Matrix Approach - Part III

Lecture 19 - Geared and Branched Systems

Lecture 20 - Continuous System and Finite Element Method

Lecture 21 - Finite Element Method

Lecture 22 - Finite Element Analysis

Lecture 23 - Finite Element Analysis - Part III

Lecture 24 - Influence Coefficient Method

Lecture 25 - Transfer Matrix Method - Part I

Lecture 26 - Transfer Matrix Method - Part II

Lecture 27 - Transfer Matrix Method - Part III

Lecture 28 - Continuous System Approach

Lecture 29 - Finite Element Method - Part I

Lecture 30 - Finite Element Method - Part II

Lecture 31 - Finite Element Method - Part III

[Lecture 32 - Instability in Rotor Systems: Bearings](#)

[Lecture 33 - Fluid-Film Bearings](#)

[Lecture 34 - Internal Damping & Asymmetrical Shaft](#)

[Lecture 35 - Steam Whirl and Seals](#)

[Lecture 36 - Subcritical Speed Whirl](#)

[Lecture 37 - Introduction to Rigid Rotor Balancing](#)

[Lecture 38 - Dynamic Balancing of Rotors: Rigid Rotor Balancing](#)

[Lecture 39 - Dynamic Balancing of Rotors:Flexible Rotor Model Balancing](#)

[Lecture 40 - Dynamic Balancing of Rotors:Influence Coefficient Method for Flexible Rotor](#)

[Lecture 41 - Common Faults & Vibration signatures](#)

[Lecture 42 - Condition Based Monitoring](#)

Lecture 1 - Fundamentals Of Engineering Mechanics

Lecture 2 - Equations of Equilibrium

Lecture 3 - Truss Analysis - Part 1

Lecture 4 - Truss Analysis - Part 2

Lecture 5 - Analysis of Frames Machines

Lecture 6 - Internal Forces

Lecture 7 - Internal Forces in Beams

Lecture 8 - Cables

Lecture 9 - Friction

Lecture 10 - Application of Friction - Part 1

Lecture 11 - Application of Friction - Part 2

Lecture 12 - Application of Friction - Part 3

Lecture 13 - Centroids Center of Mass

Lecture 14 - Centroids Area of Moments

Lecture 15 - Product of Inertia, Rotation of Axis and Principle Moments of Inertia

Lecture 16 - Principle Mass Moments of Inertia

Lecture 17 - Second Moment of Mass

Lecture 18 - Virtual Work of Ideal System

Lecture 19 - Principle of Virtual Work

Lecture 20 - Systems with Friction

Lecture 21 - Potential Energy

Lecture 22 - Stability of Equilibrium

Lecture 23 - Kinematics of a Particles

Lecture 24 - Kinematics of a Particle Moving on a Curve

Lecture 25 - Relative Motion

Lecture 26 - Plane Kinematics of Rigid Bodies

Lecture 27 - Kinematics of a Particle

Lecture 28 - Work and Energy

Lecture 29 - Impulse and Momentum

Lecture 30 - Direct and Oblique Impulse

Lecture 31 - Plane Kinetics of Rigid Bodies

[Lecture 32 - Kinetics of a Body](#)

[Lecture 33 - Method of Momentum and Analysis of Robot Manipulator](#)

[Lecture 34 - Kinematics in 3D](#)

[Lecture 35 - Kinetics in 3D](#)

[Lecture 36 - Free Vibration](#)

[Lecture 37 - Forced Vibration Damped Undamped](#)

[Lecture 38 - Vibration of Rigid Bodies - Part 1](#)

[Lecture 39 - Vibration of Rigid Bodies - Part 2](#)

[Lecture 40 - Some Problems of Vibration](#)

NPTEL : Mechanical Vibrations (Mechanical Engineering)

Co-ordinators : Prof. S.K. Dwivedy, Prof. Rajiv Tiwari

- Lecture 1 - Overview of the Course, Practical and Research Trends
- Lecture 2 - Harmonic and Periodic Motions, Vibration Terminology
- Lecture 3 - Vibration Model, Equation of Motion-Natural Frequency
- Lecture 4 - Energy Method, Principle of Virtual Work
- Lecture 5 - Viscously Damped Free Vibration Special Cases: Oscillatory
- Lecture 6 - Logarithmic Decrement Experimental Determination of Damping Coefficient Hysteresis Loop
- Lecture 7 - Coulomb Damping other Damping Models
- Lecture 8 - Forced Harmonic Vibration, Magnification Factor
- Lecture 9 - Laplace Transform, Superposition Theorem
- Lecture 10 - Rotor Unbalance and Whirling of Shaft, Transmissibility
- Lecture 11 - Support Motion, Vibration Isolation
- Lecture 12 - Sharpness of Resonance, Vibration Measuring Instruments
- Lecture 13 - Generalized and Principle Coordinates, Derivation of Equation of Motion
- Lecture 14 - Lagranges's Equation
- Lecture 15 - Coordinate Coupling
- Lecture 16 - Forced Harmonic Vibration
- Lecture 17 - Tuned Absorber, Determination of Mass Ratio
- Lecture 18 - Tuned and Damped Absorber, Untuned Viscous Damper
- Lecture 19 - Derivation of Equations of Motion, Influence Coefficient Method
- Lecture 20 - Properties of Vibrating Systems: Flexibility & Stiffness Matrices, Reciprocity Theorem
- Lecture 21 - Modal Analysis: Undamped
- Lecture 22 - Modal Analysis: Damped
- Lecture 23 - Simple Systems With One Two or Three Discs Geared System
- Lecture 24 - Multi-Degree of Freedom Systems-Transfer Matrix Method Branched Systems
- Lecture 25 - Derivation of Equations of Motion Part 1 - Newton
- Lecture 26 - Derivation of Equations of Motion Part 2 - Newton
- Lecture 27 - Vibration of Strings
- Lecture 28 - Longitudinal and Torsional Vibration of Rods
- Lecture 29 - Transverse Vibration of Beams, Equations of Motion and Boundary Conditions
- Lecture 30 - Transverse Vibration of Beams: Natural Frequencies and Mode Shapes
- Lecture 31 - Rayleigh's Energy Method

[Lecture 32 - Matrix Iteration Method](#)

[Lecture 33 - Durkerley, Rayleigh-Ritz and Galerkin Method](#)

[Lecture 34 - Finite Element Formulation for Rods, Gear Train and Branched System](#)

[Lecture 35 - Finite Element Formulation for Beams: Galerkin](#)

[Lecture 36 - Global Finite Element Assembly and Imposition of Boundary Conditions](#)

[Lecture 37 - Vibration Testing Equipments: Signal Measurements](#)

[Lecture 38 - Vibration Testing Equipments: Signal Analysis](#)

[Lecture 39 - Field Balancing of Rotors](#)

[Lecture 40 - Condition Monitoring](#)

Lecture 1 - Introduction to advanced machining processes

Lecture 2 - Ultrasonic machining - Part I

Lecture 3 - Ultrasonic machining - Part II

Lecture 4 - Abrasive jet machining

Lecture 5 - Water jet cutting and Abrasive water jet machining

Lecture 6 - Magnetic abrasive finishing

Lecture 7 - Abrasive Flow Finishing

Lecture 8 - Magnetorheological Finishing

Lecture 9 - Magnetorheological Abrasive Flow Finishing - Part I

Lecture 10 - Magnetorheological Abrasive Flow Finishing - Part II

Lecture 11 - Magnetorheological Abrasive Flow Finishing - Part III

Lecture 12 - Electric discharge machining (EDM)

Lecture 13 - Electric Discharge Grinding, Electric Discharge Diamond Grinding and Wire Electric Discharge Machining

Lecture 14 - Electrochemical Machining (ECM)

Lecture 15 - Electrochemical Grinding, Electrostream Drilling, Shaped Tube Electrolytic Machining

Lecture 16 - Plasma Arc Machining (PAM)

Lecture 17 - Electron Beam Machining (EBM) Edit Lesson

Lecture 18 - Laser Beam Machining (LBM)

Lecture 19 - Chemical Machining (ChM)

- Lecture 1 - Introduction of nuclear energy
- Lecture 2 - Binding energy and mass defect
- Lecture 3 - Radioactivity and radioactive decay
- Lecture 4 - Different types of nuclear transmutation
- Lecture 5 - Artificial radioactivity and neutron-nucleus interactions
- Lecture 6 - Energy and momentum conservation
- Lecture 7 - Fission and role of neutron energy
- Lecture 8 - Theory of elastic scattering
- Lecture 9 - Neutron multiplication factor
- Lecture 10 - Neutron diffusion theory
- Lecture 11 - Solution of one-group diffusion equation
- Lecture 12 - Simple reactor theory
- Lecture 13 - Nuclear fuel and simple energy consideration
- Lecture 14 - Axial temperature distribution and heat transfer coefficient
- Lecture 15 - Prompt and delayed neutrons
- Lecture 16 - Delayed neutron kinetics
- Lecture 17 - Different control mechanisms and various effects
- Lecture 18 - Classical reactor designs
- Lecture 19 - Evolution of reactors from Gen-I to Gen-IV
- Lecture 20 - The concept of breeding
- Lecture 21 - Fuel cycles and FBR
- Lecture 22 - Gen-IV FBR designs
- Lecture 23 - Hydrogen fusion reactions
- Lecture 24 - Coulomb barrier and other critical factors
- Lecture 25 - Radiation dose and gross biological effects
- Lecture 26 - Stochastic and deterministic effects of human cells
- Lecture 27 - Lessons from TMI and Chernobyl
- Lecture 28 - Defence-in-depth Philosophy
- Lecture 29 - Waste classification and Disposal of Mill Tailings
- Lecture 30 - Disposal methodologies for HLW and IMW

- Lecture 1 - Fundamentals of Welding and Joining - Part I
- Lecture 2 - Fundamentals of Welding and Joining - Part II
- Lecture 3 - Fundamentals of Welding and Joining - Part III
- Lecture 4 - Fundamentals of Welding and Joining - Part IV
- Lecture 5 - Fundamentals of Welding and Joining - Part V
- Lecture 6 - Laser and Electron Beam Welding - Part I
- Lecture 7 - Laser and Electron Beam Welding - Part II
- Lecture 8 - Solid State Welding Processes - Part I
- Lecture 9 - Solid State Welding Processes - Part II
- Lecture 10 - Solid State Welding Processes - Part III
- Lecture 11 - Computational Welding Mechanics - Part I
- Lecture 12 - Computational Welding Mechanics - Part II
- Lecture 13 - Computational Welding Mechanics - Part III
- Lecture 14 - Micro and Nano Joining Processes - Part I
- Lecture 15 - Micro and Nano Joining Processes - Part II
- Lecture 16 - Micro and Nano Joining Processes - Part III
- Lecture 17 - Welding Metallurgy - Part I
- Lecture 18 - Welding Metallurgy - Part II
- Lecture 19 - Welding Metallurgy - Part III
- Lecture 20 - Welding Metallurgy - Part IV
- Lecture 21 - Welding and Joining of Non-Metals - Part I
- Lecture 22 - Welding and Joining of Non-Metals - Part II
- Lecture 23 - Metal Transfer in Welding and Metal Printing

Lecture 1 - Introduction

Lecture 2 - Introduction and Importance of Machining

Lecture 3 - Principles of Machining or Metal Cutting

Lecture 4 - Cutting Tools

Lecture 5 - Forces in Machining

Lecture 6 - Tribology in Machining

Lecture 7 - Lubrication surface roughness in Machining

Lecture 8 - Machinability and Thermal Aspects

Lecture 9 - Tool Wear and Tool life - Part 1

Lecture 10 - Tool Wear and Tool life - Part 2

Lecture 11 - Tool Wear and Tool life - Part 3

Lecture 12 - Tool Materials and Coatings

Lecture 13 - Machining Fluids / Cutting Fluids and its Additives - Part 1

Lecture 14 - Machining Fluids / Cutting Fluids and its Additives - Part 2

Lecture 15 - Machining Fluids / Cutting Fluids and its Emissions

Lecture 16 - Eco Friendly Cutting Fluids - Part 1

Lecture 17 - Eco Friendly Cutting Fluids - Part 2

Lecture 18 - Rheology and Thermal Characterization of Machining / Cutting Fluids

Lecture 19 - Bio-degradation Studies of Machining / Cutting Fluids

Lecture 20 - Cutting Fluid Application in Machining Region

Lecture 21 - Practical Machining Processes - 1

Lecture 22 - Practical Machining Processes - 2

Lecture 23 - Introduction to Abrasive Processes - Grinding

Lecture 24 - Cutting fluids in Grinding Process

Lecture 25 - Unbonded Conventional Abrasive Processes

Lecture 26 - Advances in Metal Cutting_Machining Processes

Lecture 27 - Advances in Metal Cutting_Machining Processes - 2

Lecture 1 - Deformation of Metals

Lecture 2 - Mechanism of Plastic Deformation

Lecture 3 - Machining Processes: Single Edge Tool, Types of Chips

Lecture 4 - Tool Geometry: Single Point Cutting Tool Specifications

Lecture 5 - Tool Specifications, Conversion Of Tool Angles, Multi-Point Cutting Tools

Lecture 6 - Mechanics of Orthogonal Cutting, Force Relationships

Lecture 7 - Determination of Stress, Strain, and Strain Rate

Lecture 8 - Measurement of Shear Angle

Lecture 9 - Other Analysis for Force Relationships

Lecture 10 - Mechanics of Oblique Cutting

Lecture 11 - Measurement of Cutting Forces

Lecture 12 - Thermal Aspects Of Machining: Temperatures in Orthogonal Cutting

Lecture 13 - Tool Wear and Tool Life and Tool Life Equations

Lecture 14 - Economics in Machining

Lecture 15 - Practical Machining Operations: Turning And Shaping and Planning Operation

Lecture 16 - Practical Machining Operations: Milling And Drilling

Lecture 17 - Grinding of Metals and Mechanics of Grinding Process

Lecture 18 - Abrasive Machining and Finishing Operations

Lecture 19 - CNC Machines and CNC Programming

Lecture 20 - Introduction to Advanced Machining Processes

Lecture 1 - Introduction to hydraulic machines: classifications and operational principles

Lecture 2 - Euler equation for turbomachines: net head developed by the pump/turbines

Lecture 3 - Velocity triangles of pumps, effect of inlet swirl on pump operation

Lecture 4 - Velocity triangles of pumps, effect of inlet swirl on pump operation

Lecture 5 - Pump casings, Efficiencies and Problems - I

Lecture 6 - Pump casings, Efficiencies and Problems - II

Lecture 7 - Pump casings, Efficiencies and Problems - III

Lecture 8 - Axial flow pump, HQ curve, System Resistance Curve - I

Lecture 9 - Axial flow pump, HQ curve, System Resistance Curve - II

Lecture 10 - HQ Curve, System Resistance Curve - I

Lecture 11 - HQ Curve, System Resistance Curve - II

Lecture 12 - Introduction to Cavitation

Lecture 13 - Condition for Cavitation and NPSH

Lecture 14 - Net Positive Suction Head (NPSH)

Lecture 15 - Suction number and Introduction to off design condition

Lecture 16 - Cavitation: The effect of off-design Conditions

Lecture 17 - Cavitation: Preventive Measures

Lecture 18 - Cavitation: Preventive Measures, Effect on Pump Characteristic

Lecture 19 - Problems on Cavitation

Lecture 20 - Introduction to Slip : Stodola Slip Model

Lecture 21 - Departure from Euler theory

Lecture 22 - Slip Velocity - I

Lecture 23 - Slip Velocity - II

Lecture 24 - Problem on slip

Lecture 25 - Degree of reaction of pump

Lecture 26 - Degree of reaction and axial pump design

Lecture 27 - Testing of radial flow pump - I

Lecture 28 - Testing of radial flow pump - II

Lecture 29 - Problem on radial flow pump testing

Lecture 30 - Radial equilibrium of axial flow pump - I

Lecture 31 - Radial equilibrium of axial flow pump - II

- Lecture 32 - Pump operation: series and parallel connection
- Lecture 33 - Series and parallel operation of dissimilar pumps
- Lecture 34 - Pumping system design
- Lecture 35 - Design of parallel pumping system
- Lecture 36 - Numerical problem on pumps - I
- Lecture 37 - Numerical problem on pumps - II
- Lecture 38 - Numerical problem on pumps - III
- Lecture 39 - Working principle and Indicator diagram of PD pump
- Lecture 40 - Working principle and Indicator diagram of PD pump (Continued...)
- Lecture 41 - Modified indicator diagram and Head-Discharge curve
- Lecture 42 - Analysis and Head-Discharge curve of PD pump
- Lecture 43 - Analysis and efficiencies of PD pump
- Lecture 44 - Requirement of air chamber in PD pump
- Lecture 45 - Numerical problem on PD pump with air chamber
- Lecture 46 - Similarity and dimensional analysis of hydraulic machines
- Lecture 47 - Dimensional analysis of hydraulic machines: Buckingham's theorem
- Lecture 48 - Buckingham's theorem: Specific speed of hydraulic machines
- Lecture 49 - Turbine Classification and Operational principle of Pelton wheel
- Lecture 50 - Velocity Triangles and analysis
- Lecture 51 - Operational Principle of Reaction turbine
- Lecture 52 - Degree of Reaction and Introduction to axial flow turbine
- Lecture 53 - Kaplan Turbine: Operational Principle, Turbine efficiencies
- Lecture 54 - Draft Tube for Reaction Turbine and Cavitation
- Lecture 55 - Energy Balance and NPSH
- Lecture 56 - Thoma Cavitation Factor
- Lecture 57 - Reaction Turbine: Design aspects and Characteristic Curves
- Lecture 58 - Problems on Impulse and Reaction Turbines

- Lecture 1 - Introduction to Abrasive Machining and Finishing Processes
- Lecture 2 - Grinding Process
- Lecture 3 - Grinding Fluids and Its Additives
- Lecture 4 - Grinding Fluids and its Emissions
- Lecture 5 - Sustainable Grinding Process: Biodegradation of Grinding Fluids
- Lecture 6 - Sustainable Grinding Process: MQL in Grinding Process
- Lecture 7 - Honing Process
- Lecture 8 - Lapping Process
- Lecture 9 - Super Finishing and Sand Blasting
- Lecture 10 - Vibratory Bowl Finishing, Rotary Barrel Finishing or Tumbling
- Lecture 11 - Drag Finishing, Ice-bonded Abrasive Finishing, Pitch Polishing, Pad Polishing
- Lecture 12 - Introduction to Surface Texture in abrasive Process
- Lecture 13 - Representation of Surface Roughness
- Lecture 14 - Abrasive Jet Machining (AJM)
- Lecture 15 - Abrasive Water Jet Machining (AWJM)
- Lecture 16 - Ultrasonic Machining (USM)
- Lecture 17 - EDM, Wire-EDM, EDG, EDDG, AW-EDG
- Lecture 18 - Elastic Emission Machining
- Lecture 19 - PMEDM and ECD and ELID, ECH
- Lecture 20 - Abrasive Flow Finishing: Part 1
- Lecture 21 - Abrasive Flow Finishing: Part 2
- Lecture 22 - Magnetic Field Assisted Abrasive Finishing: MAF, MADe, MFP
- Lecture 23 - Magneto Rheological Finishing and BE-MRF
- Lecture 24 - Magnetic Field Assisted Abrasive Finishing: CNP, CMMRF, MRAFF, R-MRAFF
- Lecture 25 - Summary of the Course

Lecture 1 - Basic of Solid Mechanics

Lecture 2 - Energy Principles

Lecture 3 - Classification of Plate Theories and Some Basics

Lecture 4 - Tutorial: Transformation of Tensors

Lecture 5 - Governing Equation for Plate - 1

Lecture 6 - Governing Equation for Plate - 2

Lecture 7 - Tutorial: Reduced Stiffness and Plate Stiffness

Lecture 8 - Navier Solution + Levy solution

Lecture 9 - Levy Solution

Lecture 10 - Tutorial: Load Matrices Calculation

Lecture 11 - EKM and buckling of plates

Lecture 12 - 3D Solutions

Lecture 13 - Matlab Coding + ABAQUS

Lecture 14 - Tutorial: Levy Solutions

Lecture 1 - Introduction to measurement

Lecture 2 - Generalized measurement system and static characteristics

Lecture 3 - Uncertainties in measurement

Lecture 4 - Statistical treatment of random errors

Lecture 5 - System response to periodic inputs

Lecture 6 - Zeroth and first order systems

Lecture 7 - First and second order systems

Lecture 8 - Basics of digitization and number systems

Lecture 9 - Binary logic gates and binary codes

Lecture 10 - Analog-to-digital conversion

Lecture 11 - Digital-to-analog conversion

Lecture 12 - Electromagnetic indicators

Lecture 13 - Electronic amplifiers and filters

Lecture 14 - Resistive devices

Lecture 15 - Inductive, capacitive and optical devices

Lecture 16 - Piezoelectric and nozzle-flapper transducers

Lecture 17 - Resistive strain gages and associated circuitry

Lecture 18 - Strain gage rosettes and gage orientation

Lecture 19 - Elastic and strain gage load cells

Lecture 20 - Various load cells and dynamometers

Lecture 21 - Principles of manometry

Lecture 22 - Piezometer and elastic pressure transducer

Lecture 23 - Electric pressure transducer and high and low pressure measurement

Lecture 24 - Bernoulli's equation in obstruction meters

Lecture 25 - Obstruction meters and volume flowmeters

Lecture 26 - Mass flowmeters and velocity probes

Lecture 27 - Expansion-based devices

Lecture 28 - RTD, Thermistor and Thermocouple

Lecture 29 - Introduction to pyrometers

Lecture 30 - Basic seismic transducer

Lecture 31 - Vibro-, velo- and accelerometer

[Lecture 32 - Introduction to acoustic measurement](#)

[Lecture 33 - Radioactivity and its biological effects](#)

Lecture 1 - External and Internal combustion engines, Engine components, SI and CI engines

Lecture 2 - Four-stroke and Two-stroke engines, Comparison between SI and CI engines, and Four-stroke and Two-stroke engines

Lecture 3 - Classification of IC engines

Lecture 4 - Engine operating characteristics

Lecture 5 - Otto, Diesel and Dual cycles

Lecture 6 - Otto, Diesel and Dual cycles (Continued...)

Lecture 7 - Otto, Diesel and Dual cycles (Continued...)

Lecture 8 - Otto, Diesel and Dual cycles (Continued...)

Lecture 9 - Comparison between the cycles, Actual cycles and their analysis

Lecture 10 - Carburetor, Mixture requirements

Lecture 11 - Carburetor, Mixture requirements (Continued...)

Lecture 12 - Idling, cruising and power ranges

Lecture 13 - Idling, cruising and power ranges (Continued...)

Lecture 14 - Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems

Lecture 15 - Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems (Continued...)

Lecture 16 - Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems (Continued...)

Lecture 17 - Engine friction, Lubrication systems, forces on piston

Lecture 18 - Lubricating oils, Thermochemistry and Fuels, Self-ignition

Lecture 19 - Octane and Cetane Numbers, Alternative Fuels - Methanol, Ethanol, hydrogen, Natural Gas

Lecture 20 - Octane and Cetane Numbers, Alternative Fuels - Methanol, Ethanol, hydrogen, Natural Gas (Continued...)

Lecture 21 - Combustion in SI and CI Engines, Pressure Crank Angle Diagram

Lecture 22 - Combustion in SI and CI Engines, Pressure Crank Angle Diagram (Continued...)

Lecture 23 - Combustion in SI and CI Engines, Pressure Crank Angle Diagram (Continued...)

Lecture 24 - SI engine injection system, Energy distribution, Engine temperatures, Heat transfer in combustion chambers

Lecture 25 - SI engine injection system, Energy distribution, Engine temperatures, Heat transfer in combustion chambers (Continued...)

Lecture 26 - CI engine injection systems, Air-cooled and liquid-cooled engines, Modern trends

Lecture 27 - CI engine injection systems, Air-cooled and liquid-cooled engines, Modern trends (Continued...)

Lecture 28 - CI engine injection systems, Air-cooled and liquid-cooled engines, Modern trends (Continued...)

Lecture 29 - Problems on IC engine

Lecture 30 - Turbomachines, Gas Turbine theory

Lecture 31 - Open Cycle Gas Turbine Power Plant, Twin Shaft Arrangement

- Lecture 32 - Closed Cycle, Multi-Spool Arrangement, Steam Power Plant
- Lecture 33 - Basic Thermodynamics
- Lecture 34 - Brayton Cycle: Introduction and General Relationships
- Lecture 35 - Brayton Cycle: Efficiency, Work Ratio and Optimum Work Output Condition
- Lecture 36 - Brayton Cycle with Heat Exchanger/Reheater
- Lecture 37 - Brayton Cycle with Intercooler
- Lecture 38 - Real Brayton Cycle, Solved Example for Ideal Cycle
- Lecture 39 - Solved Examples for Real Brayton Cycle
- Lecture 40 - Introduction and Performance Parameters of Propulsion System
- Lecture 41 - Basics of Various Aircraft Engine
- Lecture 42 - Euler Turbomachinery Equation
- Lecture 43 - Introduction and Flow Analysis of Centrifugal Compressors
- Lecture 44 - Thermodynamics Analysis of Centrifugal Compressors
- Lecture 45 - Axial Compressor: Basics, Velocity triangles, T-S diagram and Work Interaction
- Lecture 46 - Axial Compressor: Different factors, Degree of Reaction and Free Vortex Condition
- Lecture 47 - Complete Analysis of Axial Flow Gas Turbine
- Lecture 48 - Solved Examples for Axial Compressors, Centrifugal Compressors and Turbine
- Lecture 49 - Radial Flow Turbine, Solved Example of Free vortex Condition
- Lecture 50 - Nozzles and Diffusers: Introduction, Intake efficiency, Nozzle efficiency

Lecture 1 - Introduction of welding

Lecture 2 - Classification of welding and joints

Lecture 3 - Parts of weld joint

Lecture 4 - Welding Symbol

Lecture 5 - welding power source - 1

Lecture 6 - Welding power source - 2

Lecture 7 - Welding Power sources characteristics - 1

Lecture 8 - Welding Power sources characteristics - 2

Lecture 9 - Physics of welding - 1

Lecture 10 - Physics of welding - 2

Lecture 11 - Physics of welding - 4 (Arc Stability and Arc Blow)

Lecture 12 - Physics of welding - 3

Lecture 13 - Physics of welding - 5 (Metal Transfer-1)

Lecture 14 - Physics of welding - 6 (Metal Transfer-2)

Lecture 15 - Physics of welding - 7 (Metal Transfer-3)

Lecture 16 - Physics of welding - 8 (Metal Transfer-4)

Lecture 17 - Physics of welding - 9 (Metal Transfer-5)

Lecture 18 - Physics of welding - 10 (Metalting Efficiency)

Lecture 19 - Oxy-Fuel Gas Welding

Lecture 20 - Shielded Metal Arc Welding

Lecture 21 - Gas Tungsten Arc Welding

Lecture 22 - Gas Metal Arc Welding

Lecture 23 - Submerged Arc Welding

Lecture 24 - Welding Defects and Inspection

Lecture 1 - Introduction to Polymer Assisted Abrasive Finishing Processes

Lecture 2 - Surface Integrity and Surface roughness representation - Part I

Lecture 3 - Surface Integrity and Surface roughness representation - Part II

Lecture 4 - Introduction to Grinding and Polymer assisted Grinding Wheels

Lecture 5 - Polymer medium for vibratory bowl finishing, Tumbling, Drag finishing

Lecture 6 - Polymer Pad and Chemo-mechanical Polishing

Lecture 7 - Elastic Emission Machining

Lecture 8 - Hydrodynamic Polishing, Elasto Abrasive Finishing

Lecture 9 - Abrasive Flow Machining and Finishing - Part I

Lecture 10 - Abrasive Flow Machining and Finishing - Part II

Lecture 11 - Advances in Abrasive Flow Finishing: DBGAFF, CFAAFM

Lecture 12 - Advances in Abrasive Flow Finishing: Spiral Polishing, R-AFF

Lecture 13 - AFF Processes: Magnetio AFF (MRAFF), UAA-AFF, EC-AFF

Lecture 14 - Finishing of Biomedical implants (Micro AFF: Micro holes, Micro slots, Bio Implants: Knee implants , Hip implants and Applications of one way, two way and orbital AFF)

Lecture 15 - Summary of the Course

- Lecture 1 - Materials and manufacturing Processes - 1
- Lecture 2 - Materials and manufacturing Processes - 2
- Lecture 3 - Physics based modeling approach at different scale
- Lecture 4 - Evaluation of properties and process modelling
- Lecture 5 - Thermofluid and electromagnetic analysis
- Lecture 6 - Solid-state deformation and residual stress - 1
- Lecture 7 - Solid-state deformation and residual stress - 2
- Lecture 8 - Melting, solidification and additive manufacturing
- Lecture 9 - Force and velocity diagram - 1
- Lecture 10 - Force and velocity diagram - 2
- Lecture 11 - Heat transfer analysis
- Lecture 12 - Principal and mechanism at different processes - 1
- Lecture 13 - Principal and mechanism at different processes - 2
- Lecture 14 - Mechanics of bulk metal forming
- Lecture 15 - Mechanics of sheet metal forming - 1
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- Lecture 17 - Heat transfer and thermomechanical processing
- Lecture 18 - Fusion welding processes - 1
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- Lecture 20 - Physics of welding and metal transfer
- Lecture 21 - Heat source model in fusion welding
- Lecture 22 - Heat transfer and material flow
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- Lecture 8 - Liquid-vapor phase-change process
- Lecture 9 - Use of property tables
- Lecture 10 - Equations-of-state and Compressibility factor
- Lecture 11 - Ideal cycles for reciprocating engines
- Lecture 12 - Otto, Diesel and Dual combustion cycles
- Lecture 13 - Stirling and Ericsson cycles
- Lecture 14 - Fuel-air cycle
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- Lecture 16 - Losses in actual cycle and valve-timing diagram
- Lecture 17 - Ideal Brayton cycle
- Lecture 18 - Intercooling and reheating in Brayton cycle
- Lecture 19 - Regeneration in Brayton cycle
- Lecture 20 - Ideal Rankine cycle
- Lecture 21 - Improvements and modifications in Rankine cycle
- Lecture 22 - Regenerative Rankine cycle
- Lecture 23 - Binary vapor power cycle
- Lecture 24 - Combined gas-steam power plant
- Lecture 25 - Different arrangements in combined cycles
- Lecture 26 - Vapor compression refrigeration cycle
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- Lecture 9 - Additional Considerations of Elastic Wave in Cylindrical Bar
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Lecture 7 - Dimensional measurement Gauge blocks, The pneumatic displacement gauge

Lecture 8 - Dimensional measurement Gauge blocks, The pneumatic displacement gauge

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Lecture 10 - Mechanical pressure measurement devices, U-tube manometer, The inclined well type manometer

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Lecture 12 - The Mcleod gauge, The Pirani gauge, The Ionization gauge

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Lecture 18 - Flow obstruction flow rate measurement(venturimeter/orificemeter), the Rotameter (Continued...)

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Lecture 23 - Ideal gas thermometer, Temperature measurement by mechanical and electrical effects

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Lecture 25 - Thermostatic temperature, Resistance Temperature Detectors (RTD), Thermistors, Thermocouples

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Lecture 27 - Transient response of thermal system, Thermocouple compensation, high speed flow

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Lecture 11 - Displacement, position and proximity sensors - I

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- Lecture 10 - Normal Shock Waves - I
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Lecture 19 - Gauss Divergence theorem and its application in Heat transfer and Structural analysis

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Lecture 21 - Triangular element, calculating element stiffness and element force vector

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- Lecture 22 - Modifications of Brayton cycle
- Lecture 23 - Combined Power cycle
- Lecture 24 - Gas Turbines for Aircraft Propulsion
- Lecture 25 - Hydro-Power System - Part I
- Lecture 26 - Hydro-Power System - Part II
- Lecture 27 - Wind Energy - Part I
- Lecture 28 - Wind Energy - Part II
- Lecture 29 - Energy From Oceans - Part I
- Lecture 30 - Energy From Oceans - Part II
- Lecture 31 - Geothermal Energy

[Lecture 32 - Energy Storage - I](#)

[Lecture 33 - Energy Storage - II](#)

[Lecture 34 - Energy Storage - III](#)

- Lecture 1 - Introduction to phase diagrams
- Lecture 2 - Thermodynamic relations
- Lecture 3 - Single component system and binary solutions
- Lecture 4 - Regular solutions
- Lecture 5 - Real solutions
- Lecture 6 - Phase transformations
- Lecture 7 - Practice problems (Module 1)
- Lecture 8 - Introduction to homogenous nucleation process
- Lecture 9 - Fundamental to heterogeneous nucleation
- Lecture 10 - Growth of pure metal
- Lecture 11 - Alloy solidification
- Lecture 12 - Formation of different S/L interface
- Lecture 13 - Solidification structures and segregation
- Lecture 14 - Weld Metal Solidification and Microstructure - I
- Lecture 15 - Weld Metal Solidification and Microstructure - II
- Lecture 16 - Solidification of additive manufacturing - I
- Lecture 17 - Solidification of additive manufacturing - II
- Lecture 18 - Rate of solidification-sand casting
- Lecture 19 - Rate of solidification-die casting
- Lecture 20 - Riser design and solidification of pure metal
- Lecture 21 - Zone melting and rapid solidification
- Lecture 22 - Semisolid processing and other solidification techniques
- Lecture 23 - Demonstration of the solidification process and numerical problems

NPTEL : Acoustics (Mechanical Engineering)

Co-ordinators : Prof. Nachiketa Tiwari

Lecture 1 - Intro, sound wave versus vibration, different types of waves, octave, music scales, sense of SPL

Lecture 2 - Review: Linearity, complex numbers, and spring mass system

Lecture 3 - Review: Poles and zeroes, phase and magnitude plots, transfer functions, Bode plots

Lecture 4 - Review: Transfer functions, and Bode plots

Lecture 5 - 1-D wave equation, and its solution

Lecture 6 - Solution for 1-D wave equation

Lecture 7 - Waveguides, transmission line equations, and standing waves

Lecture 8 - Waveguides, transmission line equations, and standing waves

Lecture 9 - Examples of 1-D waves in tubes, short tubes, Kundt's tube

Lecture 10 - Thermodynamic processes during sound transmission

Lecture 11 - Numerical examples

Lecture 12 - Sound transmission through walls

Lecture 13 - Sound transmission through walls

Lecture 14 - Leakage in walls, STC Ratings, Octave bands

Lecture 15 - Instantaneous power flow

Lecture 16 - Radial propagation of sound, monopoles, and dipoles

Lecture 17 - Radial propagation of sound, monopoles, and dipoles

Lecture 18 - Radial propagation of sound, monopoles, and dipoles

Lecture 19 - Numerical examples

Lecture 20 - Numerical examples

Lecture 21 - Directivity

Lecture 22 - Directivity

Lecture 23 - Directivity

Lecture 24 - Directivity

Lecture 25 - Generalized elements

Lecture 26 - Examples of electromechanical systems

Lecture 27 - Transformers, radiation impedance, and Helmholtz resonator

Lecture 28 - Radiation impedance

Lecture 29 - Radiation impedance

Lecture 30 - Models of electro-mechanical-acoustic systems

Lecture 31 - Solution for a loudspeaker model

[Lecture 32 - Microphones](#)

[Lecture 33 - Vibro-meter, seismometer, accelerometer, shaker table](#)

[Lecture 34 - Sound propagation in rooms, 1-D rooms, 2D rooms](#)

[Lecture 35 - Sound in 3-D rooms](#)

[Lecture 36 - Absorption coefficient, and irregular rooms](#)

[Lecture 37 - Room constant, and Sabine's coefficient](#)

[Lecture 38 - Design of a muffler](#)

[Lecture 39 - Noise in machines, basics of noise management](#)

[Lecture 1 - Advanced Machining Processes](#)

[Lecture 2 - Advanced Machining Processes](#)

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[Lecture 4 - Advanced Machining Processes](#)

[Lecture 5 - Advanced Machining Processes](#)

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[Lecture 8](#)

[Lecture 9](#)

[Lecture 10 \(same as 9\)](#)

[Lecture 11](#)

[Lecture 12 \(Lecture Missing\)](#)

[Lecture 13](#)

[Lecture 14](#)

[Lecture 15](#)

[Lecture 16](#)

[Lecture 17](#)

[Lecture 18](#)

[Lecture 19](#)

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Lecture 1 - Introduction

Lecture 2 - Basic Ideas of Applied Linear Algebra

Lecture 3 - Systems of Linear Equations

Lecture 4 - Square Non-Singular Systems

Lecture 5 - Ill-Conditioned and Ill-Posed Systems

Lecture 6 - The Algebraic Eigenvalue Problem

Lecture 7 - Canonical Forms, Symmetric Matrices

Lecture 8 - Methods of Plane Rotations

Lecture 9 - Householder Method, Tridiagonal Matrices

Lecture 10 - QR Decomposition, General Matrices

Lecture 11 - Singular Value Decomposition

Lecture 12 - Vector Space: Concepts

Lecture 13 - Multivariate Calculus

Lecture 14 - Vector Calculus in Geometry

Lecture 15 - Vector Calculus in Physics

Lecture 16 - Solution of Equations

Lecture 17 - Introduction to Optimization

Lecture 18 - Multivariate Optimization

Lecture 19 - Constrained Optimization: Optimality Criteria

Lecture 20 - Constrained Optimization: Further Issues

Lecture 21 - Interpolation

Lecture 22 - Numerical Integration

Lecture 23 - Numerical Solution of ODE's as IVP

Lecture 24 - Boundary Value Problems, Question of Stability in IVP Solution

Lecture 25 - Stiff Differential Equations, Existence and Uniqueness Theory

Lecture 26 - Theory of First Order ODE's

Lecture 27 - Linear Second Order ODE's

Lecture 28 - Methods of Linear ODE's

Lecture 29 - ODE Systems

Lecture 30 - Stability of Dynamic Systems

Lecture 31 - Series Solutions and Special Functions

[Lecture 32 - Sturm-Liouville Theory](#)

[Lecture 33 - Approximation Theory and Fourier Series](#)

[Lecture 34 - Fourier Integral to Fourier Transform, Minimax Approximation](#)

[Lecture 35 - Separation of Variables in PDE's, Hyperbolic Equations](#)

[Lecture 36 - Parabolic and Elliptic Equations, Membrane Equation](#)

[Lecture 37 - Analytic Functions](#)

[Lecture 38 - Integration of Complex Functions](#)

[Lecture 39 - Singularities and Residues](#)

[Lecture 40 - Calculus of Variations](#)

- Lecture 1 - Rigid Body Motion - Part 1
- Lecture 2 - Rigid Body Motion - Part 2
- Lecture 3 - Dynamic Force Analysis of Mechanisms
- Lecture 4 - Space Motion of Rigid Bodies
- Lecture 5 - Inertia Tensor Angular Momentum
- Lecture 6 - Euler's Equation of Motion
- Lecture 7 - Gyroscopic Action in Machines
- Lecture 8 - Unbalance in Machines
- Lecture 9 - Rotary Balancing
- Lecture 10 - Balancing Machines
- Lecture 11 - Field Balancing of Rotors
- Lecture 12 - Single-Cylinder Engine Balancing
- Lecture 13 - Balancing of Single Slider Machines
- Lecture 14 - In-Line Engine Balancing
- Lecture 15 - V and Radial Engine Balancing
- Lecture 16 - Turning Moment Diagram
- Lecture 17 - Flywheel Analysis
- Lecture 18 - Dynamics of Machines
- Lecture 19 - Dynamics of Machines
- Lecture 20 - Dynamics of Machines
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- Lecture 22 - Dynamics of Machines
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- Lecture 25 - Dynamics of Machines
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- Lecture 27 - Dynamics of Machines
- Lecture 28 - Dynamics of Machines
- Lecture 29 - Rotating Vector Approach
- Lecture 30 - Equivalent viscous damping
- Lecture 31 - Dynamics of Machines

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[Lecture 33 - Tuned Vibration Absorber](#)

[Lecture 34 - Design of Vibration Absorbers](#)

[Lecture 35 - Flexibility Matrix Influence Coeff](#)

[Lecture 36 - Forced Vibration of multiple](#)

[Lecture 37 - Forced Vibration of Multiple degrees](#)

[Lecture 38 - Vibration of Continuous Systems](#)

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[Lab session 1 - Advanced manufacturing process for micro sytem fabrication](#)

[Lab session 2 - EDM Micro Machening](#)

[Lab session 3 - EDM Micro Drilling](#)

[Lab session 4 - Laser Machening Process](#)

[Lab session 5 - Vaccume Assisted Forming](#)

[Lab session 6 - Vaccume Forming](#)

[Lab session 7 - Photolithiography](#)

[Lab session 8 - Replication part 1](#)

[Lab session 9 - Replication part 2](#)

[Lab session 10 - PCB Making](#)

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Lecture 2 - Lecture 2

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Lecture 4 - Review Lecture 1,2,3

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Lecture 8 - Review Lecture 4,5,6

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Lecture 19 - Lecture-18

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Lecture 21 - Review Lecture 7 to 10

Lecture 22 - Review Lecture 11 to 13

Lecture 23 - Review Lecture 14 to 16

Lecture 24 - Lecture-20

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Lecture 30 - Review Lecture 17,18,19

Lecture 31 - Review Lecture 20,21,22

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[Lecture 40 - Review lecture 23,24,25](#)

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Lecture 1 - Introduction to Quality Engineering

Lecture 2 - Quality Costs

Lecture 3 - Product Design

Lecture 4 - Design of Experiments

Lecture 5 - Applications of Quality Loss Function

Lecture 6 - Product Selection Strategies

Lecture 7 - Robust Design Approaches

Lecture 8 - Taguchi's Method

Lecture 9 - Failure mode and effects analysis

Lecture 10 - Problem Solving : Failure mode and effects analysis - 1

Lecture 11 - Problem solving : Failure mode and effects analysis - 2

Lecture 12 - Product quality improvement methods

Lecture 13 - Quality tools - Part 1

Lecture 14 - Quality Tools - Part 2

Lecture 15 - Different types of control charts

Lecture 16 - Mean, Variance and Standard deviation

Lecture 17 - X bar chart, R-chart

Lecture 18 - Plotting methods for control charts

Lecture 19 - Six Sigma - Part 1

Lecture 20 - Six Sigma - Part 2

Lecture 21 - Theory of probability

Lecture 22 - Determining the defective products using Probability

Lecture 23 - Sampling based on Permutations and Combinations

Lecture 24 - Binomial distribution

Lecture 25 - Poisson distribution

Lecture 26 - Poisson distribution

Lecture 27 - Normal Distribution

Lecture 28 - Overview of control charts and different types of distribution

Lecture 29 - Fundamental of Robotics and its applications in Automated Systems

Lecture 30 - Joint configuration systems of Robot

Lecture 1 - Introduction to Finite Element Analysis(FEA)

Lecture 2 - Introduction of FEA, Nodes, Elements and Shape Functions

Lecture 3 - Nodes, Elements and Shape Functions

Lecture 4 - Polynomials as Shape Functions, Weighted Residuals, Elements and Assembly Level Equations

Lecture 5 - Types of Errors in FEA, Overall FEA Process and Convergence

Lecture 6 - Strengths of FE Method, Continuity conditions at Interfaces

Lecture 7 - Key concepts and terminologies

Lecture 8 - Weighted integral statements

Lecture 9 - Integration by parts - Review

Lecture 10 - Gradient and Divergence Theorems-Part - I

Lecture 11 - Gradient and Divergence Theorems Part - II

Lecture 12 - Functionals

Lecture 13 - Variational Operator

Lecture 14 - Weighted Integral and Weak Formulation

Lecture 15 - Weak Formulation

Lecture 16 - Weak Formulation and Weighted Integral : Principle of minimum potential energy

Lecture 17 - Variational Methods : Rayleigh Ritz Method

Lecture 18 - Rayleigh Ritz Method

Lecture 19 - Method of Weighted Residuals

Lecture 20 - Different types of Weighted Residual Methods - Part I

Lecture 21 - Different types of Weighted Residual Methods - Part II

Lecture 22 - FEA formulation for 2nd order BVP - Part I

Lecture 23 - FEA formulation for 2nd order BVP - Part II

Lecture 24 - Element Level Equations

Lecture 25 - 2nd Order Boundary Value Problem

Lecture 26 - Assembly of element equations

Lecture 27 - Assembly of element equations and implementation of boundary conditions

Lecture 28 - Assembly process and the connectivity matrix

Lecture 29 - Radially Symmetric Problems

Lecture 30 - One dimensional heat transfer

Lecture 31 - 1D-Heat conduction with convective effects : examples

[Lecture 32 - Euler-Bernoulli beam](#)

[Lecture 33 - Interpolation functions for Euler-Bernoulli beam](#)

[Lecture 34 - Finite element equations for Euler-Bernoulli beam](#)

[Lecture 35 - Assembly equations for Euler-Bernoulli beam](#)

[Lecture 36 - Boundary conditions for Euler-Bernoulli beam](#)

[Lecture 37 - Shear deformable beams](#)

[Lecture 38 - Finite element formulation for shear deformable beams : Part - I](#)

[Lecture 39 - Finite element formulation for shear deformable beams : Part - II](#)

[Lecture 40 - Equal interpolation but reduced integration element](#)

[Lecture 41 - Eigenvalue problems](#)

[Lecture 42 - Eigenvalue problems : examples](#)

[Lecture 43 - Introduction to time dependent problems](#)

[Lecture 44 - Spatial approximation](#)

[Lecture 45 - Temporal approximation for parabolic problems : Part - I](#)

[Lecture 46 - Temporal approximation for parabolic problems : Part - II](#)

[Lecture 47 - Temporal approximation for hyperbolic problems](#)

[Lecture 48 - Explicit and implicit method, diagonalization of mass matrix, closure](#)

Lecture 1 - Introduction

Lecture 2 - Vibration versus Waves

Lecture 3 - Nature of Sound

Lecture 4 - The Decibel Scale

Lecture 5 - Some Key Terms

Lecture 6 - Adding Decibels

Lecture 7 - Modeling Sound Propagation

Lecture 8 - The Momentum Equation

Lecture 9 - The Continuity Equation and The Gas Law

Lecture 10 - 1-D Wave Equation

Lecture 11 - General Solution for 1-D Wave Equation

Lecture 12 - Complex Time Signal and Transfer Functions

Lecture 13 - Transmission line equations

Lecture 14 - Planar Waves in Closed Tubes

Lecture 15 - Planar Waves in 1-D Open Tubes

Lecture 16 - A Semi-Infinite Tube and Overall Summary

Lecture 17 - 1-D Tubes with Imperfect Terminations

Lecture 18 - Measuring Impedance Through Kundt's Apparatus

Lecture 19 - Classification of Microphones

Lecture 20 - Classification of Microphones - Continuation

Lecture 21 - Classification of Microphones by Application

Lecture 22 - Microphone Sensitivity

Lecture 23 - Microphone Sensitivity- Continuation

Lecture 24 - Selecting the Right Microphone

Lecture 25 - Fourier Series Expansion

Lecture 26 - Fourier Series Expansion - Continuation

Lecture 27 - Fourier Integral

Lecture 28 - Fourier Integral - Continuation

Lecture 29 - Fourier Transform

Lecture 30 - Fourier Transform - Continuation

Lecture 31 - Discrete Fourier Transform (DFT)

[Lecture 32 - Discrete Fourier Transform \(DFT\) - Continuation](#)

[Lecture 33 - DFT - Calculating Frequencies and Padding](#)

[Lecture 34 - DFT - Influence of Duration and Sampling frequency on resolution](#)

[Lecture 35 - FFT and Inverse FFT](#)

[Lecture 36 - Considerations while deciding instrumentation](#)

[Lecture 37 - Considerations while selecting instruments for noise measurements](#)

[Lecture 38 - Measuring impedance through two microphone method](#)

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[Lecture 40 - Octave band analysis](#)

[Lecture 41 - Calculating results in octave bands](#)

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[Lecture 43 - Short time Fourier transforms \(STFT\)](#)

[Lecture 44 - Spectrograms](#)

[Lecture 45 - Reverberation time](#)

[Lecture 46 - Anechoic rooms](#)

[Lecture 47 - STC, NRC and sound attenuation](#)

[Lecture 48 - Reverberant rooms](#)

- Lecture 1 - Introduction to Manufacturing Process Technology
- Lecture 2 - Structure of Matter (Bonding of Solids, Crystal Structures)
- Lecture 3 - Brief introduction of non-conventional machining processes
- Lecture 4 - Structure of matters (bonding of solids, crystal structures)
- Lecture 5 - Elastic and Plastic Deformation
- Lecture 6 - Crystal imperfection and dislocation
- Lecture 7 - Plastic Deformation
- Lecture 8 - Material Properties, Stress Strain Diagram for different types of materials
- Lecture 9 - Friction and Wear, Solid solutions
- Lecture 10 - Equilibrium Phase Diagram
- Lecture 11 - Iron-carbon equilibrium phase diagram
- Lecture 12 - Control of material properties (Alloying and heat treatment), Mechanical properties and Recrystallization
- Lecture 13 - Introduction To Casting Process
- Lecture 14 - Pattern and Mold Design
- Lecture 15 - Mold Making Procedures
- Lecture 16 - Fundamentals of Melting and Furnaces & Pouring and Gating Design
- Lecture 17 - Vertical and Bottom Gating Systems Edit Lesson
- Lecture 18 - Numerical Estimation To Find Mold Filling Time and Mold Design
- Lecture 19 - Effects of friction and velocity distribution in time of filling
- Lecture 20 - Numerical design of gating systems using frictional and bending losses
- Lecture 21 - Principle of cooling and solidification in single and multiphase systems
- Lecture 22 - Estimation of rate of solidification
- Lecture 23 - Principles of cooling and solidification of casting
- Lecture 24 - Modeling of Solidification Rates of Thin Casting in a Metal Mold
- Lecture 25 - Solidification with Predominant Interface Resistance
- Lecture 26 - Solidification with Constant Casting Surface Temperature
- Lecture 27 - Solidification of Casting with Predominant Resistance in Mold and Solidified Metal
- Lecture 28 - Solidification Time for Permanent Mold Casting
- Lecture 29 - Solidification with Constant Casting Surface
- Lecture 30 - Riser Design and Placement - Part 1
- Lecture 31 - Riser Design and Placement - Part 2

[Lecture 32 - Riser Design and Placement - Part 3](#)

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[Lecture 34 - Review of Basic Machining Processes and the Mechanics of Chip Formation](#)

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[Lecture 36 - Merchant's Force Analysis](#)

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[Lecture 39 - Lee Shaffer's Solution](#)

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Lecture 2 - Classification of Materials

Lecture 3 - Advanced and Exotic Materials

Lecture 4 - Mechanical Properties of Materials - I

Lecture 5 - Mechanical Properties of Materials - II

Lecture 6 - Mechanical Properties of Materials - III

Lecture 7 - Bonding between atoms

Lecture 8 - The Role of Crystal Structure - I

Lecture 9 - The Role of Crystal Structure - II

Lecture 10 - The Role of Crystal Structure - III

Lecture 11 - Metals - I (Ferrous alloys)

Lecture 12 - Metals - II (Non-Ferrous alloys)

Lecture 13 - Metals - III (Strengthening and Degradation)

Lecture 14 - Ceramics - I

Lecture 15 - Ceramics - II

Lecture 16 - Polymers : Introduction and Classification

Lecture 17 - Polymeric Structure

Lecture 18 - Effects of Glass transition temperature

Lecture 19 - Polymer Mechanical properties

Lecture 20 - Composites - I

Lecture 21 - Composites - II

Lecture 22 - Composites - III

Lecture 23 - Smart Materials - I (Introduction)

Lecture 24 - Smart Materials - II (Piezoelectricity)

Lecture 25 - Smart Materials - III (Magnetostriction)

Lecture 26 - Smart Materials - IV (Smart Polymers)

Lecture 27 - Smart Materials - V (SMA)

Lecture 28 - Materials Selection in Engineering Design

Lecture 29 - Numerical: Cantilever beam (High stiffness and light weight)

Lecture 30 - Numerical: Cantilever beam (High strength and light weight)

Lecture 31 - Numerical: Connecting rod

[Lecture 32 - Numerical: Probe for scanning probe microscope](#)

[Lecture 33 - Optical Properties](#)

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[Lecture 35 - Thermal Properties](#)

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[Lecture 37 - Electric Properties - I](#)

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[Lecture 40 - Laboratory demonstration](#)

- Lecture 1 - Introduction to Advanced Machining Processes
- Lecture 2 - Classification of Machining Processes
- Lecture 3 - Silicon growth and Crystallography
- Lecture 4 - Micro Fabrication Technology
- Lecture 5 - Photolithography
- Lecture 6 - Soft Lithography
- Lecture 7 - Introduction to Wet Etching Techniques
- Lecture 8 - Introduction to Dry Etching Techniques
- Lecture 9 - Introduction of Additive Techniques
- Lecture 10 - Introduction to Abrasive Jet Machining Process
- Lecture 11 - Ultrasonic Machining Process
- Lecture 12 - Determination of MRR of Ultrasonic Machining Process
- Lecture 13 - Mechanics of Ultrasonic Machining (USM)
- Lecture 14 - Effect of Process parameters of USM
- Lecture 15 - Ultrasonic Machining Unit
- Lecture 16 - Electrochemical Machining Processes (ECM)
- Lecture 17 - Material Removal Rate of ECM
- Lecture 18 - Electrode Double Layer
- Lecture 19 - Material removal rate of an alloy in ECM
- Lecture 20 - Kinematics and Dynamics of ECM
- Lecture 21 - Temperature and Pressure rise during ECM
- Lecture 22 - Determination of Electrolyte flow velocity in ECM
- Lecture 23 - Effect of heat and Hydrogen bubble generation during ECM Process
- Lecture 24 - Theoretical determination of Tool shape
- Lecture 25 - Design for Electrolyte flow in ECM
- Lecture 26 - Introductions of Electro-chemical Drilling Process
- Lecture 27 - Introduction to Finishing Process
- Lecture 28 - Electric Discharge Machining Process
- Lecture 29 - EDM part-2
- Lecture 30 - Effect of various process parameters on EDM process
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- [Lecture 36 - Functional Characteristics of EBM Process Edit Lesson](#)
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- [Lecture 41 - Metal forming Processes Edit Lesson](#)
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- [Lecture 43 - Concept of Principal stress, strain](#)
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- [Lecture 45 - Rolling Processes - Part 1](#)
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Lecture 1 - Overview of the Course

Lecture 2 - Fundamental principles

Lecture 3 - Steps followed in FEA

Lecture 4 - Weak Formulation

Lecture 5 - Weak Formulation : Example Problem

Lecture 6 - Assembling element level equations

Lecture 7 - Errors in FEA Solution

Lecture 8 - Measures of Errors in FEA Solution

Lecture 9 - Convergence and Accuracy of Solution - Part I

Lecture 10 - Convergence and Accuracy of Solution - Part II

Lecture 11 - Convergence - Part I

Lecture 12 - Convergence - Part II

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Lecture 14 - Numerical Integration Schemes - Part II

Lecture 15 - Approximations - Part I

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Lecture 17 - Approximations - Part III

Lecture 18 - Gauss Quadrature

Lecture 19 - Gaussian Quadrature review

Lecture 20 - Gaussian Quadrature - Part II

Lecture 21 - Gaussian Quadrature - Part III

Lecture 22 - Newton-Cotes Quadrature

Lecture 23 - Two dimensional FEM problem

Lecture 24 - Two dimensional one variable FEM problem

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Lecture 26 - 2D Finite element problems with single variable (Weak formulation)

Lecture 27 - Elemental level 2D finite element equations

Lecture 28 - Interpolation functions for 2D finite element problems

Lecture 29 - Interpolation functions for linear triangular elements - Part I

Lecture 30 - Interpolation functions for linear triangular elements - Part II

Lecture 31 - Interpolation functions for Triangular and Rectangular elements

- Lecture 32 - Evaluation of Stiffness and Force matrices
- Lecture 33 - Stiffness and Force matrices for Triangular element
- Lecture 34 - Stiffness and Force matrices for Rectangular element
- Lecture 35 - Boundary elements for Finite element Equations
- Lecture 36 - Boundary integrals for Triangular element
- Lecture 37 - Assembly of 2-D finite elements - Part I
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- Lecture 39 - 2-D Heat transfer problems - Part I
- Lecture 40 - 2-D Heat transfer problems - Part II
- Lecture 41 - Numerical integration schemes for 2-D problems
- Lecture 42 - Jacobian and transformation matrix for 2-D problems
- Lecture 43 - Numerical Integration Schemes for 2-D Problems : Closure
- Lecture 44 - Post-processing
- Lecture 45 - Plane Elasticity Problems
- Lecture 46 - Plane Elasticity Problems : Development of Weak form
- Lecture 47 - Plane Elasticity Problems : Element level equations
- Lecture 48 - Plane Elasticity Problems : Closure

- Lecture 1 - Introduction to Vibration control
- Lecture 2 - Strategies and Steps in Vibration Control
- Lecture 3 - Strategies, Active control, Detuning and Decoupling
- Lecture 4 - Viscous damping model
- Lecture 5 - Coulomb and Hysteretic damping model
- Lecture 6 - Energy Dissipation in Structural Materials
- Lecture 7 - Material Selection Criterion against Damping
- Lecture 8 - Design for Enhanced Material Damping
- Lecture 9 - Linear Viscoelastic Materials and Models
- Lecture 10 - Maxwell and 3-Parameter Models
- Lecture 11 - Complex modulus and Applications of VEM
- Lecture 12 - Basics of Dynamic Vibration Absorber
- Lecture 13 - Modelling of Dynamic Vibration Absorber
- Lecture 14 - Proof mass Actuator
- Lecture 15 - Springs for Vibration Isolation
- Lecture 16 - Introduction to Active Vibration Control
- Lecture 17 - Basics of Classical Control System
- Lecture 18 - Basics of State Space Control
- Lecture 19 - Controllability and Observability of System
- Lecture 20 - Full State Feedback Control
- Lecture 21 - SMSS Laboratory Demonstration

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Lecture 3 - Lesson 3 - Nature Of Sound

Lecture 4 - Lesson 4 - The Decibel scale

Lecture 5 - Lesson 5 - Key Terms In Acoustics

Lecture 6 - Lesson 6 - Adding Decibels

Lecture 7 - Lesson 1 - Important Mathematical Concepts-Complex Algebra

Lecture 8 - Lesson 2 - Important Mathematical Concepts-Complex Time Signals

Lecture 9 - Lesson 3 - Important Mathematical Concepts-Transfer Function

Lecture 10 - Lesson 4 - Important Mathematical Concepts-Pole Zero Plot

Lecture 11 - Lesson 5 - Important Mathematical Concepts - Bode Plot For Simple Pole

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Lecture 13 - Lesson 1 - Bode Plots (Magnitude) for Complex Transfer Functions

Lecture 14 - Lesson 2 - Momentum Equation for 1-D Sound Propagation

Lecture 15 - Lesson 3 - Continuity Equation for 1-D Sound Propagation

Lecture 16 - Lesson 4 - Gas Law for 1-D Sound Propagation

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Lecture 18 - Lesson 6 - Solution for 1-D Wave Equation

Lecture 19 - Lesson 1 - Waveguide

Lecture 20 - Lesson 2 - Transmission Line Equations - Part I

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Lecture 23 - Lesson 5 - Transmission Line Equations - Part IV

Lecture 24 - Lesson 6 - Transmission Line Equations - Part V

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Lecture 26 - Lesson 2 - Instantaneous Power in a L-R Circuit

Lecture 27 - Lesson 3 - Power Factor, and Acoustic Power

Lecture 28 - Lesson 4 - Power Flow into an Infinitely Long Tube

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Lecture 30 - Lesson 6 - Relations for Outward Travelling Spherical Acoustic Wave

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[Lecture 38 - Lesson 2 - Interference of sound sources - Part II](#)

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[Lecture 42 - Lesson 6 - Complex power, pressure and velocity for a spherical source](#)

[Lecture 43 - Lesson 1 - Noise reduction - Mass Attenuation Method](#)

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[Lecture 61 - Lesson 1 - Measuring Sound Signals](#)

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Lecture 1 - Recap - I

Lecture 2 - Recap - II

Lecture 3 - Recap - III

Lecture 4 - Determination of Phase Diagram (Experimentally) - I

Lecture 5 - Determination of Phase Diagram (Experimentally) - II

Lecture 6 - Determination of Phase Diagram (Thermodynamically)

Lecture 7 - Effect of pressure on phase transformation temperature and concept of equilibrium between condensed and vapor phase

Lecture 8 - Effect of different parameters on heat treatment and concept of saturation vapor pressure with examples

Lecture 9 - Title: Formation of ideal solid or liquid solution and (G-X) diagrams for ideal solutions (Part-I)

Lecture 10 - G-X diagrams (Part- II) and concept of chemical potential (Micro Sign) from G-X diagrams.

Lecture 11 - Concept of common tangent for equilibrium between two phases

Lecture 12 - Expressions for equilibrium of two phases - I

Lecture 13 - Expressions for equilibrium of two phases - II

Lecture 14 - Expressions for equilibrium of two phases - III

Lecture 15 - Determining nucleation of phases using G-X plot

Lecture 16 - $\hat{\Delta}G$ for nucleation and overall transformation, concepts of solid state transformation including precipitation and Quasi-Chemical Model (QCM)

Lecture 17 - Introduction to real solutions and expression of \hat{H}_{mix} based on the Quasi-Chemical Model (QCM)

Lecture 18 - Expression for \hat{H}_{mix} as a function of interaction energy and mole fraction, based on the QCM - Part I

Lecture 19 - Expression for \hat{H}_{mix} as a function of interaction energy and mole fraction, based on the QCM - Part II

Lecture 20 - Graphical representation of \hat{H}_{mix} , \hat{G}_{mix} , and $-T\hat{S}_{mix}$ for real solutions and evolution of eutectic phase diagram from the G-X plots

Lecture 21 - Effect of \hat{H}_{mix} on determination of phase diagrams (same crystal structure)

Lecture 22 - Effect of \hat{H}_{mix} on determination of phase diagrams (Continued...)

Lecture 23 - Importance of phase diagrams

Lecture 24 - Effect of heat treatment on microstructure evolution in steel - I

Lecture 25 - Effect of heat treatment on microstructure evolution in steel - II

Lecture 26 - Recap of homogeneous and heterogeneous nucleation for solid to solid transformation

Lecture 27 - Nucleation rate and its dependence on T (temp. of interest), \hat{I}^*T , \hat{I}^*G^* and \hat{I}^*G^* and, introduction to growth kinetics

Lecture 28 - Growth kinetics (Continued...)

Lecture 29 - Growth rate variation with undercooling and kinetics of overall phase transformation

Lecture 30 - Implication of Avrami's equation with example on excel spreadsheet

Lecture 31 - Experimental verification of Avrami Equation

Lecture 32 - Linear regression (least squares) method to find the value of n and k in Avrami equation

Lecture 33 - In this lecture, method to determine the goodness of fit has been explained. Procedure to estimate the values of n and k from experimental data have also been discussed.

Lecture 34 - Stereology and quantitative metallography - I

Lecture 35 - Stereology and quantitative metallography - II

Lecture 36 - Grain size measurements methods

Lecture 37 - Statistical tools for analysis and reporting of obtained data with examples

Lecture 38 - Evolution of TTT and CCT diagram from f vs. t plots

Lecture 39 - TTT, CCT continue and hardenability of steel

Lecture 40 - Importance of heat treatment practices in real life (with examples)

Lecture 1 - Brief Introduction

Lecture 2 - Define Phase, Equilibrium

Lecture 3 - Free Energy, Stability of Phases

Lecture 4 - Gibbs Free Energy of Binary Solution

Lecture 5 - Ideal Solution and Chemical Potential

Lecture 6 - Thermodynamics of solid solutions

Lecture 7 - G vs X curves

Lecture 8 - Solid solutions: Types

Lecture 9 - Heterogeneous phase equilibria

Lecture 10 - G vs X curves for eutectic system

Lecture 11 - G-X plot for peritectic system

Lecture 12 - Effect of temperature of solid solubility, Influence of interfaces on Equilibrium

Lecture 13 - Introduction of Diffusion

Lecture 14 - Mechanism of Diffusion, Fick's I law

Lecture 15 - Fick's II law

Lecture 16 - Fick's II law (Continued...), Diffusion and Temperature

Lecture 17 - Interfacial Free Energy, Solid/Vapor Interface

Lecture 18 - Boundaries in single phase solids

Lecture 19 - High angle grain boundaries, Equilibrium in poly-crystalline materials, Interphase interfaces in solids

Lecture 20 - Interphase interfaces in solids (Continued...)

Lecture 21 - CSL Boundaries

Lecture 22 - Types of Nucleations

Lecture 23 - Homogeneous Nucleation

Lecture 24 - Homogeneous Nucleation (Continued...)

Lecture 25 - Heterogeneous Nucleation

Lecture 26 - Heterogeneous nucleation (Continued...)

Lecture 27 - Growth

Lecture 28 - Atomic mechanism of growth

Lecture 29 - Dendritic Solidification

Lecture 30 - Growth rate for dendrite formation

Lecture 31 - Alloy solidification

- [Lecture 32 - Alloy solidification \(Continued...\)](#)
- [Lecture 33 - Eutectic: Solidification](#)
- [Lecture 34 - Eutectic: solidification \(Continued...\)](#)
- [Lecture 35 - Solidification of casting / ingot](#)
- [Lecture 36 - Precipitation hardenable alloy](#)
- [Lecture 37 - Precipitation age- hardening alloy \(Continued...\)](#)
- [Lecture 38 - Age hardening alloy](#)
- [Lecture 39 - Eutectoid transformation](#)
- [Lecture 40 - Eutectoid transformation \(Continued....\)](#)
- [Lecture 41 - Eutectoid transformation in steel \(Continued...\)](#)
- [Lecture 42 - Martensite](#)
- [Lecture 43 - Martensite \(Continued...\)](#)
- [Lecture 44 - Martensite \(Continued...\) and TTT curves](#)
- [Lecture 45 - TTT diagram](#)
- [Lecture 46 - Recovery, Recrystallization and Grain growth](#)
- [Lecture 47 - Recovery](#)
- [Lecture 48 - Recrystallization](#)
- [Lecture 49 - Recrystallization \(Continued...\)](#)
- [Lecture 50 - Introduction to spinodal decomposition](#)

Lecture 1 - Introduction to Composites

Lecture 2 - Matrices

Lecture 3 - Fiber reinforcements

Lecture 4 - Fiber reinforcements (Continued...)

Lecture 5 - Composites properties

Lecture 6 - Composites testing

Lecture 7 - Selection of material

Lecture 8 - Selection of material (Continued...)

Lecture 9 - Design for Manufacturing

Lecture 10 - Design for Manufacturing (Continued...)

Lecture 11 - Composite Manufacturing Processes

Lecture 12 - Filament winding Processes

Lecture 13 - Resin transfer moulding

Lecture 14 - Pultrusion

Lecture 15 - Compression Moulding Process

Lecture 16 - Vacuum Impregnation Methods

Lecture 17 - Stacking of Composites

Lecture 18 - Thermoplastic Composites Manufacturing Processes - Part 1

Lecture 19 - Thermoplastic Composites Manufacturing Processes - Part 2 (Continued...)

Lecture 20 - Non-destructive testing methods for composite materials

Lecture 21 - Metal Matrix Composites

Lecture 22 - Metal Matrix Composites applications (Continued...)

Lecture 23 - Processing of Metal Matrix Composites - Part 1

Lecture 24 - Processing of Metal Matrix Composites - Part 2

Lecture 25 - Ceramic Matrix Composites

Lecture 26 - Fabrication of Ceramic Matrix Composites (CMCs)

Lecture 27 - Carbon - Carbon Composites

Lecture 28 - Polymer Matrix and Nano Composites

Lecture 29 - Machining of Composites

Lecture 30 - Repair of Composites

Lecture 31 - Manufacturing Processes: Selection and Considerations

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[Lecture 40 - Industrial accidents](#)

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[Lecture 51 - Applications of Biomechanics](#)

[Lecture 52 - Problem solving - 1](#)

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[Lecture 54 - Problem solving - 3](#)

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[Lecture 2 - Basics of Production \(Continued...\)](#)

[Lecture 3 - Sustainability and Manufacturing](#)

[Lecture 4 - Introduction to Simulation](#)

[Lecture 5 - Introduction to Simulation \(Continued...\)](#)

[Lecture 6 - Basic Statistical Concepts for Sustainable Manufacturing Analysis](#)

[Lecture 7 - Basic Statistical Concepts for Sustainable Manufacturing Analysis \(Continued...\)](#)

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[Lecture 9 - Life Cycle Assessment Elements](#)

[Lecture 10 - Life Cycle Assessment Procedure](#)

[Lecture 11 - Life Cycle Assessment \(Continued...\)](#)

[Lecture 12 - Sustainability Framework](#)

[Lecture 13 - Basic Modeling Concepts for Factory Simulation](#)

[Lecture 14 - Basic Modeling Concepts for Factory Simulation \(Continued...\)](#)

[Lecture 15 - Green Manufacturing Modelling: Metrics for Green Manufacturing](#)

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[Lecture 17 - Green Manufacturing Modelling \(Continued...\) Developing Green Manufacturing System](#)

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[Lecture 30 - Sustainability and Green Manufacturing System](#)

Lecture 1 - Course Overview

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Lecture 3 - Nature Of Sound

Lecture 4 - Beats

Lecture 5 - The Decibel Scale

Lecture 6 - Key Terms in Acoustics

Lecture 7 - Decibel Scale - Part 1

Lecture 8 - Decibel Scale - Part 2

Lecture 9 - Decibel Scale - Part 3

Lecture 10 - Complex Numbers

Lecture 11 - Complex Time Function

Lecture 12 - Linear Systems

Lecture 13 - Transfer Functions

Lecture 14 - Introduction to One Dimensional Wave Equation

Lecture 15 - The Momentum Equation

Lecture 16 - The Continuity Equation and The Gas Law

Lecture 17 - One Dimensional Wave Equation

Lecture 18 - Solution for One Dimensional Wave Equation

Lecture 19 - Transmission Line Equations

Lecture 20 - One Dimensional Example Problems

Lecture 21 - Impedance

Lecture 22 - Pressure Wave Travels in a Closed Tube

Lecture 23 - Standing Wave Formation in a Closed Tube With Rigid Termination

Lecture 24 - Pressure Wave Travels in an Open Tube

Lecture 25 - 1-D sound wave propagation: Kundt's tube - I

Lecture 26 - 1-D sound wave propagation: Kundt's tube - II

Lecture 27 - Radially propagating sound waves in spherical coordinate system - I

Lecture 28 - Radially propagating sound waves in spherical coordinate system - II

Lecture 29 - Complex impedance for radially propagating sound waves in spherical coordinate system

Lecture 30 - Volume velocity - I

Lecture 31 - Interference of 1-D spherically propagating sound waves - I

- Lecture 32 - Interference of 1-D spherically propagating sound waves - II
- Lecture 33 - Noise sources and introduction to microphones
- Lecture 34 - Classification of microphones - I
- Lecture 35 - Classification of microphones - II
- Lecture 36 - Classification of microphones - III
- Lecture 37 - Microphone Parameters
- Lecture 38 - Understanding microphone specifications
- Lecture 39 - Noise Source: Terminology
- Lecture 40 - Noise Source: Sound Attenuation
- Lecture 41 - Noise Source: Sound Pressure Level due to a noise source located outdoors
- Lecture 42 - Noise Source: Role of reflecting surfaces
- Lecture 43 - Noise Source: Sound Pressure Level due to a noise source located indoors - Part I
- Lecture 44 - Noise Source: Sound Pressure Level due to a noise source located indoors - Part II
- Lecture 45 - Measuring Sound Power Level - Understanding standard octave bands
- Lecture 46 - Measuring Sound Power Level - Fan noise - Part I
- Lecture 47 - Measuring Sound Power Level - Fan noise - Part II
- Lecture 48 - Measuring Sound Power Level - Fan noise - Part III
- Lecture 49 - Weighting
- Lecture 50 - Noise coming from Motors
- Lecture 51 - Noise coming from Motors and Pumps
- Lecture 52 - Noise coming from Pump and Motor Working Simultaneously
- Lecture 53 - Noise coming from Compressors
- Lecture 54 - Example problems regarding Noise coming from Compressor
- Lecture 55 - Noise Spread Mechanisms
- Lecture 56 - Reverberation time
- Lecture 57 - Reverberation time example problem
- Lecture 58 - Noise from Adjacent Room
- Lecture 59 - Acoustic Enclosures
- Lecture 60 - Acoustic Enclosures - Example Problems
- Lecture 61 - Large acoustical enclosures - I
- Lecture 62 - Large acoustical enclosures - II
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- Lecture 38 - Rapid Manufacturing - Part 1
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- Lecture 40 - Laboratory demonstration, Rapid Manufacturing - Part 1
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- Lecture 42 - Laboratory Demonstration, CAD using Fusion 360, an introduction
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- Lecture 44 - Material Handling
- Lecture 45 - Laboratory Demonstration, Plant Simulation software - Part 1
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- Lecture 48 - Computers in Manufacturing Industry, current scenario - Part 1
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- Lecture 50 - Computers in Manufacturing Industry, current scenario - Part 3

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Lecture 2 - Mechanism of plastic deformation

Lecture 3 - Basic machining parameters, Cutting Tools and Types of Machining

Lecture 4 - Types of Chips, Tool nomenclature and tool angles

Lecture 5 - Tool Nomenclature in Normal Rake System and conversion of angles

Lecture 6 - Selection of Tool angles

Lecture 7 - Forces in machining, Merchant's Circle Diagram

Lecture 8 - Stress, Strain and Strain Rate and Shear Plane Angle

Lecture 9 - Numerical Examples; Lee and Shaffer's model

Lecture 10 - Friction in metal cutting: Zorev's Friction Model

Lecture 11 - Practical Machining Operations

Lecture 12 - Slab Milling; Measurement of Cutting Forces

Lecture 13 - Dynamometers; Tool Wear and Tool Life

Lecture 14 - Factors affecting tool life; Abrasive Machining Processes

Lecture 15 - Mechanics of Grinding Process

Lecture 16 - Chip length and specific energy in Grinding

Lecture 17 - Grinding wheel wear; Oblique Cutting

Lecture 18 - Rake angles in oblique cutting; Economics of Machining

Lecture 19 - Economics of Machining (Continued...); Thermal aspects of machining

Lecture 20 - Surface finish

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[Lecture 6 - Architecture of the Brain \(Continued...\)](#)

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Lecture 2 - Robot Joints and Work Volume

Lecture 3 - Spatial transformations

Lecture 4 - Homogenous Transformtions

Lecture 5 - Practice Problems with MATLAB in Rotation matrices

Lecture 6 - Kinematics: Derivation of Link Transformations

Lecture 7 - Problem Solving DH Parameters

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Lecture 9 - Inverse Kinematics

Lecture 10 - Problems in Kinematics

Lecture 11 - Inverse Kinematics of PUMA Robot

Lecture 12 - Jacobian and Singularity

Lecture 13 - Velocity and Static Forces

Lecture 14 - Dynamics - Lagrangian Euler

Lecture 15 - Newton Euler Dynamics

Lecture 16 - Trajectory Planning

Lecture 17 - Inverse Dynamics using MATLAB

Lecture 18 - Sensors

Lecture 19 - Actuators and Basic Control System

Lecture 20 - Block Diagram Reduction and Position Regulator

Lecture 21 - Control of a single joint

Lecture 22 - Non Linear Control of Manipulators

Lecture 23 - Force Control

Lecture 24 - Manipulator Mechanism Design

Lecture 25 - Industrial Robots and Applications

Lecture 26 - Specifications and Programming

Lecture 27 - VAL programming

Lecture 28 - Experiment With PUMA Robot Using VAL- II

Lecture 1 - Introduction to Acoustic Wave Propagation

Lecture 2 - D'Alembert's solution and 1-D Continuity equation

Lecture 3 - Muffler Acoustics-Application to Automotive Exhaust Noise Control

Lecture 4 - Linearization of governing equations, and Development of 1-D Acoustic wave and Helmholtz equation

Lecture 5 - Solution of 1-D Helmholtz equation: Propagation in 1-D ducts/pipes

Lecture 6 - 1-D Acoustic Wave Equation in Ducts Carrying Uniform Mean Flow: Derivation

Lecture 7 - 1-D Acoustic Wave Equation in Ducts Carrying Uniform Mean Flow: Solution

Lecture 8 - 3-D Acoustic Wave Equation in Rectangular and Circular Waveguides: Derivation, Modal Solution and Concept of Cut-on Frequency

Lecture 9 - Sound Pressure Level, Intensity Level and Sound Power Level

Lecture 10 - Acoustic Impedance and Reflection Coefficient

Lecture 11 - Lumped System Analysis: Inertance and Compliance

Lecture 12 - Lumped Analysis of a Uniform Pipe Closed/Open at an End, Concept of End Correction

Lecture 13 - Helmholtz Resonator, Electro-Acoustic Analogy and Layout of a typical engine exhaust system

Lecture 14 - Muffler Performance Measures: Insertion Loss

Lecture 15 - Muffler Performance Measures: Transmission Loss and Level Difference

Lecture 16 - Lumped Analysis of a Tube, Simple Area Discontinuity and Transfer Matrices

Lecture 17 - Sudden area Discontinuity (Continued...)

Lecture 18 - Simple Expansion Chamber Analysis Using Transfer Matrix Method

Lecture 19 - Transmission Loss (TL) Graph for a Simple Expansion Muffler (MATLAB)

Lecture 20 - Extended-Inlet and Extended-Outlet Muffler Analysis

Lecture 21 - Extended-Inlet and Extended-Outlet Muffler Analysis (Continued...)

Lecture 22 - TL Analysis of Extended-Inlet and Extended-Outlet Muffler (MATLAB)

Lecture 23 - TL Analysis of Side-Inlet and Side-Outlet Muffler Using Transfer Matrix Method

Lecture 24 - Wave Propagation in Gradually Varying Area Ducts: Webster's Horn Equation

Lecture 25 - Webster's Horn Equation (Continued...) and Exponential Ducts

Lecture 26 - Solution of Webster's Horn Equation for Conical Ducts

Lecture 27 - TL analysis for Conical Muffler Configurations (MATLAB)

Lecture 28 - Segmentation Approach for Analysing Gradually Varying Area Ducts (MATLAB)

Lecture 29 - Acoustic Intensity (Energy Flux) in a Pipe with Mean Flow, and Transmission Loss Expression

Lecture 30 - Aeroacoustic State Variables Transfer Matrix for a Tubular Element (Uniform Pipe)

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Lecture 31 - Transfer Matrix for Extended-Inlet and Outlet Element and Use of Perforated Elements in Commercial Mufflers

Lecture 32 - Two-interacting Duct Configurations: Development of Equations and Concentric Tube Resonators

Lecture 33 - Concentric Tube Resonator: Partially Perforated Pipe or Airway (MATLAB)

Lecture 34 - Review of Perforate Impedance Expressions

Lecture 35 - MATLAB Demonstration for Fully and Partially Perforated CTR

Lecture 36 - Cross-Flow elements: Setting-up the Equations

Lecture 37 - Cross-Flow elements: MATLAB Demonstration for Simple Configurations

Lecture 38 - Plug Mufflers, Three-pass Perforated Element Muffler (Commercial Configurations) - MATLAB

Lecture 39 - Multiply-Connected Mufflers: HQ Tubes

Lecture 40 - TL Analysis of HQ Tubes (MATLAB): Network Analysis and Analytical Formula

Lecture 41 - Transmission Loss in terms of Scattering and Impedance Matrix Parameters

Lecture 42 - Rectangular Chamber Muffler: Characterization and TL Analysis using 3-D Piston-driven Model

Lecture 43 - Circular Chambers: Characterization and TL Analysis Using 3-D Piston-driven Model

Lecture 44 - Analytical Mode-Matching for Extended-Inlet and Outlet Muffler: Setting-up of the Equations

Lecture 45 - MATLAB Demonstration for Transmission Loss Calculations

Lecture 46 - Dissipative Mufflers (Lined Circular duct) - A Brief Discussion

Lecture 47 - Summary of the Topics Covered in This Course, Topics to be Covered in a Future Course

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Lecture 3 - Patterns and Moulds

Lecture 4 - Sand Mould and Gating System

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Lecture 10 - Expendable Mould Casting Processes

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Lecture 12 - Various Casting Processes and Cost Analysis

Lecture 13 - Cost analysis, Casting Defects and Product Design

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Lecture 20 - Gas Welding, Brazing and Soldering, Welding Defects

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- Lecture 2 - Finite Difference Method - Basic Idea of Discretization
- Lecture 3 - Explicit and Implicit Formulations, Stability Analysis - Part 1
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- Lecture 12 - Introduction to Finite Element Method (Preliminary Concepts)
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- Lecture 15 - Vorticity Stream Function Approach (Formulation and Algorithm)
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- Lecture 17 - Solving Navier-Stokes Equations For Incompressible Flows using SIMPLE Algorithm - Part 1
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- Lecture 20 - MAC Algorithm (Pressure - Velocity Iteration and the Solution)
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- Lecture 5 - Metal Machining-2: Mechanism of plastic deformation
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NPTEL : Fluid Mechanics (Mechanical Engineering)

Co-ordinators : Prof. S.K. Som

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Lecture 7 - Stepper motors, Permanent magnet DC motors

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Lecture 19 - Cutter Path Generation (Concluding Part) and Current Status - CNC Machining and Related Processes

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**NPTEL : NOC:Non Traditional Abrasive Machining Processes - Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining
(Mechanical Engineering)**

Co-ordinators : Prof. Asimava Roy Choudhury

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Lecture 3 - Ultrasonic Machining (Continued...)

Lecture 4 - Ultrasonic Machining - Free Impacts and Problem Solving

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Lecture 7 - USM - Horn Design (Continued...)

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Lecture 9 - Ultrasonic Machining - Effects of Various Inputs on the Output

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Lecture 11 - A JM (Abrasive jet machining)

Lecture 12

Lecture 13 - A JM - Numerical problems

Lecture 14 - A JM - Process Parameters and Response Characteristics take - home assignment discussing

Lecture 15 - A JM - MCQs

Lecture 16

Lecture 17 - AWJM - Equipment

Lecture 18 - AWJM - Numerical Problems

Lecture 19 - AWJM - Application Equipment Details

Lecture 20 - AWJM - MCQs

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- Lecture 2 - Streamlines, Streakline and Pathline
- Lecture 3 - Acceleration of fluid flow
- Lecture 4 - Deformation and Conservation of mass of fluid a element
- Lecture 5 - Angular deformation of a fluid element, vorticity and streamfunction and velocity potential
- Lecture 6 - Euler's equation
- Lecture 7 - Bernoulli's Equation - Part I
- Lecture 8 - Bernoulli's Equation - Part II
- Lecture 9 - Reynolds Transport Theorem (RTT)
- Lecture 10 - Application of Conservation of Mass
- Lecture 11 - Application of RTT: Conservation of Linear Momentum
- Lecture 12 - Application of RTT in Accelerating Reference Frames
- Lecture 13 - Navier's Equation of Motion
- Lecture 14 - Derivation of Navier-Stokes Equation
- Lecture 15 - Derivation of Navier-Stokes Equation (Continued...)
- Lecture 16 - Derivation of Navier-Stokes Equation (Continued...)
- Lecture 17 - Fully developed flow between two parallel plates
- Lecture 18 - Force on a surface immersed in fluid - Part III, Stability of solid bodies in fluid - Part I
- Lecture 19 - Couette flow
- Lecture 20 - Flow with interfaces
- Lecture 21 - Thin film flow on an inclined plane and Hagen-Poiseuille flow
- Lecture 22 - Hagen-Poiseuille flow (Continued...)
- Lecture 23 - Flow between two rotating cylinders
- Lecture 24 - Stokes 1st problem
- Lecture 25 - Stokes 2nd problem
- Lecture 26 - Introduction to turbulence: basic concepts
- Lecture 27 - Eddies
- Lecture 28 - Eddies (Continued...) and Vortex shredding
- Lecture 29 - Statistical description of turbulent flows
- Lecture 30 - Reynolds stress
- Lecture 31 - Reynolds averaged Navier Stokes equation (RANS)

- Lecture 32 - Bernoulli's equation - Part I
- Lecture 33 - Bernoulli's equation - Part II
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- Lecture 35 - Euler's equation in streamline coordinates
- Lecture 36 - Flow over a flat plate: Blasius equation
- Lecture 37 - Momentum integral method for boundary layer analysis
- Lecture 38 - Approximate solution of the momentum integral equation
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- Lecture 42 - Resultant force on a body immersed in a fluid under motion
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- Lecture 44 - Examples of Potential flow
- Lecture 45 - Some more examples of Potential flows, Lift and Drag force
- Lecture 46 - Applications of lift and drag force
- Lecture 47 - Some examples of flow past immersed bodies
- Lecture 48 - Sports Ball aerodynamics
- Lecture 49 - Introduction to compressible flows
- Lecture 50 - Significance of Mach number
- Lecture 51 - Navier-Stokes equation - Part I
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- Lecture 54 - Navier-Stokes equation - Part IV
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- Lecture 60 - Principle of Similarity and Dynamical Analysis - Part II

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Lecture 2 - Simple Gear Calculations

Lecture 3 - Gear Geometry

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Lecture 6 - Numerical Problem Milling of Helical Gears

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- Lecture 6 - Zeroth Law of Thermodynamics
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- Lecture 8 - First law of thermodynamics for closed systems - Part II, some examples
- Lecture 9 - Tutorial 2: First law of thermodynamics for closed systems
- Lecture 10 - First law of thermodynamics for open systems
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- Lecture 21 - Review of learning concepts

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Lecture 2 - Introduction to waste heat recovery (Continued...)

Lecture 3 - Introduction to waste heat recovery (Continued...)

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Lecture 5 - Thermodynamic principles of waste heat recovery

Lecture 6 - Thermodynamic principles of waste heat recovery (Continued...)

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Lecture 13 - Entropy (Continued...), Exergy

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Lecture 15 - Second Law efficiency (Continued...)

Lecture 16 - Recapitulation of common power cycles

Lecture 17 - Recapitulation of common power cycles (Continued...)

Lecture 18 - Recapitulation of common power cycles (Continued...)

Lecture 19 - Recapitulation of common power cycles (Continued...)

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Lecture 23 - Combined cycle

Lecture 24 - Combined cycle (Continued...)

Lecture 25 - Combined Cycle (Continued...)

Lecture 26 - Heat recovery steam generator

Lecture 27 - Thermodynamic cycles for low temperature application

Lecture 28 - Thermodynamic cycles for low temperature application (Continued...), Cogeneration

Lecture 29 - Heat Exchanger

Lecture 30 - Heat Exchanger (Continued...)

Lecture 31 - Heat Exchanger (Continued...)

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Elements of Metal Cutting, Machine tools, Gear Cutting and CNC Machining (Mechanical Engineering)

Co-ordinators : Prof. Asimava Roy Choudhury

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NPTEL : Rocket Propulsion (Mechanical Engineering)

Co-ordinators : Prof. K. Ramamurthi

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NPTEL : NOC:Design for Quality, Manufacturing and Assembly (Mechanical Engineering)

Co-ordinators : Prof. Palaniappaan Ramu

Lecture 1 - Introduction to DfX

Lecture 2 - Introduction to Quality

Lecture 3 - Introduction to Robustness

Lecture 4 - Introduction to Six Sigma Concept

Lecture 5 - Recap and clarifications of basic concepts

Lecture 6 - Review of Six Sigma and Quality Loss Function (QLF)

Lecture 7 - Types of QLF and SN Ratio

Lecture 8 - Linking Quality and Robustness

Lecture 9 - Design for Six Sigma - Stages, Design of Experiments

Lecture 10 - Introduction To Design Of Experiments

Lecture 11 - Need for DoE and basic DoE methods

Lecture 12 - Factorial Design

Lecture 13 - Orthogonal Array- L4 and L8 example

Lecture 14 - Setting up an Orthogonal Array

Lecture 15 - Confounding OA and Resolution Table

Lecture 16 - Confounding Logic and Randomization of Experiments

Lecture 17 - Paper Helicopter Case Study - Part I

Lecture 18 - Paper Helicopter Case Study - Part II

Lecture 19 - Introduction To Injection Molding Process, Materials, Terminologies Related To Plastic Parts and Design Guidelines

Lecture 20 - Estimation of Mold Cost for Injection Molding (Dixon and Poli's Method)

Lecture 21 - Estimation of Mold Cost for Injection Molding (Dixon and Poli's Method) (Continued...)

Lecture 22 - Mold Cost Estimation - Tutorial

Lecture 23 - Design for Additive Manufacturing

Lecture 24 - Demo

Lecture 25 - Introduction to Sustainable Development and Sustainability Indicators - Part 1

Lecture 26 - Introduction to Sustainable Development and Sustainability Indicators - Part 2

Lecture 27 - Introduction to design process

Lecture 28 - Accounting for manufacturability and assembly in design - An overview

Lecture 29 - DfMA in product design

Lecture 30 - General design guidelines for manual assembly

Lecture 31 - Systematic DFA methodology

[Lecture 32 - Alpha symmetry, Beta symmetry](#)

[Lecture 33 - Quantification of part size and thickness](#)

[Lecture 34 - Systematic DFA Case study - controller assembly](#)

[Lecture 35 - DFA examples and discussion](#)

[Lecture 36 - Xerox Producibility Index \(XPI\)](#)

[Lecture 37 - High Speed and Robotic Assembly](#)

[Lecture 38 - Sheet Metal Working](#)

[Lecture 39 - Overview of DoE Workflow](#)

[Lecture 40 - DFA Software](#)

[Lecture 41 - DFM Software and Case Studies](#)

Lecture 1 - Overview and Motivation of Course

Lecture 2 - Basic Optimization Problem Formulation

Lecture 3 - Problem Formulation Example

Lecture 4 - Calculus related to Optimization

Lecture 5 - The big picture - Overview

Lecture 6 - Introduction to DOE - 1

Lecture 7 - Introduction to DOE - 2

Lecture 8 - Types of DOE - 1

Lecture 9 - Types of DOE - 2 and some examples

Lecture 10 - Introduction to surrogate modeling

Lecture 11 - Types of surrogate - Polynomial models

Lecture 12 - Radial basis function - 1

Lecture 13 - Radial basis function - 2

Lecture 14 - Kriging - 1

Lecture 15 - Kriging - 2

Lecture 16 - Metamodels for Safe and Efficient Automotive Structures

Lecture 17 - Exploration and Exploitation in Surrogates

Lecture 18 - Errors Based Exploration

Lecture 19 - Ensemble of Surrogates

- Lecture 1 - Concept of Steel Quality
- Lecture 2 - Typical Examples of Surface Defects
- Lecture 3 - Origin of Common Quality Problems
- Lecture 4 - Present Scenario on Quality Demands
- Lecture 5 - Control of Residuals and Impact on Quality
- Lecture 6 - Non-Metallic Inclusions
- Lecture 7 - Evaluation of Residuals and Inclusions
- Lecture 8 - Cleanliness Requirements for Different applications
- Lecture 9 - Limitation of Primary Steelmaking and Importance of secondary Refining
- Lecture 10 - Deoxidation
- Lecture 11 - Prevention of Slag carryover
- Lecture 12 - Desulphurisation
- Lecture 13 - Degassing
- Lecture 14 - Secondary Refining Processes
- Lecture 15 - Injection of Calcium
- Lecture 16 - Decarburisation
- Lecture 17 - Cleanliness Measures in Ladle and Tundish
- Lecture 18 - Cleanliness Measures in Mould
- Lecture 19 - Different Routes and Temperature Control
- Lecture 20 - Nature and Distribution of Entrapments in Casting
- Lecture 21 - Sources of Exogenous Entrapments
- Lecture 22 - Effect of Vertical vis-a-vis Curved Mould
- Lecture 23 - Quality of Cast Product
- Lecture 24 - Role of Concast Process, Caster Design and Steel Grade
- Lecture 25 - Primary Cooling in Caster Mould
- Lecture 26 - Heat Transfer in Mould
- Lecture 27 - Cast Structure and Dendrite Size
- Lecture 28 - Role of Mould Oscillation
- Lecture 29 - Role of Chemistry - Part I
- Lecture 30 - Role of Chemistry - Part II
- Lecture 31 - Role of Segregation - Part I

[Lecture 32 - Role of Segregation - Part II](#)

[Lecture 33 - Deleterious Effect of Phosphorus](#)

[Lecture 34 - Strength of Solidifying Strand](#)

[Lecture 35 - Brittle Zone Near Solidus](#)

[Lecture 36 - Strength and Toughness of Solid Shell](#)

[Lecture 37 - Role of Chemistry on Solidification Behaviour](#)

[Lecture 38 - Sticking vis-a-vis Depression Behaviour](#)

[Lecture 39 - Role of Chemistry on Bulging or Depression Tendency - Part I](#)

[Lecture 40 - Role of Chemistry on Bulging or Depression Tendency - Part II](#)

[Lecture 41 - Effect of Cast Grain Size](#)

[Lecture 42 - Brittle Temperature Regions](#)

[Lecture 43 - Role of Secondary Cooling - Part 1](#)

[Lecture 44 - Role of Secondary Cooling - Part 2](#)

[Lecture 45 - Typical Cracks and Defects - Part I](#)

[Lecture 46 - Typical Cracks and Defects - Part II](#)

[Lecture 47 - Remedial Measures to Control Defects - Part I](#)

[Lecture 48 - Remedial Measures to Control Defects - Part II](#)

[Lecture 49 - Remedial Measures to Control Defects - Part III](#)

[Lecture 50 - Grade - Specific Casting Parameters - Part I](#)

[Lecture 51 - Grade - Specific Casting Parameters - Part II](#)

[Lecture 52 - Identification of Genesis of Quality Problems Through Metallographic Investigation - Part I](#)

[Lecture 53 - Identification of Genesis of Quality Problems Through Metallographic Investigation - Part II](#)

[Lecture 54 - Identification of Genesis of Quality Problems Through Metallographic Investigation - Part III](#)

[Lecture 55 - Some Examples of Quality Problems](#)

- Lecture 1 - Review of Kinematics Fundamentals-I
- Lecture 2 - Links, Pairs, Kinematic Chains; Planar Mobility Criterion
- Lecture 3 - Mobility of Mechanisms, Grubler's Criterion and Applications
- Lecture 4 - Inversions, Grashof Criterion, Kinematic equivalence
- Lecture 5 - Linkage Synthesis Classification, 2-position Motion Generation
- Lecture 6 - Driver dyad, Quick-return synthesis - I
- Lecture 7 - Quick-return synthesis - II, 3-position Motion Generation
- Lecture 8 - Specified fixed pivots, Path generation
- Lecture 9 - Function generation
- Lecture 10 - Function generation using relative poles
- Lecture 11 - Structural Error, and Chebyshev Spacing
- Lecture 12 - Chebyshev Spacing
- Lecture 13 - Analytical Linkage Synthesis-I: Vector Loop Closure, Freudenstein's method
- Lecture 14 - Analytical Linkage Synthesis-II: Bloch's method, Driver Dyad
- Lecture 15 - Four-bar Position Analysis, Dyad or Standard Form Synthesis
- Lecture 16 - Dyad Form Synthesis: Motion Generation
- Lecture 17 - Dyad Form Synthesis: Path and Function Generation
- Lecture 18 - Dyad Form Synthesis: Multi loop linkages
- Lecture 19 - Dyad Form Synthesis: Four Position Motion Generation
- Lecture 20 - Coupler Curves - I
- Lecture 21 - Coupler Curves - II, Fixed and Moving Centroides
- Lecture 22 - Coupler Curves - III, Symmetrical Coupler Curves
- Lecture 23 - Roberts-Chebyshev Theorem
- Lecture 24 - Cognates
- Lecture 25 - Velocity Analysis: Review of Velocity Polygons
- Lecture 26 - Velocity Analysis: Velocity Polygons (Continued...) and Instant Centres
- Lecture 27 - Velocity Analysis: Auxiliary Point Method
- Lecture 28 - Auxiliary Point Method: (Continued...)
- Lecture 29 - Velocity and Acceleration Analysis: Analytical Method
- Lecture 30 - Acceleration Analysis: Analytical Method (Continued...)
- Lecture 31 - Acceleration Analysis: Auxiliary Point Method

[Lecture 32 - Force Analysis of Mechanisms, Mechanical Advantage](#)

[Lecture 33 - Force Analysis of Mechanisms - II](#)

[Lecture 34 - Balancing of Mechanisms using Counterweights](#)

[Lecture 35 - Balancing of Mechanisms using Springs](#)

[Lecture 36 - Spatial Mechanisms](#)

[Lecture 37 - Introduction to the Kinematics of Spatial Mechanisms](#)

Lecture 1 - Introduction to Engineering Mechanics - I

Lecture 2 - Introduction to Engineering Mechanics - II

Lecture 3 - Force Systems - I

Lecture 4 - Force Systems - II

Lecture 5 - Equilibrium of Rigid bodies - I

Lecture 6 - Equilibrium of Rigid bodies - II

Lecture 7 - Trusses - I

Lecture 8 - Trusses - II

Lecture 9 - Trusses - III

Lecture 10 - Beams - I

Lecture 11 - Beams - II

Lecture 12 - Beams - III

Lecture 13 - Beams - IV

Lecture 14 - Virtual Work - I

Lecture 15 - Virtual Work - II

Lecture 16 - Energy Relations

Lecture 17 - Review Before Quiz - I

Lecture 18 - Friction - I

Lecture 19 - Friction - II

Lecture 20 - Friction - III

Lecture 21 - Particle Dynamics

Lecture 22 - Circular Motion

Lecture 23 - Absolute Motion

Lecture 24 - Relative Motion - I

Lecture 25 - Relative Motion - II

Lecture 26 - Relative Motion - III and Instantaneous Center

Lecture 27 - Rotating frame of reference I - Velocity

Lecture 28 - Rotating frame of reference II - Acceleration

Lecture 29 - Rotating frame of reference III - Choice of rotating frame of reference

Lecture 30 - RFR- IV Crank and slotted bar

Lecture 31 - RFR-V Understanding Coriolis Acceleration

[Lecture 32 - Kinetics - I](#)

[Lecture 33 - Kinetics - II](#)

[Lecture 34 - Kinetics - III](#)

[Lecture 35 - 3D Kinematics - I](#)

[Lecture 36 - 3D Kinematics - II](#)

[Lecture 37 - 3D Kinematics - III](#)

Lecture 1 - Introduction to the course

Lecture 2 - Some applications of MD simulations

Lecture 3 - Introduction to Bravais lattices and constructing simple crystals with MATLAB

Lecture 4 - Introduction to symmetry - 1

Lecture 5 - Symmetry Elements - 1

Lecture 6 - Symmetry elements - 2

Lecture 7 - Plane groups and their Hermann-Mauguin (HM) symbols

Lecture 8 - Glide reflection; Examples of writing point group symbols; Wyckoff positions

Lecture 9 - Generating 2D crystal with MATLAB using Bilbao crystallography website

Lecture 10 - Symmetry of space groups

Lecture 11 - Hermann mauguin symbols of space groups

Lecture 12 - Translational symmetry operators

Lecture 13 - The Space groups

Lecture 14 - Generation of crystals

Lecture 15 - Generation of monoclinic lattice

Lecture 16 - Introduction to Statistical Mechanics - 1

Lecture 17 - Introduction to Statistical Mechanics - 2

Lecture 18 - Introduction to Statistical Mechanics - 3

Lecture 19 - Statistical mechanics - 1

Lecture 20 - Statistical mechanics - 2

Lecture 21 - Basic introduction to mechanics

Lecture 22 - Introduction to phase space

Lecture 23 - Introduction to phase average and time average

Lecture 24 - Canonical ensemble; Partition function

Lecture 25 - Basic introduction to MD

Lecture 26 - Input script for LAMMPS - 1

Lecture 27 - Input script for LAMMPS - 2

Lecture 28 - Input script for LAMMPS - 3

Lecture 29 - Input script for LAMMPS - 4

Lecture 30 - LAMMPS exercises - 1

Lecture 31 - LAMMPS exercises - 2

[Lecture 32 - LAMMPS exercises - 3](#)

[Lecture 33 - LAMMPS exercises - 4](#)

[Lecture 34 - LAMMPS exercises - 5](#)

Lecture 1 - Introduction

Lecture 2 - Combustion processes in ICE and Gas turbine engines

Lecture 3 - Combustion in solid and liquid rocket motors

Lecture 4 - Equilibrium

Lecture 5 - Chemical kinetics, Equilibrium vs rate controlled

Lecture 6 - Demonstration of NASA-CEA

Lecture 7 - Premixed and diffusion flames: principal features and differences - Part I

Lecture 8 - Premixed and diffusion flames: principal features and differences - Part II

Lecture 9 - Quenching, flammability and other limit phenomena

Lecture 10 - Conservation equations

Lecture 11 - Integral Analysis of flame

Lecture 12 - Solid propellant combustion

Lecture 13 - Erosive burning

Lecture 14 - Instability in solid rockets

Lecture 15 - Analysis of p-t traces - Part II

Lecture 16 - Statistical representation of composite propellants in HeQu1D - geometry and thermochemistry

Lecture 17 - HeQu1D model - Parameter estimation

Lecture 18 - Effects of Al - extended HeQu1D model

Lecture 19 - Instability in solid rockets - II

Lecture 20 - Tutorial

Lecture 21 - Liquid propellant rockets - Part I

Lecture 22 - Liquid propellant rockets - Part II

Lecture 23 - Combustion in liquid rockets

Lecture 24 - Instabilities in liquid rockets and gas turbine after burners

Lecture 25 - CFD modeling aspects - Fundamentals

Lecture 26 - CFD modeling aspects - Modeling approaches

Lecture 27 - Effect of turbulence on flames

Lecture 28 - Scramjets - Part I

Lecture 29 - Scramjets - Part II

Lecture 30 - Summary - Premixed flames

Lecture 31 - Summary - Non-premixed flames

[Lecture 32 - Summary - Solid rocket propulsion](#)

[Lecture 33 - Additional Insights](#)

Lecture 1 - Introduction

Lecture 2 - Material Property Landscape

Lecture 3 - Crystal Structure-1 (Platonic Solids)

Lecture 4 - Crystal Structure-2 (Unit Cell, Lattice, Crystal)

Lecture 5 - Crystal Structure-3 (Bravais lattice, Symmetry in Crystals)

Lecture 6 - Crystal Structure-4 (Miller Indices for Crystallographic Points and Directions)

Lecture 7 - Crystal Structure-5 (Miller-Bravais Indices, Linear and Planar Density)

Lecture 8 - Crystal Structure-6 (Planar density, Close-Packed Structures, Stacking Faults)

Lecture 9 - Crystal Structure-7 (Single Crystal and Polycrystalline Materials)

Lecture 10 - Crystal Structure-8 (X-Ray Diffraction and Determination of Structure)

Lecture 11 - Defects in Crystalline Materials-1 (Types of Crystalline Defects)

Lecture 12 - Defects in Crystalline Materials-1 (Point Defects)

Lecture 13 - Defects in Crystalline Materials-1 (Equilibrium Concentration of Vacancies)

Lecture 14 - Defects in Crystalline Materials-1 (Theoretical Shear Strength)

Lecture 15 - Defects in Crystalline Materials-2 (Effect of Point Defects)

Lecture 16 - Defects in Crystalline Materials-2 (Point Defects and Solid Solutions)

Lecture 17 - Defects in Crystalline Materials-3 (Line Defects, Types of Dislocations and their Characteristics)

Lecture 18 - Defects in Crystalline Materials-4 (Slip Systems, Burger's Vector and Dislocation Motion)

Lecture 19 - Defects in Crystalline Materials-4 (Slip in Single Crystals and Resolved Shear Stress)

Lecture 20 - Defects in Crystalline Materials-5 (Different Stages of Slip in Single Crystalline Materials)

Lecture 21 - Defects in Crystalline Materials-5 (Geometry and Slip, Stress Field Around a Dislocation and Deformation Twinning)

Lecture 22 - Defects in Crystalline Materials-6 (Twinning, Interfacial Defects and Volume Defects)

Lecture 23 - Defects in Crystalline Materials-6 (Strengthening Mechanisms)

Lecture 24 - Defects in Crystalline Materials-7 (Plastic deformation in polycrystalline materials, Softening Mechanisms)

Lecture 25 - Mechanical Properties of Materials (Concept of Stress Tensor)

Lecture 26 - Mechanical Properties (Tension Test-Elastic Deformation)

Lecture 27 - Mechanical Properties (Tension Test - Plastic Deformation)

Lecture 28 - Mechanical Properties (Tension Test - Plastic Deformation)

Lecture 29 - Mechanical Properties (Hardness Test)

Lecture 30 - Static Failure Theories (Introduction, Definition of Failure)

Lecture 31 - Static Failure Theories (General form of failure theory, Stress tensor, Principal stress)

Lecture 32 - Static Failure Theories (Distortion Energy Theory)

Lecture 33 - Static Failure Theories (Maximum Shear Stress Theory)

Lecture 34 - Static Failure Theories (Design Problems)

Lecture 35 - Static Failure Theories (Failure of Brittle Materials)

Lecture 36 - Static Failure Theories (Coulomb-Mohr and Modified Coulomb-Mohr)

Lecture 37 - Static Failure Theories (Notches and Stress Concentration)

Lecture 38 - Introduction to Fracture Mechanics, Griffith's Analysis of a Cracked Body

Lecture 39 - Fracture Mechanics (Energy Release Rate)

Lecture 40 - Fracture Mechanics (Crack Resistance, Stress Intensity Factor, Fracture Toughness)

Lecture 41 - Fatigue Failure of Materials (Introduction, Historical Events, S-N Diagram)

Lecture 42 - Fatigue Failure of Materials (S-N Diagram, Types of Time Varying Loads)

Lecture 43 - Fatigue Failure of Materials (High Cycle Fatigue, Low Cycle Fatigue, Stress Ratio, Amplitude Ratio)

Lecture 44 - Fatigue Failure of Materials (Rotating Beam Bending Test, Estimated S-N diagram)

Lecture 45 - Fatigue Failure Theories (Fatigue strength correction factors)

Lecture 46 - Problems on Fatigue Failure-1 (S-N diagram and Corrected endurance strength)

Lecture 47 - Fatigue Failure of Materials (Features of Fatigue Failure; Factor of Safety in Life and Stress)

Lecture 48 - Fatigue Failure of Materials (Effect of Mean Stress)

Lecture 49 - Fatigue Failure of Materials (Multiaxial Fatigue and Variable Amplitude Loading)

Lecture 50 - Fatigue Failure of Materials (Fatigue Stress Concentration Factor)

Lecture 51 - Fatigue Failure of Materials (Fatigue Crack Growth, Paris' law)

Lecture 52 - Problems on Fatigue Failure-2 (Effect of mean stress, Fatigue crack growth)

Lecture 53 - Problems on Fatigue Failure-3 (Effect of Notch, Multiaxial Loading)

Lecture 54 - Phase Diagrams (Introduction)

Lecture 55 - Phase Diagrams (Language of Phase Diagrams, Types of Binary Phase Alloys)

Lecture 56 - Phase Diagrams (Tie line, Lever Rule, Identification of compositions and weight fractions in two-phase regions)

Lecture 57 - Phase Diagrams (Type I: Isomorphous Alloys, Microstructure evolution in Equilibrium and Non equilibrium cooling)

Lecture 58 - Phase Diagrams (Congruent Melting Alloys, Type II Alloys, Eutectic Reaction)

Lecture 59 - Phase Diagrams (Type III Alloys with Partial Solubility in Solid State)

Lecture 60 - Phase Diagrams (Congruent melting alloys, Peritectic Reaction, Monotectic Reaction)

Lecture 61 - Phase Diagrams (Allotropy, Eutectoid and Peritectoid Reactions)

Lecture 62 - Phase Diagrams (Iron-Iron Carbide Phase Diagram)

Lecture 63 - Kinetics of Phase Transformations (Homogeneous Nucleation)

Lecture 64 - Kinetics of Phase Transformations (Heterogeneous Nucleation)

[Lecture 65 - Isothermal Transformation Diagram](#)

[Lecture 66 - Martensite Transformation, C-C-T Diagram](#)

[Lecture 67 - Heat Treatment of Steels \(Annealing and Normalizing\)](#)

Lecture 1 - Review of governing equations: Conservation of mass

Lecture 2 - Review of governing equations: Conservation of momentum

Lecture 3 - Review of governing equations: Conservation of energy

Lecture 4 - Review of governing equations: Navier-Stokes equations and energy equation

Lecture 5 - Review of governing equations: General scalar transport equation

Lecture 6 - Review of governing equations: classification of PDEs

Lecture 7 - Overview of Numerical Methods: Finite Difference Method

Lecture 8 - Overview of Numerical Methods: Finite Volume Method

Lecture 9 - Overview of Numerical Methods: Solution of linear algebraic equations

Lecture 10 - Finite Volume Method for Diffusion Equation: Discretization of 1D diffusion equation

Lecture 11 - Finite Volume Method for Diffusion Equation: Discretization of 2D diffusion equation

Lecture 12 - Finite Volume Method for Diffusion Equation: Boundary conditions for 2D diffusion equation

Lecture 13 - Finite Volume Method for Diffusion Equation: Discretization of 3D diffusion equation, mixed boundary conditions

Lecture 14 - Finite Volume Method for Diffusion Equation: Tri-Diagonal Matrix Algorithm

Lecture 15 - Finite Volume Method for Diffusion Equation: Linearization of source term, line-by-line TDMA

Lecture 16 - Finite Volume Method for Diffusion Equation: Problem solving using TDMA

Lecture 17 - Finite Volume Method for Diffusion Equation: Problem solving using line-by-line TDMA

Lecture 18 - Finite Volume Method for Diffusion Equation: Steady diffusion in polar and axisymmetric coordinates

Lecture 19 - Finite Volume Method for Diffusion Equation: Discretization of unsteady diffusion equation

Lecture 20 - Finite Volume Method for Diffusion Equation: Unsteady diffusion time-stepping schemes

Lecture 21 - Finite Volume Method for Diffusion Equation: Unsteady diffusion time-stepping schemes and Truncation errors of the FV schemes

Lecture 22 - Finite Volume Method for Diffusion Equation: Truncation errors and stability analysis

Lecture 23 - Finite Volume Method for Diffusion Equation: Stability analysis and steady diffusion in unstructured meshes.

Lecture 24 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 1

Lecture 25 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 2

Lecture 26 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 3

Lecture 27 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 4

Lecture 28 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 5

Lecture 29 - Finite Volume Method for Convection and Diffusion: Discretization of steady convection equation

Lecture 30 - Finite Volume Method for Convection and Diffusion: Discretization of steady convection equation

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[Lecture 31 - Finite Volume Method for Convection and Diffusion: Discretization of steady and unsteady convection equation](#)

[Lecture 32 - Finite Volume Method for Convection and Diffusion: Discretization of unsteady convection equation](#)

[Lecture 33 - Finite Volume Method for Convection and Diffusion: Discretization of convection-diffusion equation on unstructured mesh](#)

[Lecture 34 - Finite Volume Method for Convection-diffusion and fluid flow calculations](#)

[Lecture 35 - Finite Volume Method for Fluid Flow Calculations: The staggered grid approach](#)

[Lecture 36 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm - Part 1](#)

[Lecture 37 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm - Part 2](#)

[Lecture 38 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm - Part 3](#)

[Lecture 39 - Finite Volume Method for Fluid Flow Calculations: SIMPLE-Revised and SIMPLE-Corrected algorithm](#)

[Lecture 40 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm for Colocated mesh - Part 1](#)

[Lecture 41 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm for Colocated mesh - Part 2](#)

[Lecture 42 - Finite Volume Method for Fluid Flow Calculations: SIMPLE-Colocated algorithm for Unstructured mesh](#)

Lecture 1 - Introduction to Mobile Robots and Manipulators

Lecture 2 - Introduction to Locomotion and Types of Locomotion

Lecture 3 - Introduction to Mobile Robot Kinematics

Lecture 4 - Degree of Maneuverability and Types of Wheels

Lecture 5 - Kinematic Simulation of a Mobile Robot (Land-based)

Lecture 6 - Kinematic Simulation and Motion Animation of a Mobile Robot (Land-based)

Lecture 7 - A Generalized Wheel (Kinematic) Model

Lecture 8 - Examples related to the Generalized Wheel (Kinematic) Model

Lecture 9 - Holonomic and Non-holonomic Mobile Robots

Lecture 10 - Kinematic Simulation of Wheeled Mobile Robots - Part 1

Lecture 11 - Kinematic Simulation of Wheeled Mobile Robots - Part 2

Lecture 12 - Kinematic Simulation of Wheeled Mobile Robots - Part 3

Lecture 13 - Mobile Robot Dynamics - Part 1

Lecture 14 - Mobile Robot Dynamics - Part 2

Lecture 15 - Equation of Motion and Dynamic Simulation of a Mobile Robot

Lecture 16 - Dynamic Models of Wheeled Mobile Robots with Wheel Configurations

Lecture 17 - Kinematic and Dynamic Models of a Mobile base with Four-Independent Steerable Power Wheels

Lecture 18 - Sensing and Perception

Lecture 19 - Sensors and Sensing

Lecture 20 - Commonly used sensors - 1

Lecture 21 - Commonly used sensors - 2

Lecture 22 - Commonly used sensors - 3

Lecture 23 - Sensor Errors and Error modelling

Lecture 24 - Mobile Robot Localisation

Lecture 25 - Map based Localisation

Lecture 26 - Markov Localisation

Lecture 27 - Kalman Filter Localisation

Lecture 28 - SLAM

Lecture 29 - Mobile Robot Navigation

Lecture 30 - Path Planning: Graph Construction

Lecture 31 - Graph Search Methods

[Lecture 32 - Path Planning and Obstacle avoidance](#)

[Lecture 33 - Introduction to Motion Control of Mobile Robots - Part 1](#)

[Lecture 34 - Introduction to Motion Control of Mobile Robots - Part 2](#)

[Lecture 35 - Kinematic control of Land-based Mobile Robots](#)

[Lecture 36 - Simulation of Land-based Mobile Robots along with Kinematic Control - Part 1](#)

[Lecture 37 - Simulation of Land-based Mobile Robots along with Kinematic Control - Part 2](#)

[Lecture 38 - Simulation of Land-based Mobile Robots along with Kinematic Control - Part 3](#)

[Lecture 39 - Dynamic Control of Mobile Robots](#)

[Lecture 40 - Cascaded or Back-stepping Control of Mobile Robots](#)

[Lecture 41 - Modern Robotics and Challenges](#)

[Lecture 42 - Multiple Mobile Robotic Systems](#)

[Lecture 43 - Autonomous Mobile Robots and Mobile Manipulators](#)

[Lecture 44 - Legged and Hybrid Robots](#)

[Lecture 45 - Underwater and Aerial Robots](#)

[Lecture 46 - Healthcare Robots](#)

Lecture 1 - Fuel and their properties - Part 1

Lecture 2 - Fuel and their properties - Part 2 - Gaseous and Liquid fuels

Lecture 3 - Fuel and their properties - Part 3 - Liquid and Solid fuels

Lecture 4 - Review of basic thermodynamics of ideal gas mixtures - Part 1

Lecture 5 - Review of basic thermodynamics of ideal gas mixtures - Part 2

Lecture 6 - Stoichiometry - Part 1

Lecture 7 - Stoichiometry - Part 2 - Worked Examples

Lecture 8 - Stoichiometry - Part 3 - Worked Examples (Continued...)

Lecture 9 - First law and Second law of thermodynamics applied to combustion - Part 1 - Heat Calculation

Lecture 10 - First law and Second law of thermodynamics applied to combustion - Part 2 - Enthalpy Calculation

Lecture 11 - First law and Second law of thermodynamics applied to combustion - Part 3 - Calculation of flame temperature

Lecture 12 - First law and Second law of thermodynamics applied to combustion - Part 4 - Chemical equilibrium

Lecture 13 - First law and Second law of thermodynamics applied to combustion - Part 5 - Chemical equilibrium (Continued...)

Lecture 14 - First law and Second law of thermodynamics applied to combustion - Part 6 - Worked examples

Lecture 15 - First law and Second law of thermodynamics applied to combustion - Part 7 - Worked examples (Continued...)

Lecture 16 - Mass transfer basics - Part 1 - Fundamentals

Lecture 17 - Mass transfer basics - Part 2 - Calculation of diffusion velocity

Lecture 18 - Mass transfer basics - Part 3 - Steady evaporation (The Stefan Problem)

Lecture 19 - Mass transfer basics - Part 4 - Steady evaporation of liquid droplet and Worked examples

Lecture 20 - Fundamentals of combustion kinetics - Part 1 - Global and elementary reactions

Lecture 21 - Fundamentals of combustion kinetics - Part 2 - Reaction rates and equilibrium constant

Lecture 22 - Fundamentals of combustion kinetics - Part 3 - Steady state and partial equilibrium approximation

Lecture 23 - Fundamentals of combustion kinetics - Part 4 - Worked examples

Lecture 24 - Governing equations for reacting flow - Part 1 - Continuity, momentum and species conservation equations

Lecture 25 - Governing equations for reacting flow - Part 2 - The energy equation

Lecture 26 - Governing equations for reacting flow - Part 3 - Estimation of thermo-physical properties and control of combustion phenomena

Lecture 27 - Governing equations for reacting flow - Part 4 - Control of combustion phenomena and simplified chemically reacting system

Lecture 28 - Governing equations for reacting flow - Part 5 - Conserved scalars and mixture fraction approach

Lecture 29 - Characteristics of combustion flame and detonation - Part 1

Lecture 30 - Characteristics of combustion flame and detonation - Part 2

- Lecture 31 - Characteristics of combustion flame and detonation - Part 3 - Rankine-Hugoniot relation
- Lecture 32 - Characteristics of combustion flame and detonation - Part 4 - Estimation of detonation velocity and Worked examples
- Lecture 33 - Laminar Premixed Flames - Part 1 - Laminar flame propagation
- Lecture 34 - Laminar Premixed Flames - Part 2 - Laminar flame speed variation and Structure of premixed flames
- Lecture 35 - Laminar Premixed Flames - Part 3 - Flammability limits and Premixed flame theory
- Lecture 36 - Laminar Premixed Flames - Part 4 - Estimation of laminar flame speed
- Lecture 37 - Laminar Premixed Flames - Part 5 - Ignition of premixed mixture (Semenov's Analysis)
- Lecture 38 - Laminar Premixed Flames - Part 6 - Piloted ignition and Flame quenching
- Lecture 39 - Laminar Premixed Flames - Part 7 - Premixed flame stability
- Lecture 40 - Laminar Premixed Flames - Part 8 - Stability Maps and Worked examples
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NPTEL : Introduction to Turbomachines (Mechanical Engineering)

Co-ordinators : Prof. Babu Viswanathan

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NPTEL : Metal Casting (Mechanical Engineering)

Co-ordinators : Dr. D. B. Karunakar

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- Lecture 2 - Overview of different casting processes - 1
- Lecture 3 - Overview of different casting processes - 2
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- Lecture 6 - Moulding Sands and Design - 1
- Lecture 7 - Moulding Sands and Design - 2
- Lecture 8 - Moulding Sands Properties
- Lecture 9 - Moulding Sand Properties Testing
- Lecture 10 - Cores and Core Sands
- Lecture 11 - Patterns and Allowances
- Lecture 12 - Steps Involved in Making a Sand Casting
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- Lecture 16 - Design of Riser System - 4
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- Lecture 18 - Design of Gating System - 1
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- Lecture 20 - Sand Casting Defects - 1
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- Lecture 22 - Melting Furnaces and Practice
- Lecture 23 - Treatment of Molten Metal
- Lecture 24 - Fluidity of Molten Metal
- Lecture 25 - Solidification
- Lecture 26 - Cast Irons and Steels
- Lecture 27 - Aluminum and Magnesium Cast Alloys
- Lecture 28 - Copper, Zinc and Titanium Cast Alloys
- Lecture 29 - Die Casting Process - I
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Lecture 8 - Ceramic Powder Preparation

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Lecture 12 - Ceramics: Secondary Processing

Lecture 13 - Thermoplastics and Thermosets

Lecture 14 - Processing of Plastics

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Lecture 20 - Composite Materials

Lecture 21 - Composite Materials: Classification and Applications

Lecture 22 - Processing of Polymer Matrix Composites

Lecture 23 - Hand Lay-up and Spray Lay-up

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Lecture 28 - Pre-pregging and Sheet Molding Compounds

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- Lecture 7 - Fundamentals of Arc Initiation
- Lecture 8 - Arc Maintenance & Arc Characteristics
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- Lecture 12 - Types of power sources and their characteristics - I
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- Lecture 14 - SMAW - I
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- Lecture 21 - Brazing, Soldering & Braze Welding
- Lecture 22 - Braze welding and Electroslag welding
- Lecture 23 - Weld Thermal Cycle
- Lecture 24 - Effect of WTC and Cooling rate in welding
- Lecture 25 - Cooling rate
- Lecture 26 - Peak temperature & Solidification rate
- Lecture 27 - Residual stress - I
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Lecture 2 - Flow Regimes

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Lecture 5 - Separated Flow Model

Lecture 6 - Dispersed Flow

Lecture 7 - Slug Flow

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Lecture 9 - Droplet Annular and Stratified Flow

Lecture 10 - Measurement of Void Fraction

Lecture 11 - Signal Analysis

Lecture 12 - Two Fluid and Population Balance Model

Lecture 13 - Interface Tracking

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Lecture 15 - Smoothed Particle Hydrodynamics

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Lecture 20 - Gas-Solid Flow

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Lecture 5 - Aircraft Refrigeration Cycles - 2

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Lecture 7 - Vapour Compression Cycle - 1

Lecture 8 - Vapour Compression Cycle - 2

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Lecture 10 - Actual Vapour Compression Cycle - 1

Lecture 11 - Actual Vapour Compression Cycle - 2

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Lecture 19 - Vpour Absorption Systems - 2

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Lecture 21 - Introduction to Air-conditioning

Lecture 22 - Properties of Moist Air

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- Lecture 2 - Some economic concepts, Value and utility, Interest and Interest rate, Time value of money
- Lecture 3 - Interest formulas: Simple and compound interest, Cash flow diagrams
- Lecture 4 - Interest formulas for discrete compounding and discrete payments: Single payment (CAF and PWF)
- Lecture 5 - Interest formulas for discrete compounding and discrete payments: Equal payment series (CAF, CRF and PWF)
- Lecture 6 - Problem solving on discrete compounding, discrete payment
- Lecture 7 - Interest formulas for Uniform gradient series
- Lecture 8 - Interest formulas for geometric gradient series
- Lecture 9 - Compounding frequency of Interest: Nominal and Effective interest rates
- Lecture 10 - Problem solving on frequency compounding of interest and gradient series factors
- Lecture 11 - Economic equivalence: Meaning and principles of equivalence
- Lecture 12 - Equivalence calculations involving cash flows
- Lecture 13 - Methods of comparison of alternatives: Present worth, Annual equivalent, Future worth, Internal rate of return
- Lecture 14 - comparison of alternatives: Capitalized equivalent amount, Capital recovery with return
- Lecture 15 - Problem solving on equivalence and comparison of alternatives
- Lecture 16 - Replacement analysis: Reason, Concept of defender and challenger
- Lecture 17 - Proper treatment of sunk cost in replacement
- Lecture 18 - Replacement because of improved efficiency, inadequacy, demand etc.
- Lecture 19 - Problem solving on replacement analysis
- Lecture 20 - Economic life of the asset
- Lecture 21 - Depreciation: Definition, Reasons, Types of property, Value time function and book value
- Lecture 22 - Basic depreciation methods:S-L method, Declining balance method
- Lecture 23 - Depreciation: Declining balance switching to S-L, SOYD Method
- Lecture 24 - Modified accelerated cost recovery system (MACRS) method of depreciation, Depletion
- Lecture 25 - Depreciation: Units of production method, Depletion
- Lecture 26 - Problem solving based on Depreciation and Depletion
- Lecture 27 - Elements of cost: types of cost
- Lecture 28 - Breakeven analysis, Effect of fixed and variable cost on BEP.
- Lecture 29 - Economic order quantity
- Lecture 30 - Problem solving based on Breakeven analysis and EOQ
- Lecture 31 - Cost estimation: Methods of cost estimation, Adjustment of data, Learning

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[Lecture 34 - Expected value decision making under risk](#)

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Lecture 3 - Different Forms of Thermal Energy Equation

Lecture 4 - Thermal Boundary Layer

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Lecture 6 - Forced Convection : High Prandtl Number over a Flat Plate

Lecture 7 - Forced Convection over a Flat Plate : Uniform Heat Flux

Lecture 8 - Natural Convection : Uniform Wall Temperature

Lecture 9 - Natural Convection : Uniform Heat Flux

Lecture 10 - Tutorial : Convection over Flat Plate

Lecture 11 - Forced Convection in Ducts

Lecture 12 - Thermally Developed Slug Flow in a Duct

Lecture 13 - Thermally and Hydrodynamically Developed Flow : Uniform Heat Flux

Lecture 14 - Thermally and Hydrodynamically Developed Flow : Uniform Wall Temperature

Lecture 15 - Thermal Entrance Region : Uniform Wall Temperature

Lecture 16 - Thermal Entrance Region : Uniform Heat Flux

Lecture 17 - Rayleigh Benard Convection

Lecture 18 - Heat Transfer with Phase Change

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Lecture 20 - Tutorial : Convection inside Duct and Mass Transfer

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Lecture 2 - Lesson 2 - Addition of two harmonic motions and beat phenomenon

Lecture 3 - Lesson 3 - Fourier series and harmonic analysis

Lecture 4 - Lesson 4 - Vibration analysis procedure

Lecture 5 - Lesson 5 - Numerical problems

Lecture 6 - Lesson 1 - Undamped free vibration

Lecture 7 - Lesson 2 - Energy method

Lecture 8 - Lesson 3 - Damped free vibration

Lecture 9 - Lesson 4 - Viscous damped systems and logarithmic decrement

Lecture 10 - Lesson 5 - Coulomb damping

Lecture 11 - Lesson 1 - Harmonic excitations

Lecture 12 - Lesson 2 - Magnification factor and frequency response curve

Lecture 13 - Lesson 3 - Rotating unbalance

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Lecture 15 - Lesson 5 - Energy input and dissipation by viscous damping

Lecture 16 - Lesson 1 - Coulomb damping and equivalent viscous damping

Lecture 17 - Lesson 2 - Structural damping and equivalent viscous damping

Lecture 18 - Lesson 3 - Vibration isolation and force transmissibility

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Lecture 22 - Lesson 2 - Vibrometer

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- Lecture 2 - Fundamental mechanisms of Joining
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- Lecture 5 - Protection of Weld Metal
- Lecture 6 - Principle of Fusion Welding Processes: Gas Welding
- Lecture 7 - Fundamentals of Welding
- Lecture 8 - Physics of Welding Arc
- Lecture 9 - Shielded Metal Arc Welding
- Lecture 10 - Gas Tungsten Arc Welding
- Lecture 11 - Newer variants of Gas tungsten arc welding
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- Lecture 14 - Electro-slag and Electro-gas welding
- Lecture 15 - Laser beam welding
- Lecture 16 - Brazing
- Lecture 17 - Soldering and braze welding
- Lecture 18 - Fundamentals of resistance welding
- Lecture 19 - Resistance welding processes: spot and seam welding
- Lecture 20 - Flash butt welding
- Lecture 21 - Adhesive joining
- Lecture 22 - Weld bonding
- Lecture 23 - Solid state joining technologies: Fundamentals
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- Lecture 25 - Diffusion welding
- Lecture 26 - Explosive welding
- Lecture 27 - Magnetic pulse welding
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- Lecture 29 - Heat affected zone and weld thermal cycle - I
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- Lecture 31 - Solidification of weld metal

- Lecture 32 - Metallurgical transformations in weld and heat affected zone of steels
- Lecture 33 - Residual Stresses in Weld Joints
- Lecture 34 - Solidification cracking and their control
- Lecture 35 - Cracking of Welded Joints II - Cold Cracks
- Lecture 36 - Understanding Weldability Introduction - I
- Lecture 37 - Understanding Weldability Introduction - II
- Lecture 38 - Metal Properties and Weldability - I
- Lecture 39 - Metal Properties and Weldability - II
- Lecture 40 - Weldability of Work Hardenable Metals
- Lecture 41 - Weldability of Work Hardenable and Precipitation Strengthened Metals
- Lecture 42 - Weldability of Precipitation Strengthened Metals
- Lecture 43 - Weldability of Metals Strengthened by Grain Refinement and Transformation Hardening
- Lecture 44 - Weldability of Transformation Hardening Metals
- Lecture 45 - Weldability of Metals - Combination of Strengthening Mechanisms
- Lecture 46 - Weldability Consideration
- Lecture 47 - Weldability of Carbon and Alloy Steel - I
- Lecture 48 - Weldability of Carbon and Alloy Steel - II
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- Lecture 50 - Weldability of Low Carbon Steel and Mild Steel
- Lecture 51 - Weldability of Medium Carbon Steel and High Carbon Steel
- Lecture 52 - Weldability of High Strength Low Alloy Steels
- Lecture 53 - Weldability of HTLA Steel - I
- Lecture 54 - Weldability of HTLA Steel - II
- Lecture 55 - Weldability of Cr-Mo Steel - I
- Lecture 56 - Weldability of Cr-Mo Steel - II
- Lecture 57 - Weldability of Pre-coated Steel - I
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- Lecture 59 - Weldability of Stainless Steel - I
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- Lecture 2 - Examples of models
- Lecture 3 - Modeling of Dynamic Systems
- Lecture 4 - Introduction to Simulation
- Lecture 5 - MATLAB as a Simulation tool
- Lecture 6 - Bond graphs modelling
- Lecture 7 - Bond graph model and causality
- Lecture 8 - Generation of System Equations
- Lecture 9 - Methods of Drawing bond graph models - Mechanical Systems
- Lecture 10 - Methods of Drawing bond graph models - Electrical Systems
- Lecture 11 - Basic System Models - Mechanical Systems
- Lecture 12 - Basic System Models - Electrical Systems
- Lecture 13 - Basic System Models - Hydraulic Systems
- Lecture 14 - Basic System Models - Pneumatic Systems
- Lecture 15 - Basic System Models - Thermal Systems
- Lecture 16 - System Models : Linearity and Non Linearity in Systems
- Lecture 17 - System Model of Combined Rotary and Translatory Systems
- Lecture 18 - System Model of Electro Mechanical Systems
- Lecture 19 - System Model of Hydro Mechanical Systems
- Lecture 20 - System Models of Robots
- Lecture 21 - Dynamic response of the 1st order system
- Lecture 22 - Dynamic response of 2nd order system
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- Lecture 24 - System Transfer functions
- Lecture 25 - Transfer Function of 1st and 2nd Order System
- Lecture 26 - Block Diagram Algebra
- Lecture 27 - Signal Flow Graphs
- Lecture 28 - State Variable Formulation
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- Lecture 31 - Simulation using SIMULINK

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Lecture 12 - Technology of core making

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : Micro and Smart Systems (Mechanical Engineering)

Co-ordinators : Dr. K.J. Vinoy, Prof. S. Gopalakrishnan, Prof. K.N. Bhat, Prof. G.K. Anathasuresh

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Lecture 29 - Calculus of variations in functionals involving two and three independent variables - Part II

Lecture 30 - General variation of a functional, transversality conditions. Broken extremals, Weierstrass-Erdmann corner conditions - Part I

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Lecture 31 - General variation of a functional, transversality conditions. Broken extremals, Wierstrass-Erdmann corner conditions - Part II

Lecture 32 - Variational (energy) methods in statics; principles of minimum potential energy and virtual work

Lecture 33 - General framework of optimal structural designs - Part I

Lecture 34 - General framework of optimal structural designs - Part II

Lecture 35 - Optimal structural design of bars and beams using the optimality criteria method

Lecture 36 - Invariants of Euler-Lagrange equations and canonical forms

Lecture 37 - Noether's theorem

Lecture 38 - Minimum characterization of Sturm-Liouville problems

Lecture 39 - Rayleigh quotient for natural frequencies and mode shapes of elastic systems

Lecture 40 - Stability analysis and buckling using calculus of variations

Lecture 41 - Strongest (most stable) column

Lecture 42 - Dynamic compliance optimization

Lecture 43 - Electro-thermal-elastic structural optimization

Lecture 44 - Formulating the extremization problem starting from the differential equation, self-adjointness of the differential operator, and methods to deal with conservative and dissipative system

Lecture 1 - Overview

Lecture 2 - Spirit of compliant design

Lecture 3 - A glimpse of applications

Lecture 4 - Mobility and degrees of freedom in compliant mechanisms

Lecture 5 - Maxwell's rule and Grubler's formula

Lecture 6 - Using compatibility and force equilibrium matrices to identify degrees of freedom and states of self-stress in trusses

Lecture 7 - Empirical formula for flexure joints

Lecture 8 - Types of elastic pairs (flexures)

Lecture 9 - Linear finite element analysis of compliant mechanisms with beam elements

Lecture 10 - A compliant mechanism kit

Lecture 11 - Linear and nonlinear finite element analyses using continuum elements

Lecture 12 - Subtleties in finite element analysis: geometric nonlinearity and contact

Lecture 13 - Deformation of a cantilever under a tip-load, using elliptic integrals

Lecture 14 - Elliptic integrals and their use in elastica analysis

Lecture 15 - Frisch-Fay's approach to large deformation of beam

Lecture 16 - Burns-Crossley's kinematic model

Lecture 17 - Howell-Midha's elastic model

Lecture 18 - Putting together the pseudo rigid-body model

Lecture 19 - Modeling a partially compliant mechanism

Lecture 20 - Kinematic coefficients of a four-bar linkage with and without springs

Lecture 21 - Solving equations of PRB modeling and comparing with finite element analysis

Lecture 22 - Loop-closure equations for PRB models of compliant mechanisms

Lecture 23 - Burmester theory for compliant mechanisms

Lecture 24 - PRB-based Synthesis Examples

Lecture 25 - Structural optimization approach

Lecture 26 - Early works on design for compliance

Lecture 27 - Design for deflection of trusses

Lecture 28 - Design for deflection of beams and frames

Lecture 29 - Design of elastic continua for desired deflection

Lecture 30 - Continuum element-based topology optimization of compliant mechanisms

Lecture 31 - YinSyn; synthesis of nonlinear responses with compliant mechanisms

[Lecture 32 - Five different formulations for compliant mechanism design and some benchmark problems](#)

[Lecture 33 - Distributed compliance](#)

[Lecture 34 - How to achieve distributed compliance](#)

[Lecture 35 - Shape optimization](#)

[Lecture 36 - Cam-flexure clamp-case-study](#)

[Lecture 37 - SL model for compliant mechanisms](#)

[Lecture 38 - Feasibility maps for compliant mechanisms](#)

[Lecture 39 - Selection of compliant mechanisms for given user-specifications](#)

[Lecture 40 - Two case-studies using feasibility maps technique](#)

[Lecture 41 - SML model for compliant mechanisms for dynamic response](#)

[Lecture 42 - Re-design of compliant mechanisms; Matlab and Java codes](#)

[Lecture 43 - Non-dimensional analysis of beams](#)

[Lecture 44 - Deformation index and slenderness ratio of compliant mechanisms](#)

[Lecture 45 - Kinetoelastostatic maps](#)

[Lecture 46 - Designing with kinetoelastic maps](#)

[Lecture 47 - Non-dimensinalization of stress, frequency, and other measures](#)

[Lecture 48 - Designing compliant suspensions using kinetoelastic maps](#)

[Lecture 49 - Instant centre method for designing compliant mechanisms](#)

[Lecture 50 - Stiffness and compliance ellipsoids](#)

[Lecture 51 - Building block method of designing compliant mechanisms](#)

[Lecture 52 - Comparative analysis of different methods for designing compliant mechanisms](#)

[Lecture 53 - Aspects of Mechanical advantage of compliant mechanisms](#)

[Lecture 54 - Mechanical advantage of rigid-body and compliant mechanisms](#)

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[Lecture 56 - Analysis of bistable arches](#)

[Lecture 57 - Compliant mechanisms with bistable arches](#)

[Lecture 58 - Static balancing and zero-free-length springs](#)

[Lecture 59 - Static balance of a compliant mechanism using a linkage](#)

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[Lecture 61 - A catalogue of compliant mechanisms](#)

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[Lecture 63 - Micromechanical signal processors using compliant mechanisms](#)

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[Lecture 70 - Compliant tissue cutting mechanism](#)

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[Lecture 72 - A compliant easy-chair for the elderly](#)

Lecture 1 - Introduction to Multiphase

Lecture 2 - Thermodynamics of Multiphase systems

Lecture 3 - Thermodynamics of Interface - I

Lecture 4 - Thermodynamics of Interface - II

Lecture 5 - Interfacial phenomena key concepts - I

Lecture 6 - Interfacial phenomena key concepts - II

Lecture 7 - Interfacial heat and mass transfer - I - Interfacial mass, momentum and energy balance, Surface tension, WettingL07

Lecture 8 - Interfacial heat and mass transfer - II - Interfacial dynamics, Instabilities of the interface

Lecture 9 - Interfacial heat and mass transfer - III - Evaporation from thin films

Lecture 10 - Governing equations and interfacial conditions

Lecture 11 - Governing equations : Averaging techniques - I

Lecture 12 - Governing equations : Averaging techniques - II

Lecture 13 - Governing equations : Averaging techniques - III

Lecture 14 - Interface shapes

Lecture 15 - Transport processes at interface with key concepts - I

Lecture 16 - Transport processes at interface with key concepts - II

Lecture 17 - Interfacial transport

Lecture 18 - Interfacial transport including dynamic behavior

Lecture 19 - Interface behavior

Lecture 20 - Heat transfer and evaporation in droplets

Lecture 21 - Droplet vaporization models - I

Lecture 22 - Droplet vaporization models - II

Lecture 23 - Droplet vaporization dynamics - I

Lecture 24 - Droplet vaporization dynamics - II

Lecture 25 - Droplet liquid phase transport

Lecture 26 - Comprehensive droplet vaporization model and correlations - I

Lecture 27 - Comprehensive droplet vaporization model and correlations - II

Lecture 28 - Comparison of droplet vaporization models

Lecture 29 - Species transport in droplet

Lecture 30 - Heat transfer and transport processes in sessile droplets

Lecture 31 - Introduction to atomization

[Lecture 32 - Atomization principles and governing parameters](#)

[Lecture 33 - Spray / droplet breakup models \$\hat{A}\$ - I \(TAB model\)](#)

[Lecture 34 - Spray / droplet breakup models \$\hat{A}\$ - II \(WAVE model\)](#)

[Lecture 35 - Droplet combustion - I](#)

[Lecture 36 - Droplet combustion - II](#)

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[Lecture 38 - Boiling - I](#)

[Lecture 39 - Boiling - II \(Bubble dynamics\)](#)

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- Lecture 1 - Introduction to convective heat transfer
- Lecture 2 - Governing equations I - Momentum Conservation
- Lecture 3 - Governing equations II - Energy Conservation
- Lecture 4 - Introduction to external forced convection
- Lecture 5 - Scaling Analysis - Momentum
- Lecture 6 - Scaling Analysis - Energy I
- Lecture 7 - Scaling Analysis - Energy II
- Lecture 8 - Similarity solution - Momentum
- Lecture 9 - Similarity solution - Energy
- Lecture 10 - Integral solutions - Momentum
- Lecture 11 - Integral solutions - Energy
- Lecture 12 - Suction and Blowing
- Lecture 13 - Falkner-Skan solution
- Lecture 14 - Arbitrary Wall temperature
- Lecture 15 - Internal forced convection - Developing flow
- Lecture 16 - Hydrodynamic fully developed flow
- Lecture 17 - Mean temperature in fully developed flow
- Lecture 18 - Uniform heat flux
- Lecture 19 - Uniform wall temperature
- Lecture 20 - Tube surrounded by isothermal flow
- Lecture 21 - Heat transfer to fully developed flow - I
- Lecture 22 - Heat transfer to fully developed flow - II
- Lecture 23 - Laminar slug flow
- Lecture 24 - Power law fluids
- Lecture 25 - Forced convection - Tutorial I
- Lecture 26 - Forced convection - Tutorial II
- Lecture 27 - Forced convection - Tutorial III
- Lecture 28 - Introduction to external natural convection
- Lecture 29 - Scaling analysis - I
- Lecture 30 - Scaling analysis - II
- Lecture 31 - Integral solution

- Lecture 32 - Similarity solution
- Lecture 33 - Uniform wall heat flux
- Lecture 34 - Thermal stratification
- Lecture 35 - Mixed convection
- Lecture 36 - Internal natural convection - Scaling analysis
- Lecture 37 - Heat transfer regimes
- Lecture 38 - Regime III
- Lecture 39 - Regime IV - Shallow enclosure limit - I
- Lecture 40 - Regime IV - Shallow enclosure limit - II
- Lecture 41 - Partially divided enclosures
- Lecture 42 - Inclined enclosures
- Lecture 43 - Natural convection - Tutorial I
- Lecture 44 - Natural convection - Tutorial II
- Lecture 45 - Introduction to Turbulence
- Lecture 46 - Reynolds-Averaged Navier Stokes equation - I
- Lecture 47 - Reynolds-Averaged Navier Stokes equation - II
- Lecture 48 - Turbulent boundary layer - Viscous sub layer
- Lecture 49 - Turbulent boundary layer - Fully turbulent sub layer
- Lecture 50 - Heat transfer in turbulent boundary layer
- Lecture 51 - Turbulent internal flow - I
- Lecture 52 - Turbulent internal flow - II
- Lecture 53 - Turbulent internal flow - III
- Lecture 54 - $k - \epsilon$ model
- Lecture 55 - Turbulence - Tutorial
- Lecture 56 - Experimental techniques - Thermochromic liquid crystals
- Lecture 57 - Experimental techniques - IR thermography
- Lecture 58 - Droplet evaporation - Sessile I
- Lecture 59 - Droplet evaporation - Sessile II
- Lecture 60 - Droplet evaporation - Contact free

- Lecture 1 - Introduction to complex variables
- Lecture 2 - Cauchy Riemann Equations
- Lecture 3 - Analytic Functions
- Lecture 4 - Simple definitions
- Lecture 5 - Definition of sets, domains, theorem on antiderivative
- Lecture 6 - Cauchy Goursat Theorem
- Lecture 7 - Implications of Cauchy Goursat Theorem, Cauchy Integral Formula
- Lecture 8 - Implications of CIF, converse of CG theorem
- Lecture 9 - Examples in contour integrals, ratios of polynomials
- Lecture 10 - Contour integration of sinc function
- Lecture 11 - Method of path deformation
- Lecture 12 - Method of path deformation (Continued...)
- Lecture 13 - Infinite and finite branch cuts
- Lecture 14 - Finite Branch Cut
- Lecture 15 - Infinite branch cut example
- Lecture 16 - Contour integration: rectangular contour
- Lecture 17 - Finite square root branch cut
- Lecture 18 - Example on finite branch cut
- Lecture 19 - Pole on a branch cut
- Lecture 20 - L shaped branch cut
- Lecture 21 - L shaped branch cut continued
- Lecture 22 - Inverse Laplace Transform
- Lecture 23 - Inverse Laplace Transform (Continued...)
- Lecture 24 - Additional material or corrections to lectures
- Lecture 25 - Summary of the total course

Lecture 1 - Introduction

Lecture 2 - Deborah number

Lecture 3 - Response of Elastic solid

Lecture 4 - Response of Viscous fluid

Lecture 5 - Viscoelastic material

Lecture 6 - Creep and stress relaxation

Lecture 7 - Creep and stress relaxation functions

Lecture 8 - Linearity

Lecture 9 - Mechanical Analogues

Lecture 10 - Tutorial

Lecture 11 - Atoms and bonds

Lecture 12 - Interatomic bonds

Lecture 13 - Polymers

Lecture 14 - Polymers (Continued...)

Lecture 15 - Polymers (Continued...)

Lecture 16 - Freely jointed model

Lecture 17 - Constitutive equations

Lecture 18 - Constitutive equations (Continued...)

Lecture 19 - Constitutive equations (Continued...)

Lecture 20 - Viscoelastic effects

Lecture 21 - Lab Session

Lecture 22 - Polymer concentrations

Lecture 23 - Lagrangian and Eulerian perspectives

Lecture 24 - Maxwell model

Lecture 25 - Maxwell model (Continued...)

Lecture 26 - Kelvin-Meyer-Voigt model

Lecture 27 - Three parameter model

Lecture 28 - Three parameter model (Continued...)

Lecture 29 - Three parameter model (Continued...)

Lecture 30 - Jefferey's model

Lecture 31 - Two Maxwell model

[Lecture 32 - N-Maxwell model](#)

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[Lecture 34 - N-Kelvin Meyer Voigt model](#)

[Lecture 35 - Constitutive modelling](#)

[Lecture 36 - Objectivity](#)

[Lecture 37 - Objectivity](#)

[Lecture 38 - Sinusoidal oscillations](#)

[Lecture 39 - Sinusoidal oscillations \(Continued...\)](#)

[Lecture 40 - Sinusoidal oscillations \(Continued...\)](#)

[Lecture 41 - Summary](#)

[Lecture 42 - Tutorial](#)

[Lecture 43 - Tutorial \(Continued...\)](#)

Lecture 1 - Introduction, Types and Classification of Robots

Lecture 2 - Main Elements of a Robot

Lecture 3 - Modelling and Analysis of Robots

Lecture 4 - Mathematical Preliminaries, Homogeneous Transformations

Lecture 5 - Elements of robot - Joints, Elements of robots - Links

Lecture 6 - Examples of D-H parameters and Link transformation matrices

Lecture 7 - Introduction, Direct Kinematics of Serial Robots

Lecture 8 - Inverse Kinematics of Serial Robots

Lecture 9 - Inverse Kinematics of Serial Robots with $n < 6$, Inverse Kinematics of Serial Robots with $n > 6$

Lecture 10 - Elimination Theory and Solution of Non-linear Equations, Inverse Kinematics of a General 6R Robot

Lecture 11 - Introduction, Loop-closure Equations

Lecture 12 - Direct Kinematics of Parallel Manipulators

Lecture 13 - Mobility of Parallel Manipulators

Lecture 14 - Inverse Kinematics of Parallel Manipulators

Lecture 15 - Direct Kinematics of Stewart Platform Manipulators

Lecture 16 - Sun tracking using 3-DOF parallel manipulator

Lecture 17 - Stewart-Gough platform-based force-torque sensor

Lecture 18 - Vibration isolation using a Stewart-Gough platform

Lecture 19 - Introduction, Linear and Angular Velocity of Links

Lecture 20 - Serial Manipulator Jacobian Matrix

Lecture 21 - Parallel Manipulator Jacobian Matrix

Lecture 22 - Singularities in Serial and Parallel Manipulators

Lecture 23 - Statics of Serial and Parallel Manipulators

Lecture 24 - Hyper-redundant robots

Lecture 25 - Redundancy resolution in human arm

Lecture 26 - Flexible robots

Lecture 27 - Introduction, Lagrangian formulation

Lecture 28 - Examples of Equations of Motion

Lecture 29 - Inverse Dynamics and Simulation of Equations of Motion

Lecture 30 - Recursive Formulations of Dynamics of Manipulators

Lecture 31 - Motion planning

[Lecture 32 - Control of a single link](#)

[Lecture 33 - Control of a multi-link serial manipulator](#)

[Lecture 34 - Control of a multi-link manipulator](#)

[Lecture 35 - Control of constrained and parallel manipulator, Cartesian control of serial manipulators](#)

[Lecture 36 - Force control of manipulators, Hybrid position/force control of manipulators](#)

[Lecture 37 - Advanced topics in non-linear control of manipulators](#)

[Lecture 38 - Wheeled Mobile Robots \(WMR\) on Flat Terrain](#)

[Lecture 39 - Wheeled Mobile Robots \(WMR\) on Uneven Terrain](#)

[Lecture 40 - Kinematics and Dynamics of WMR on Uneven Terrain](#)

[Lecture 41 - Over-Constrained Mechanism and Deployable Structures](#)

[Lecture 42 - Kinematic and Static Analysis](#)

Lecture 1 - The longitudinal wave in vibrating spring

Lecture 2 - Harmonically excited systems

Lecture 3 - The concept of coincidence frequency

Lecture 4 - A classical problem in sound-structure interaction

Lecture 5 - Classical problem (Continued...)

Lecture 6 - Uncoupled solution to the classical problem

Lecture 7 - Uncoupled solution (Continued...).

Lecture 8 - Introduction to the coupled problem.

Lecture 9 - The coupled roots

Lecture 10 - Physical meaning of terms

Lecture 11 - Derivation of coupled roots using asymptotic method

Lecture 12 - Coupled roots derivation (Continued...)

Lecture 13 - Regions of heavy and light fluid loading

Lecture 14 - Light and heavy fluid loading (Continued...)

Lecture 15 - The coupled vibration field

Lecture 16 - The coupled acoustic field and stationary phase

Lecture 17 - The 2-D structural-acoustic waveguide

Lecture 18 - The coupled partial differential equations

Lecture 19 - Derivation of the coupled dispersion equation

Lecture 20 - A schematic of coupled waves

Lecture 21 - Derivation of coupled waves using asymptotic method

Lecture 22 - Asymptotic method (Continued...) and Maple demo

Lecture 23 - Physics of the coupled waves

Lecture 24 - Critical points

Lecture 25 - Heavy fluid loading

Lecture 26 - Summary of the rectangular waveguide

Lecture 27 - Impedance and mobility

Lecture 28 - Derivation of acoustic and vibration response

Lecture 29 - Derivation of vibro-acoustic response (Continued...)

Lecture 30 - Derivation of vibro-acoustic response (Continued...)

Lecture 31 - Numerical example

- Lecture 32 - Coupled resonance analysis using matrices
- Lecture 33 - Coupled resonance analysis (Continued...)
- Lecture 34 - Sound radiation from a baffled panel
- Lecture 35 - Derivation of pressure response.
- Lecture 36 - Radiation efficiency
- Lecture 37 - Physics of volume velocity cancellation
- Lecture 38 - Derivations in the frequency domain: 1-D
- Lecture 39 - Physics of the vibration spectrum in 2-D
- Lecture 40 - Modal character across the frequency range
- Lecture 41 - Simultaneous radiation from several modes
- Lecture 42 - Panel radiation model using monopoles
- Lecture 43 - Physics of panel radiation using monopole model
- Lecture 44 - Physics of panel radiation using monopole model (Cointinued...)
- Lecture 45 - Radiation resistance derivation from Maidanikâ€™s work (Continued...)
- Lecture 46 - Radiation resistance derivation from Maidanikâ€™s work (Continued...)
- Lecture 47 - Radiation resistance derivation from Maidanikâ€™s work (Continued...)
- Lecture 48 - Modal average radiation efficiency
- Lecture 49 - Modal average radiation efficiency (Cointinued...)
- Lecture 50 - Transmission of sound through a rigid panel with flexible mounts
- Lecture 51 - Frequency dependence of sound transmission
- Lecture 52 - Sound transmission through a flexible partition
- Lecture 53 - Transmission loss in different situations
- Lecture 54 - Cylindrical shell vibration
- Lecture 55 - Behavior of uncoupled shell waves
- Lecture 56 - Fluid waves in rigid-walled cylindrical shells
- Lecture 57 - Wave propagation characteristics in flexible cylindrical shells carrying fluid: Fullers paper
- Lecture 58 - Wave impedance of an infinite plate: fluid loading
- Lecture 59 - Fluid loading in a finite plate
- Lecture 60 - Summary of the entire course

- Lecture 1 - Introduction to differential geometry
- Lecture 2 - Properties of surfaces: First fundamental form
- Lecture 3 - Properties of surfaces: Second fundamental form
- Lecture 4 - Surfaces of revolution
- Lecture 5 - Gauss Codazzi relations
- Lecture 6 - Gauss Codazzi (Continued...)
- Lecture 7 - Differential element length in a thin shell
- Lecture 8 - Strain of a differential element
- Lecture 9 - Explicit strain expressions
- Lecture 10 - Love simplifications and inconsistencies Of the theory
- Lecture 11 - Euler Bernoulli Beam equation using the Hamilton's Law
- Lecture 12 - Euler Bernoulli Beam and Hamilton's Law (Continued...)
- Lecture 13 - Beta definition, force and moment resultants
- Lecture 14 - Hamilton's Law for a general shell
- Lecture 15 - The Hamilton's law (Continued...)
- Lecture 16 - Final Dynamical Equations and boundary conditions
- Lecture 17 - Physics of each term in the dynamic equations
- Lecture 18 - Physics of each term (Continued...)
- Lecture 19 - The sixth equation of motion
- Lecture 20 - The sixth equation of motion (Continued...)
- Lecture 21 - Equations of motion for a rectangular plate using Hamilton's law
- Lecture 22 - Equations of motion for a rectangular Plate (Continued...)
- Lecture 23 - Rectangular plate boundary conditions
- Lecture 24 - Rectangular plate equation using force balance
- Lecture 25 - Modeshapes and resonances of a vibrating beam
- Lecture 26 - Modeshapes and resonances of a vibrating Rectangular plate
- Lecture 27 - Modeshapes and resonances of a vibrating Circular plate
- Lecture 28 - Vibrating circular plate (Continued...)
- Lecture 29 - Modeshapes and resonances of a vibrating Circular ring
- Lecture 30 - Details of vibrating rings
- Lecture 31 - Insights into vibrations of ring

- Lecture 32 - Cylindrical shell equations of motion using Force balance
- Lecture 33 - Cylindrical shell: Transverse equation of motion
- Lecture 34 - Orthogonality of modeshapes
- Lecture 35 - Orthogonality of Modes (Continued...)
- Lecture 36 - The Rayleigh Quotient
- Lecture 37 - Rayleigh Quotient Example: Simply-supported beam
- Lecture 38 - The Rayleigh Ritz method
- Lecture 39 - The Rayleigh Ritz method applied to a Complicated system
- Lecture 40 - The Lagrange Multiplier method
- Lecture 41 - The penalty method
- Lecture 42 - Orthogonal polynomials of RB Bhat
- Lecture 43 - Rayleigh Ritz paper by RB Bhat
- Lecture 44 - Numerical examples of the Rayleigh Ritz method
- Lecture 45 - Numerical examples of Rayleigh Ritz method And animations
- Lecture 46 - Rayleigh Ritz applied to curved structures
- Lecture 47 - Forced response of plates and shells
- Lecture 48 - Forced response (Continued...)
- Lecture 49 - Simply-supported plate response to various forces
- Lecture 50 - Simply-supported plate response to various Forces (Continued...)
- Lecture 51 - Simply-supported cylindrical shell response to a Point harmonic force
- Lecture 52 - Cylindrical shell response (Continued...)
- Lecture 53 - Cylindrical shell response (Continued...)
- Lecture 54 - Cylindrical shell response to a traveling load using Only transverse modes
- Lecture 55 - The Receptance method
- Lecture 56 - The receptance method (Continued...)
- Lecture 57 - Stiffening a cylindrical shell using rings
- Lecture 58 - Stiffening of a cylindrical shell (Continued...)
- Lecture 59 - Damping in structures
- Lecture 60 - Loss factor and Complex Young modulus

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Lecture 2 - Position and Orientation of a Rigid Body

Lecture 3 - Homogenous Transformation

Lecture 4 - Linear and angular velocity of rigid body

Lecture 5 - Motion of Rigid Body and Particles

Lecture 6 - Introduction to multi-body systems

Lecture 7 - Joints, Degrees of Freedom and Constraints

Lecture 8 - Position, Velocity and Acceleration in Multi-body Systems

Lecture 9 - Mass and Inertia of a Rigid Body

Lecture 10 - External forces and moments

Lecture 11 - Angular momentum, Spinning tops and Gyroscopes

Lecture 12 - Free-body diagram and Equations of motion

Lecture 13 - Newton-Euler Formulation for Serial Chains

Lecture 14 - Lagrangian Formulation

Lecture 15 - Examples of Equations of Motion

Lecture 16 - Equations of Motion Using Computer Tools

Lecture 17 - Introduction and Examples of equations of motion

Lecture 18 - Inverse dynamics and Simulations of equations Of motion

Lecture 19 - Simulation using Computer Tools

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Lecture 21 - State Space Formulation

Lecture 22 - Solution of State Equations

Lecture 23 - Stability of Dynamical Systems

Lecture 24 - Controllability and Observability of Linear Systems

Lecture 25 - Examples of Controllability and Observability

Lecture 26 - Introduction to Classical Control

Lecture 27 - Root Locus

Lecture 28 - Frequency Domain Approach

Lecture 29 - PID Control

Lecture 30 - Root Locus based Controller Design

Lecture 31 - State Space Design

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Lecture 2 - Mathematical Preliminaries - I

Lecture 3 - Tensors and Deformations

Lecture 4 - Lagrangian and Eulerian Perspectives

Lecture 5 - Mathematical Preliminaries - II

Lecture 6 - Image Processing Preliminaries

Lecture 7 - Image Processing Operations

Lecture 8 - Light Matter Interaction - I

Lecture 9 - Lab Demo I: Optical Microscope

Lecture 10 - Optical System: Lenses

Lecture 11 - Lab Demo II: Lenses and Camera

Lecture 12 - Light Matter Interaction - II (Lab Demonstration)

Lecture 13 - Light Matter Interaction - II (Lab Demonstration)

Lecture 14 - Tracer Particles for Flow Visualisation

Lecture 15 - Particle Tracking Velocimetry

Lecture 16 - Particle Image Velocimetry - I

Lecture 17 - Particle Image Velocimetry - II

Lecture 18 - Particle Image Velocimetry - III

Lecture 19 - Particle Image Velocimetry - IV

Lecture 20 - Particle Image Velocimetry - V

Lecture 21 - Particle Image Velocimetry - VI

Lecture 22 - Schlieren and Shadowgraphy

Lecture 23 - Lab Demo III: PIV and Schlieren

Lecture 24 - Introduction to optical methods for solids

Lecture 25 - Basics of Digital Image Correlation

Lecture 26 - Iterative implementation of DIC

Lecture 27 - Example implementations

Lecture 28 - How is a DIC experiment set up ?

Lecture 29 - DIY(C)!

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Lecture 31 - Why do we see fringes ?

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- Lecture 2 - Basic Probability Theory and Statistics
- Lecture 3 - Important Probability Distributions
- Lecture 4 - Combinatorial Analysis for Statistical Thermodynamics
- Lecture 5 - Basic Concepts
- Lecture 6 - Macrostates and Microstates
- Lecture 7 - Bose Einstein and Fermi Dirac Statistics
- Lecture 8 - Entropy and the equilibrium particle distribution
- Lecture 9 - Operator Theory - 1
- Lecture 10 - Stirling Approximation and Lagrange Multipliers
- Lecture 11 - Equilibrium particle distribution
- Lecture 12 - The Dilute Limit and Concept of Molecular Partition Function
- Lecture 13 - The Molecular Partition Function and its relationship with Classical Thermodynamics
- Lecture 14 - Historical Survey of Quantum Mechanics
- Lecture 15 - Operator Theory - 2
- Lecture 16 - Operator Theory - 3
- Lecture 17 - Bohr Model for the Spectrum of Atomic Hydrogen
- Lecture 18 - Heuristic Introduction to the Schrodinger Equation
- Lecture 19 - The postulates of Quantum Mechanics
- Lecture 20 - The Steady State Schrodinger Equation: Single Particle Analysis
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- Lecture 23 - Coordinate System - 3
- Lecture 24 - The Steady State Schrodinger Equation: Multiparticle analysis
- Lecture 25 - The Particle in a Box
- Lecture 26 - The Uncertainty Principle
- Lecture 27 - The Pauli Exclusion and the Correspondence Principle
- Lecture 28 - Problem Solving - 1
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- Lecture 30 - The Internal Motion for a two particle system
- Lecture 31 - The rotational and vibrational energy mode for a diatomic molecule

- Lecture 32 - Hermite polynomials as vibrational energy mode solution
- Lecture 33 - Equivalent two body model of atomic hydrogen
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- Lecture 35 - Problem Solving - 3
- Lecture 36 - The four quantum numbers and multielectron systems
- Lecture 37 - Spectroscopic term symbols for multielectron atoms
- Lecture 38 - Electron energies for multielectron systems
- Lecture 39 - Combined energy modes for atoms and diatomic molecules
- Lecture 40 - Perturbation analysis of the Schrodinger Wave equation
- Lecture 41 - Selection rules
- Lecture 42 - The Rotational and vibrational spectroscopy
- Lecture 43 - Ro-vibrational spectroscopy (Simplex model)
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- Lecture 46 - Ro-vibronic spectroscopy
- Lecture 47 - Working with Spectroscopic Schemes, Notations and Term Symbols
- Lecture 48 - From Particles to assembly - I
- Lecture 49 - From Particles to assembly - II
- Lecture 50 - Connecting Quantum Mechanics to Classical Mechanics
- Lecture 51 - The Equipartition principle and ideal gas
- Lecture 52 - Thermodynamic properties of ideal monoatomic and diatomic gas
- Lecture 53 - The zero of energy (rotational and vibrational)
- Lecture 54 - Specific heats, Internal energy through Vibrational and Ro-vibrational energy modes
- Lecture 55 - The Ro-vibrational partition function and Introduction to intersction of Radiationand Matter
- Lecture 56 - Absorption and Emission of Radiation
- Lecture 57 - The Rabi frequency and Beer's Law
- Lecture 58 - Insights into radiative spectral transitions
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NPTEL : Electroceramics (Metallurgy and Material Science)

Co-ordinators : Dr. Ashish Garg

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NPTEL : Steel Making (Metallurgy and Material Science)

Co-ordinators : Prof. Satish Ch. Koria, Prof. Dipak Mazumdar

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Lecture 44 - Organic electronic materials: conducting polymers, semi-conducting organic materials, applications

Lecture 45 - Thermal analyses

Lecture 46 - Introduction of spectroscopic technique : UV-VIS spectroscopy

Lecture 47 - Infra-red and Raman spectroscopy

Lecture 48 - Optical and scanning electron microscopy

Lecture 49 - X-ray photoelectron spectroscopy

Lecture 50 - Measurement of mechanical properties, fracture toughness, MOR, hardness

Lecture 51 - Ferroelectric thin film: synthesis and characterization

Lecture 52 - Thermal analysis techniques: Differential scanning calorimetry and thermogravimetry

Lecture 53 - Measurement of optical properties

Lecture 54 - Novel ferroic composites: Synthesis and measurement

Lecture 55 - Fundamentals of corrosion, corrosion of materials

Lecture 56 - Oxidation, corrosion of ceramic materials, degradation of polymers: swelling and dissolution, bond rupture, weathering

Lecture 57 - Ceramics in biology and medicine

Lecture 58 - Design of Ceramics

Lecture 59 - Finishing of Ceramics

Lecture 60 - Fly-ash based glazed wall tiles: A case study

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Lecture 2 - Scanning Electron Microscopy

Lecture 3 - SEM and Its Capabilities

Lecture 4 - Main Components of SEM - Electron Guns

Lecture 5 - Main Components of SEM - Electron Guns and Electromagnetic Lenses

Lecture 6 - Electron Probe Diameter Verses Electron Probe Current

Lecture 7 - Electron Beam - Specimen Interaction

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Lecture 9 - BSE Detector and Sample Preparation for SEM

Lecture 10 - Parameters Need to be Considered to obtain a Good SEM Image

Lecture 11 - How to Get a Good SEM Image

Lecture 12 - Additional Capabilities of SEM

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Lecture 14 - Additional Capabilities of SEM (Continued...)

Lecture 15 - Scanning Ion Microscopy - An Introduction

Lecture 16 - Ions Versus Electrons as Source for Microscopy

Lecture 17 - Ions Source in HIM

Lecture 18 - GFIS Properties and Ion Optical Column

Lecture 19 - Ion Optical Column

Lecture 20 - Ion-Solid Interactions and Signal Generation

Lecture 21 - Signal Generation and Contrast Mechanism

Lecture 22 - Contrast Mechanism and Imaging Modes

Lecture 23 - Scanning Transmission Ion Microscopy and Microanalysis with HIM

Lecture 24 - Creation and Modification of Materials by HIM

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Lecture 29 - Main Components of STM (Continued...)

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[Lecture 39 - Phase Imaging, Noises and Resolution](#)

[Lecture 40 - Surface Properties Measurements using Other Forces](#)

[Lecture 41 - Surface Properties Measurements using AFM](#)

[Lecture 42 - Manipulation of Atoms, Molecules and Industrial Applications](#)

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- Lecture 2 - Image formation, resolution, magnification, depth of field and depth of focus
- Lecture 3 - Aberrations in microscopy: General concepts
- Lecture 4 - Introduction, types and image formation in Optical microscopy
- Lecture 5 - Components of optical microscope
- Lecture 6 - Bright field and Dark field modes
- Lecture 7 - Phase contrast optical microscopy
- Lecture 8 - Polarized light microscopy
- Lecture 9 - Differential interference contrast
- Lecture 10 - Fluorescence microscopy
- Lecture 11 - Basic components of electron microscope
- Lecture 12 - Basic components of electron microscope (Continued...)
- Lecture 13 - Basic components of electron microscope (Continued...)
- Lecture 14 - Electron-material interaction
- Lecture 15 - Electron-material interaction (Continued...)
- Lecture 16 - Electron-material interaction (Continued...) and Image formation and contrast generation
- Lecture 17 - Modes of TEM (BF and DF)
- Lecture 18 - Modes of TEM
- Lecture 19 - Modes of TEM (Continued...) and Electron diffraction in TEM
- Lecture 20 - Electron diffraction in TEM
- Lecture 21 - Electron diffraction in TEM (Continued...)
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- Lecture 23 - Electron diffraction in TEM (Continued...)
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- Lecture 25 - Application of Electron diffraction
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- Lecture 31 - Basic components of SEM

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- [Lecture 33 - Optics of SEM](#)
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- [Lecture 35 - Optics of SEM \(Continued...\) and analytical detectors](#)
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- [Lecture 48 - Intensity of diffracted beam \(Continued...\)](#)
- [Lecture 49 - Intensity of diffracted beam \(Continued...\)](#)
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- [Lecture 52 - Intensity of diffracted beam \(Continued...\)](#)
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- [Lecture 54 - Intensity of diffracted beam \(Continued...\)](#)
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- [Lecture 59 - X-ray diffraction profile and analysis \(Continued...\)](#)
- [Lecture 60 - Electron backscatter diffraction \(EBSD\)](#)

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Lecture 4 - Concepts of thermodynamics pertinent to electrochemical cells

Lecture 5 - Kinetics of electrochemical cells and structural characteristics of electrodes

Lecture 6 - Introduction to EMF, redox potential, Faraday law and Nernst's law

Lecture 7 - Terminology related to secondary battery : half-cell, full-cell, redox couple, positive

Lecture 8 - Measurements: Cyclic voltammetry, nominal voltage, capacity, rate performance

Lecture 9 - Impedance spectroscopy measurement and analyses

Lecture 10 - Measurement of rechargeable cell: Case study

Lecture 11 - History and categories of lithium batteries

Lecture 12 - Operational mechanisms for lithium batteries: Intercalation materials, alloys

Lecture 13 - Differences of voltage profiles between intercalation materials, alloys, and conversion

Lecture 14 - Properties of electrode materials (Case study: alloy as anode)

Lecture 15 - Properties of electrode materials (conversion type oxide as case study)

Lecture 16 - Positive electrodes: Lithiated transition metal oxides, lithiated iron oxyphosphates etc

Lecture 17 - Negative electrodes: Carbonaceous materials, lithium titanium oxides etc

Lecture 18 - Electrolyte :Liquid Electrolyte, Polymer Electrolyte

Lecture 19 - Current Collector, Conductive Agents, Separator and Other Accessories

Lecture 20 - Novel materials for lithium ion rechargeable cells

Lecture 21 - Principle of Operation of Commercial Cells : viz. C - NMC, C - NCA etc

Lecture 22 - Principle of operation of commercial cells

Lecture 23 - Major characteristics of commercial Li ion cells: Cell performance, degradation phenomena

Lecture 24 - Fabrication of Li ion cell: Cylindrical configuration

Lecture 25 - Fabrication of Li ion cell: Pouch and prismatic cell

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Lecture 28 - Electrolytes: Roles and requirements, organic electrolyte, ionic liquid electrolyte

Lecture 29 - Performance of Na ion rechargeable cell

Lecture 30 - Future perspective of Na ion cells

Lecture 31 - Introduction to battery module, BMS, thermal management and pack design

- Lecture 32 - Degradation and safety issues of Li ion rechargeable cells
- Lecture 33 - Introduction to battery management system: BMS topologies, hardware, concept of active
- Lecture 34 - Introduction to thermal management: Active thermal management system, passive thermal
- Lecture 35 - Packaging of battery pack and battery testing: Material selection, sealing of enclosure
- Lecture 36 - Classification of supercapacitors: EDLC and pseudocapacitive type
- Lecture 37 - Pseudocapacitor
- Lecture 38 - Asymmetric supercapacitor and BATCAP: Battery supercapacitor hybrid electrochemical
- Lecture 39 - Electrolytes for supercapacitors: Aqueous/organic liquid electrolytes/ionic liquid
- Lecture 40 - Current collectors, separators etc. and their effect on performance
- Lecture 41 - Operational principles of aqueous and Li - O₂ batteries
- Lecture 42 - Electrolytes for Li - O₂ batteries
- Lecture 43 - Limitations of Li - Air batteries
- Lecture 44 - State of the art Li - Air batteries : Carbonaceous materials
- Lecture 45 - State of the art Li - Air batteries: Case study
- Lecture 46 - The element sulfur, principle of operation
- Lecture 47 - Advantages and disadvantages of Li - S batteries, positive electrodes
- Lecture 48 - Electrolyte and negative electrode for Li - S battery
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- Lecture 52 - Nature and geological origin of all potential lithium resources
- Lecture 53 - State of the art extraction techniques and known production reserves
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- Lecture 55 - Recycling of lithium and other battery constituents from used battery (Continued...)
- Lecture 56 - Lead Acid Batteries: Operational principles, main characteristics and applications
- Lecture 57 - Lead Acid Batteries: Operational principles, main characteristics and applications (Continued...)
- Lecture 58 - Ni-Cd and Ni-MeH Batteries: Operational principles, main characteristics and applications
- Lecture 59 - Redox flow battery vanadium redox battery, operational principle, and main characteristics
- Lecture 60 - Other Redox Flow Battery Technologies

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Lecture 3 - Processing - Texture - Anisotropic Properties

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Lecture 7 - Structure Factor and Diffraction Extinction Criteria

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Lecture 10 - Pole figures (Continued...)

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Lecture 16 - Euler Angles and ODFs (Continued...)

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Lecture 19 - Texture Fibre, Periodicity in Euler Space, Incomplete Pole Figures

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Lecture 21 - Size of Euler Space in Relation to Crystal and Sample Symmetry

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Lecture 23 - Penetration Depth of X-ray, Neutron, e-1 and Basics of X-ray Generation

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Lecture 25 - Principles of pole figure measurements by X-ray diffraction

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Lecture 27 - Limitations and Errors in X-ray Texture Measurement and Corrections

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Lecture 29 - Basics of Electron Microscopy - II

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- Lecture 32 - Quantitative Evaluation of Kikuchi Diffraction Pattern - I
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- Lecture 36 - Analysis using the AZtec Crystal software
- Lecture 37 - Analysis using the ATEX software
- Lecture 38 - Introduction to solidification texture
- Lecture 39 - Solidification texture in Alloys
- Lecture 40 - Solidification texture in FCC, BCC, and HCP structures
- Lecture 41 - Phase Transformation Texture and Bain Strain
- Lecture 42 - Orientation Relationships between FCC and BCC / BCT
- Lecture 43 - Various Orientation Relationships and Variants
- Lecture 44 - Basic Mechanics of Polycrystal Plasticity
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- Lecture 54 - Static recrystallization
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- Lecture 2 - Properties of bulk material vis-a-vis different bulk handling operations
- Lecture 3 - Fundamentals of BMH and Transport: Capacity and Productivity Concepts
- Lecture 4 - Bulk material handling in Processing plants: Crushing and Screening Flow Charts
- Lecture 5 - Introduction to Bulk Material Transport and Autonomous Vehicles
- Lecture 6 - Constructional Components: Trends of Developments
- Lecture 7 - Belt Conveyor Construction: Belting for Bulk Material Conveyor
- Lecture 8 - Idlers and Belt Cleaners
- Lecture 9 - Feeding and Discharging Devices
- Lecture 10 - Safety and Troubleshooting
- Lecture 11 - Size Selection and Power Calculation
- Lecture 12 - Principle of operations and applicability
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- Lecture 15 - Design Calculations for Pneumatic Conveying
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- Lecture 21 - System Layout
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- Lecture 2 - Genesis of Materials Degradation
- Lecture 3 - Classification of degradation and Parameters Influencing it - Part I
- Lecture 4 - Parameters Influencing Degradation - Part II
- Lecture 5 - Engineering Solution to Combat Environmental Degradation of Materials
- Lecture 6 - Aqueous corrosion-thermodynamics of Wet Corrosion
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- Lecture 24 - Prevention of Chemical/Electrochemical Degradation (Continued...)
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- Lecture 27 - Mechanical and Electrochemical Testing - Part I
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- Lecture 30 - Characterization
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- Lecture 33 - Shot Peening
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- Lecture 36 - Conventional Surface Hardening (Flame and induction)
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- Lecture 39 - Fused bath and Gas Nitriding
- Lecture 40 - Plasma Nitriding
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- Lecture 46 - Thick Coatings by Weld Overlay and Cladding
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Lecture 4 - Mine Closure Costs and Financing Approaches

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Lecture 7 - Post Closure Liabilities and Activities

Lecture 8 - Post Closure Community Concerns and Sustainable Development Plans

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- Lecture 34 - Brownfield Redevelopment and Value Addition to Assets
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- Lecture 29 - Structure of cellular solids - Pore structure characterization
- Lecture 30 - Interfacial phenomena - Basic concept, Adhesion and Wettability
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- Lecture 42 - Dependence of properties on pore structure
- Lecture 43 - Mechanics of cellular solids
- Lecture 44 - Mechanics of cellular solids (Continued...)
- Lecture 45 - Deformation behavior of honeycomb and foams
- Lecture 46 - Deformation behaviour of Foams
- Lecture 47 - Deformation behaviour of Foams (Continued...)
- Lecture 48 - Deformation behaviour of Foams (Continued...)
- Lecture 49 - Thermal properties of foams
- Lecture 50 - Other important properties of foams (Continued...)
- Lecture 51 - Advanced composites - MMCs
- Lecture 52 - Advanced composites - MMCs (Continued...)
- Lecture 53 - Advanced composites - CMCs
- Lecture 54 - Advanced composites - Advanced Processing Techniques
- Lecture 55 - Advanced composites - Advanced Processing Techniques (Continued...)
- Lecture 56 - Advanced composites - Advanced Processing Techniques (Continued...)
- Lecture 57 - Advanced composites - Application oriented advanced composites
- Lecture 58 - Microstructure and properties of natural cellular solid - wood
- Lecture 59 - Advanced hybrid material - Functionally graded composite materials (FGMs)
- Lecture 60 - Advanced hybrid material - Functionally graded composite materials (FGMs) (Continued...)

- Lecture 1 - Introduction, Classification and Uses of Metals
- Lecture 2 - Introduction, Classification and Uses of Metals (Continued...)
- Lecture 3 - Occurrence/Source of Metals
- Lecture 4 - Metal Extraction Process Overview
- Lecture 5 - Mineral Beneficiation: Overview and Mass Balances
- Lecture 6 - Crushing and Grinding (Comminution)
- Lecture 7 - Mineral Classification: Separation in Flowing Fluid
- Lecture 8 - Mineral Concentration by Froth Flotation
- Lecture 9 - Mineral Concentration by Froth Flotation
- Lecture 10 - Magnetic and Electric Separation/Concentration
- Lecture 11 - Sensor-based/Automatic Ore Sorting
- Lecture 12 - Solid-Liquid Separation
- Lecture 13 - Particle Size Estimation and Screening
- Lecture 14 - Fuels in Metallurgical Processes and Coal Characteristics
- Lecture 15 - Calorific Value and Caking Properties of Coal
- Lecture 16 - Coke: Making and Properties
- Lecture 17 - Combustion of Fuels
- Lecture 18 - Combustion: Mass and Heat Balance
- Lecture 19 - Combustion Heat Balance: Flame Temperature
- Lecture 20 - Combustion Heat Utilization in Furnace
- Lecture 21 - Heat Utilization in Furnace: Numerical Examples
- Lecture 22 - Classification of Furnaces
- Lecture 23 - Refractories for Furnace Linings
- Lecture 24 - Refractories: Testing and Production
- Lecture 25 - Agglomeration of Fines: Pelletization and Briquetting
- Lecture 26 - Agglomeration of Fines: Sintering
- Lecture 27 - Extraction of Metal from Sulfides: Roasting
- Lecture 28 - Roasting Reactors and Heat Balance
- Lecture 29 - Roasting: Predominance Area Diagram
- Lecture 30 - Roasting: Application of Predominance Area Diagram
- Lecture 31 - Reduction Smelting and Matte Smelting

Lecture 32 - Metallurgical Slag

Lecture 33 - Slag Viscosity, Surface Tention and Theories

Lecture 34 - Slag: Masson and Molecular Theory, Numerical Examples

Lecture 35 - Copper Extraction: Matte Smelting

Lecture 36 - Copper Extraction: Flash Smelting

Lecture 37 - Cu Extraction: Cyclone Flash Smelting and Numerical Examples

Lecture 38 - Cu Extraction: Conversion

Lecture 39 - Conversion of Nickel Sulphide and Numerical Examples

Lecture 40 - TSL Smelting, Continuous Conversion and Direct Cu-Production

Lecture 41 - Reduction Smelting: Lead Extraction

Lecture 42 - Reduction Smelting: Zinc Extraction and ISP

Lecture 43 - Extraction of Tin, Tungsten, Molybdenum and Numerical Examples

Lecture 44 - Extraction of Nb, V, Ferroalloys and Titania (from Ilmenite)

Lecture 45 - Silicothermy: Pyrometallurgical Magnesium Extraction

Lecture 46 - Reduction Smelting: Iron Extraction in Blast Furnace

Lecture 47 - Alternative Routes of Iron Extraction

Lecture 48 - Halide Metallurgy: Extraction of Ti, Zr, Hf, U, Si Purification

Lecture 49 - Purification of Bulk Metals: Chemical Refining

Lecture 50 - Chemical Refining: Purification of Lead

Lecture 51 - Chemical Refining of Zinc, Tin, Nickel, Ti (Zr, Hf, Th)

Lecture 52 - Physical Refining: Vacuum De-gassing, Zone Melting and Distillation

Lecture 53 - Hydrometallurgy: Unit Steps, Leaching Reagents and Methods

Lecture 54 - Physiochemical Aspect of Leaching, Bacterial Leaching, S/L Separation

Lecture 55 - Hydrometallurgy: Solution Purification and Metal Ion Reduction

Lecture 56 - Hydrometallurgy: Cementation, Electrowinning, Au Extraction and Bayer Process

Lecture 57 - Electrometallurgy: Electrowinning, Electrorefining, Current and Energy Efficiency

Lecture 58 - Electrometallurgy: Extraction of Mg and Al

Lecture 59 - Environmental Concern and Sustainable Metal Extraction

Lecture 60 - New Development in Metal Extraction: Solvometallurgy, Bio-Metallurgy, Membrane Technology

Lecture 1 - Basic definitions

Lecture 2 - Free energy, Stability, equilibrium in a unary system

Lecture 3 - Effect of Pressure on equilibrium transformations: Clausius Clapeyron equation, phase diagram for unary system

Lecture 4 - Free energy of solutions, free energy-composition diagrams

Lecture 5 - Solution models, chemical potential

Lecture 6 - Phase rule, free energy-composition diagrams and phase diagrams

Lecture 7 - Evolution of phase diagrams

Lecture 8 - Evolution of phase diagrams, miscibility gap

Lecture 9 - To concept, partition less solidification

Lecture 10 - To concept, partition less solidification (Continued...)

Lecture 11 - Eutectic solidification, glass formation

Lecture 12 - Kauzmann paradox, order of a transformation, glass forming ability

Lecture 13 - Eutectic solidification, coupled growth, heterogeneous nucleation

Lecture 14 - Peritectic solidification, metastable phase diagrams

Lecture 15 - Errors in drawing phase diagrams, Fe-C vs. Fe-Fe₃C phase diagram

Lecture 16 - Free energy of undercooled liquid, shape of nucleus

Lecture 17 - Solid state phase transformations - Precipitation

Lecture 18 - Precipitation

Lecture 19 - Precipitation - quasicrystals

Lecture 20 - Precipitate coarsening, stability of a phase, spinodal decomposition

Lecture 21 - Spinodal decomposition

Lecture 22 - Eutectoid reaction

Lecture 23 - Eutectoid reaction (Continued...)

Lecture 24 - Bainitic transformation

Lecture 25 - Kinetics of eutectoid transformations

Lecture 26 - Martensitic Transformation

Lecture 27 - Martensitic transformation, order-disorder transformation

Lecture 28 - Miscibility gap in phase diagrams

Lecture 29 - Phase diagram calculations

Lecture 30 - Thermodynamics of heterogeneous systems

Lecture 31 - Thermodynamics of heterogeneous systems (Continued...)

Lecture 1 - Properties of light, Image formation

Lecture 2 - Magnification and resolution

Lecture 3 - Depth of field, focus and field of view

Lecture 4 - Lens defects, filters and light microscopy introduction

Lecture 5 - Optical microscope demo., Bright field imaging, opaque specimen illumination

Lecture 6 - Opaque stop microscopy, Phase contrast microscopy

Lecture 7 - Dark field microscopy, Polarization microscopy

Lecture 8 - Differential interference contrast and fluorescence microscopy

Lecture 9 - Sample preparation techniques for optical microscopy

Lecture 10A - Tutorial problems (Continuation...)

Lecture 10 - Tutorial problems

Lecture 11 - Introduction to scanning electron Microscopy

Lecture 12 - Lens aberrations, Object resolution, Image quality

Lecture 13 - Interaction between electrons and sample, Imaging capabilities, Structural analysis, Elemental analysis

Lecture 14 - SEM and its mode of operation, Effect of aperture size, Working distance, condenser lens strength

Lecture 15 - SEM and its mode of operation- continuation, Relation between probe current and probe diameter, Summary

Lecture 16 - Factors affecting Interaction volume, Demonstration of SEM

Lecture 17 - Image formation and interpretation

Lecture 18 - Image formation and interpretation continued, EDS, WDS

Lecture 19 - Special contrast mechanisms, Monte Carlo simulations of Interaction volume

Lecture 20 - Electron channeling contrast imaging (ECCI), Electron back scattered diffraction (EBSD)-Theory & instrument demonstration

Lecture 21 - Tutorial Problems on SEM

Lecture 22 - Basics of X-ray emission from source, electron excitation and X-ray interaction with materials in general

Lecture 23 - Properties of X-rays

Lecture 24 - Bragg's Law Derivation

Lecture 25 - Diffraction relationship with reciprocal space

Lecture 26 - X-ray scattering

Lecture 27 - Factors affecting intensities of X-ray peaks

Lecture 28 - Factors affecting intensities of X-ray peaks- continuation

Lecture 29 - Effect of crystallite size and strain on intensity of X-rays

- Lecture 30 - Profile fit, Factors affecting peak broadening
- Lecture 31 - Indexing of diffraction pattern, Quantitative analysis
- Lecture 32 - Indexing, Quantitative analysis-continuation, Residual stress measurements
- Lecture 33 - XRD and Residual stress measurement- lab demonstration
- Lecture 34 - Introduction to Transmission Electron Microscopy (TEM)
- Lecture 35 - Fundamentals of Transmission Electron Microscopy (TEM)
- Lecture 36 - Basics of Diffraction-1
- Lecture 37 - Basics of Diffraction-2
- Lecture 38 - TEM imaging-1
- Lecture 39 - TEM imaging-2
- Lecture 40 - TEM instrument demonstration
- Lecture 41 - TEM sample preparation-1
- Lecture 42 - TEM sample preparation-2
- Lecture 43 - XRD Tutorial - 1
- Lecture 44 - XRD tutorial - 2
- Lecture 45 - TEM Tutorial - 1
- Lecture 46 - TEM Tutorial - 2
- Lecture 47 - Quantitative metallography - Tutorial 1
- Lecture 48 - Quantitative metallography - Tutorial 2
- Lecture 49 - Quantitative metallography - Tutorial 3
- Lecture 50 - Quantitative metallography - Tutorial 4
- Lecture 51 - Quantitative metallography - Tutorial 5
- Lecture 52 - Quantitative metallography - Tutorial 6
- Lecture 53 - Quantitative metallography - Tutorial 7

Lecture 1 - Introduction

Lecture 2 - Properties of Materials

Lecture 3 - Thermal Expansion

Lecture 4 - Measuring Electrical Conductivity: DC and AC

Lecture 5 - Free Electron Gas

Lecture 6 - The Ideal Gas

Lecture 7 - Drude Model: Electrical Conductivity

Lecture 8 - Drude Model: Thermal Conductivity

Lecture 9 - Drude Model: Successes and Limitations

Lecture 10 - Drude Model: Source of Shortcomings

Lecture 11 - Large Systems and Statistical Mechanics

Lecture 12 - Maxwell Boltzmann Statistics

Lecture 13 - Classical Particles and Quantum Particles

Lecture 14 - History of Quantum Mechanics - 1

Lecture 15 - History of Quantum Mechanics - 2

Lecture 16 - Introduction to Drude Sommerfeld model

Lecture 17 - Fermi-Dirac Statistics - Part 1

Lecture 18 - Fermi-Dirac Statistics - Part 2

Lecture 19 - Features of the Fermi Dirac Distribution Function

Lecture 20 - Maxwell-Boltzmann Distribution Vs Fermi-Dirac Distribution

Lecture 21 - Anisotropy and Periodic Potential in a Solid

Lecture 22 - Confinement and Quantization - Part 1

Lecture 23 - Confinement and Quantization - Part 2

Lecture 24 - Density of States

Lecture 25 - Fermi Energy, Fermi Surface, Fermi Temperature

Lecture 26 - Electronic Contribution to Specific Heat at Constant Volume

Lecture 27 - Reciprocal Space-1: Introduction to Reciprocal Space

Lecture 28 - Reciprocal Space-2: Condition for Diffraction

Lecture 29 - Reciprocal Space-3: Ewald sphere, Simple Cubic, FCC and BCC in Reciprocal Space

Lecture 30 - Wigner Seitz Cell and Introduction to Brillouin Zones

Lecture 31 - Brillouin Zones, Diffraction, and Allowed Energy Levels

[Lecture 32 - E Vs k, Brillouin Zones and the Origin of Bands](#)

[Lecture 33 - Calculating Allowed Energy Bands and Forbidden Band Gaps](#)

[Lecture 34 - Bands; Free Electron Approximation, Tight Binding Approximation](#)

[Lecture 35 - Semiconductors](#)

[Lecture 36 - Magnetic Properties](#)

[Lecture 37 - Electron Compounds; Phonons, Optoelectronic Materials](#)

[Lecture 38 - Superconductivity](#)

[Lecture 39 - Bose-Einstein Statistics](#)

[Lecture 40 - Physics of Nano Scale Materials; Course Summary](#)

- Lecture 1 - Metals, semiconductors and insulators
- Lecture 2 - Introduction to semiconductors
- Lecture 3 - Density of states and Fermi-Dirac statistics
- Lecture 4 - Assignment 1 - Bonding, DOS, and Fermi statistics
- Lecture 5 - Intrinsic semiconductors
- Lecture 6 - Intrinsic semiconductors - conductivity
- Lecture 7 - Assignment 2 - Intrinsic semiconductors
- Lecture 8 - Extrinsic semiconductors
- Lecture 9 - Extrinsic semiconductors - Fermi level
- Lecture 10 - Extrinsic semiconductors - conductivity
- Lecture 11 - Assignment 3 - Extrinsic semiconductors
- Lecture 12 - Metal-semiconductor junctions
- Lecture 13 - Assignment 4 - Metal-semiconductor junctions
- Lecture 14 - pn junctions in equilibrium
- Lecture 15 - pn junctions under bias
- Lecture 16 - pn junction breakdown and heterojunctions
- Lecture 17 - Assignment 5 - pn junctions
- Lecture 18 - Transistors
- Lecture 19 - MOSFETs
- Lecture 20 - Assignment 6 - transistors
- Lecture 21 - Optoelectronic devices: Introduction
- Lecture 22 - Optoelectronic devices: LEDs
- Lecture 23 - Optoelectronic devices: LASERS
- Lecture 24 - Optoelectronic devices: photodetector
- Lecture 25 - Optoelectronic devices: solar cells
- Lecture 26 - Assignment 7 - optical properties
- Lecture 27 - Assignment 8 - optoelectronic devices
- Lecture 28 - Semiconductor manufacturing: Introduction
- Lecture 29 - Si wafer manufacturing
- Lecture 30 - IC device manufacturing: overview
- Lecture 31 - Layering: thermal oxidation

[Lecture 32 - Doping: thermal and ion implantation](#)

[Lecture 33 - Lithography](#)

[Lecture 34 - Etching and deposition \(growth\)](#)

[Lecture 35 - Metallization and polishing](#)

[Lecture 36 - Process and device evaluation](#)

[Lecture 37 - Productivity and process yield](#)

[Lecture 38 - Clean room design and contamination control](#)

[Lecture 39 - Devices and IC formation](#)

[Lecture 40 - IC circuit logic and packaging](#)

Lecture 1 - Properties of light, Image formation

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Lecture 7 - Dark field microscopy, Polarization microscopy

Lecture 8 - Differential interference contrast and fluorescence microscopy

Lecture 9 - Sample preparation techniques for optical microscopy

Lecture 10 - Tutorial problems

Lecture 11 - Tutorial problems (Continued...)

Lecture 12 - Introduction to scanning electron Microscopy

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Lecture 19 - Image formation and interpretation continued, EDS, WDS

Lecture 20 - Special contrast mechanisms, Monte Carlo simulations of Interaction volume

Lecture 21 - Electron channeling contrast imaging (ECCI), Electron back scattered diffraction (EBSD)-Theory & instrument demonstration

Lecture 22 - Tutorial Problems on SEM

- Lecture 1 - Electronic Materials
- Lecture 2 - Semiconductors - Introduction
- Lecture 3 - Electron statistics in a solid
- Lecture 4 - Worked numericals on week 1 lessons
- Lecture 5 - Intrinsic semiconductors
- Lecture 6 - Intrinsic semiconductors - conductivity
- Lecture 7 - Optional - worked assignment on intrinsic semiconductors
- Lecture 8 - Extrinsic semiconductors - Introduction
- Lecture 9 - Extrinsic semiconductors - Fermi level
- Lecture 10 - Extrinsic semiconductors - Mobility
- Lecture 11 - Worked assignment on extrinsic semiconductors
- Lecture 12 - Metal-semiconductor junctions
- Lecture 13 - pn junctions in equilibrium
- Lecture 14 - Optional - worked assignment on metal-semiconductor junctions
- Lecture 15 - pn junctions under bias
- Lecture 16 - Junction breakdown and heterojunctions
- Lecture 17 - Worked assignment on pn junctions
- Lecture 18 - Transistors - overview
- Lecture 19 - MOSFETs
- Lecture 20 - Worked assignment on transistors
- Lecture 21 - Optoelectronic devices - Introduction
- Lecture 22 - Light emitting diodes
- Lecture 23 - Solid state semiconductor lasers
- Lecture 24 - Optional - worked assignment on optical properties
- Lecture 25 - Photodetectors
- Lecture 26 - Solar cells
- Lecture 27 - Worked assignment on optoelectronic devices

Lecture 1 - Reciprocal space; Definition and Properties

Lecture 2 - Condition for Diffraction

Lecture 3 - Worked out examples

Lecture 4 - Ewald Sphere and lattices in reciprocal space

Lecture 5 - Wigner Sietz cells and Brillouin Zones

Lecture 6 - Worked out exmaples

Lecture 7 - Brillouin Zones, Diffraction and allowed energy levels

Lecture 8 - E Vs K, Brillouin zones and the Origin of Bands

Lecture 9 - Week 3 Worked out examples

Lecture 10 - Reciprocal space as Fourier transform of real lattice

Lecture 11 - Alternate notation of reciprocal space

Lecture 1 - Introduction to fusion welding processes: Part 1/2

Lecture 2 - Introduction to fusion welding processes: Part 2/2

Lecture 3 - Heat sources - Part 1/2

Lecture 4 - Heat sources - Part 2/2

Lecture 5 - Heat removal

Lecture 6 - Thermal Modelling - Part 1/2

Lecture 7 - Thermal Modelling - Part 2/2

Lecture 8 - Zones in a weldment

Lecture 9 - Analytical Solutions to Weld Thermal Field

Lecture 10 - Conduction to Keyhole mode

Lecture 11 - Fluid flow modelling - Part 1/2

Lecture 12 - Fluid flow modelling - Part 2/2

Lecture 13 - Solute transfer modelling - Part 1/2

Lecture 14 - Solute transfer modelling - Part 2/2

Lecture 15 - Solute segregation profile - Part 1/2

Lecture 16 - Solute segregation profile - Part 2/2

Lecture 17 - Microstructure Formation in Fusion Welds

Lecture 18 - Numerical Solutions to Thermal Field and Fluid Flow in Welding - Part 1

Lecture 19 - Numerical Solutions to Thermal Field and Fluid Flow in Welding - Part 2

Lecture 20 - Dissimilar Welding

Lecture 1 - Basics of X-ray emission from source, electron excitation and X-ray interaction with materials in general

Lecture 2 - Properties of X-rays

Lecture 3 - Bragg's law derivation

Lecture 4 - Diffraction relationship with reciprocal space

Lecture 5 - X-ray scattering

Lecture 6 - Factors affecting intensities of X-ray peaks

Lecture 7 - Factors affecting intensities of X-ray peaks (Continued...)

Lecture 8 - Effect of crystallite size and strain on intensity of X-rays

Lecture 9 - Profile fit, Factors affecting peak broadening

Lecture 10 - Indexing of diffraction pattern, Quantitative analysis

Lecture 11 - Indexing and Quantitative analysis-continuation, Residual stress measurements

Lecture 12 - XRD and Residual stress measurement - lab demonstration

Lecture 13 - XRD Tutorial - 1

Lecture 14 - XRD tutorial - 2

Lecture 15 - Introduction to Transmission Electron Microscopy (TEM)

Lecture 16 - Fundamentals of Transmission Electron Microscopy (TEM)

Lecture 17 - Basics of Diffraction - 1

Lecture 18 - Basics of Diffraction - 2

Lecture 19 - TEM Imaging - 1

Lecture 20 - TEM Imaging - 2

Lecture 21 - TEM instrument demonstration

Lecture 22 - TEM sample preparation - 1

Lecture 23 - TEM sample preparation - 2

Lecture 24 - TEM Tutorial - 1

Lecture 25 - TEM Tutorial - 2

Lecture 26 - TEM Tutorial - 3

Lecture 27 - TEM Tutorial - 4

Lecture 1 - Visual optical method

Lecture 2 - Dye Penetrant Testing - 1

Lecture 3 - Dye Penetrant Testing - 2

Lecture 4 - Dye Penetrant Testing - 3

Lecture 5 - Dye Penetrant Testing - 4

Lecture 6 - Magnetic particle testing - 1

Lecture 7 - Magnetic particle testing - 2

Lecture 8 - Magnetic particle testing - 3

Lecture 9 - Magnetic particle testing - 4

Lecture 10 - Magnetic particle testing - 5

Lecture 11 - Eddy current testing - 1

Lecture 12 - Eddy current testing - 2

Lecture 13 - Eddy current testing - 3

Lecture 14 - Eddy current testing - 4

Lecture 15 - Eddy current testing - 5

Lecture 16 - Ultrasonic testing - 1

Lecture 17 - Ultrasonic testing - 2

Lecture 18 - Ultrasonic testing - 3

Lecture 19 - Ultrasonic testing - 4

Lecture 20 - Ultrasonic testing - 5

Lecture 21 - Ultrasonic testing - 6

Lecture 22 - Ultrasonic testing - 7

Lecture 23 - Ultrasonic testing - 8

Lecture 24 - Ultrasonic testing - 9

Lecture 25 - Ultrasonic testing - 10

Lecture 26 - Acoustic Emission Testing - 1

Lecture 27 - Acoustic Emission Testing - 2

Lecture 28 - Acoustic Emission Testing - 3

Lecture 29 - Acoustic Emission Testing - 4

Lecture 30 - Acoustic Emission Testing - 5

Lecture 31 - Radiography - 1

[Lecture 32 - Radiography - 2](#)

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[Lecture 34 - Radiography - 4](#)

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[Lecture 36 - Radiography - 6](#)

[Lecture 37 - Radiography - 7](#)

[Lecture 38 - Radiography - 8](#)

[Lecture 39 - Radiography - 9](#)

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Lecture 1 - Introduction to defects in materials

Lecture 2 - 1-D Lattice

Lecture 3 - 2-D Lattice

Lecture 4 - 3-D Lattice - a

Lecture 5 - 3-D Lattice - b

Lecture 6 - 3-D Lattice - c

Lecture 7 - 3-D Crystals

Lecture 8 - Types of Point Defects

Lecture 9 - Vacancy Concentration Determination - 1

Lecture 10 - Vacancy Concentration Determination - 2

Lecture 11 - Point Defect Interstitial

Lecture 12 - Transformation of co-ordinates

Lecture 13 - Tensor - 1

Lecture 14 - Tensor - 2

Lecture 15 - Strain

Lecture 16 - Stress

Lecture 17 - Description of Dislocation - 1

Lecture 18 - Description of Dislocation - 2

Lecture 19 - Stress field around Dislocation

Lecture 20 - Self Energy of Dislocation

Lecture 21 - Force on Dislocation

Lecture 22 - Forces Between Dislocation

Lecture 23 - Chemical Force on Dislocation

Lecture 24 - Perfect Dislocation in FCC Structures

Lecture 25 - Intrinsic Stacking Faults in FCC

Lecture 26 - Extrinsic Faults and Thompson Tetrahedron in FCC

Lecture 27 - Dislocations in BCC and HCP

Lecture 28 - Dislocations in Ordered Alloys and Dislocation Dislocation Interaction

Lecture 29 - Twinning - 1

Lecture 30 - Twinning - 2

Lecture 31 - Martensitic Transformation - 1

[Lecture 32 - Martensitic Transformation - 2](#)

[Lecture 33 - Interfaces - 1](#)

[Lecture 34 - Interfaces - 2](#)

[Lecture 35 - Defect Interaction and Strength](#)

Lecture 1 - Method of Stereology

Lecture 2 - Volume Fraction and Particle Size - Part 1

Lecture 3 - Volume Fraction and Particle Size - Part 2

Lecture 4 - Geometric Probability - Part 1

Lecture 5 - Geometric Probability - Part 2

Lecture 6 - Probability Distributions

Lecture 7 - Volume Fraction and Particle Size - Part 3

Lecture 8 - Volume Fraction and Particle Size - Part 4

Lecture 9 - Geometrical Probability - I

Lecture 10 - Geometrical Probability - II

Lecture 11 - Basic Stereological Parameters - Part 1

Lecture 12 - Basic Stereological Parameters - Part 2

Lecture 13 - Counting of grains and particles - Part 1

Lecture 14 - Description of Polycrystalline Microstructures derived measures

Lecture 15 - Counting of grains and particles - Part 2

Lecture 16 - Counting of Grains and Particles - Part 3

Lecture 17 - Counting of Grains and Particles - Part 4

Lecture 18 - Other Applications of the Disector

Lecture 19 - Stereology of Anisotropic Microstructures

- Lecture 1 - Introduction to the course, Introduction to physical metallurgy of steels
- Lecture 2 - Martensitic transformation, Introduction to modern automotive steels
- Lecture 3 - Introduction to modern automotive steels
- Lecture 4 - Introduction to advanced high strength steels
- Lecture 5 - Introduction to Dual Phase Steel and TRIP Steel Heat Treatments
- Lecture 6 - Thermal and Mechanical Processing of TRIP and Hot Forming Steels
- Lecture 7 - Introduction to Welding Processes in Automotive Industries
- Lecture 8 - Principles of Resistance Spot Welding (RSW)
- Lecture 9 - Process Characteristics of Resistance Spot Welding - Part I
- Lecture 10 - Process Characteristics of Resistance Spot Welding - Part II
- Lecture 11 - Introduction to Laser Beam Welding - Part I
- Lecture 12 - Introduction to Laser Beam Welding - Part II
- Lecture 13 - Principles of Gas Metal Arc Welding - Part I
- Lecture 14 - Principles of Gas Metal Arc Welding - Part II
- Lecture 15 - Welding Metallurgy of Advanced High Strength Steels - Part I
- Lecture 16 - Microstructural Evolution During Welding of Advanced High Strength Steels
- Lecture 17 - Elemental Behaviour During Welding of Advanced High Strength Steels
- Lecture 18 - Quantification of Microstructural Constituents in Automotive Steel Welds - Part I
- Lecture 19 - Quantification of Microstructural Constituents in Automotive Steel Welds - Part II and Mechanical Properties
- Lecture 20 - Methodologies to Improve the Weldability of Advanced High Strength Steels

- Lecture 1 - Introduction to the course
- Lecture 2 - Classification of welding processes and definition of welding arc
- Lecture 3 - Physics of welding arc - Part 1
- Lecture 4 - Physics of welding arc - Part 2
- Lecture 5 - Physics of welding arc - Part 3
- Lecture 6 - Physics of welding arc - Part 4
- Lecture 7 - Fundamentals of ionisation in welding arc
- Lecture 8 - Electrical conductivity of welding arc
- Lecture 9 - Electrical resistivity of welding arc
- Lecture 10 - Heat transfer inside the arc
- Lecture 11 - Arc ignition mechanisms Part - I
- Lecture 12 - Arc ignition mechanisms Part - II
- Lecture 13 - Principles of Gas Tungsten Arc Welding
- Lecture 14 - Shielding gases for arc welding
- Lecture 15 - Selection of shielding gases for engineering alloys
- Lecture 16 - Arc welding power sources - Part 1
- Lecture 17 - Arc welding power sources - Part 2
- Lecture 18 - Arc welding power sources - Part 3
- Lecture 19 - Variations in GTAW process
- Lecture 20 - Square wave, variable polarity, GTAW with filler, hot wire GTAW
- Lecture 21 - Dual gas GTAW and Plasma Welding processes
- Lecture 22 - Multi cathode GTAW and Activated GTAW
- Lecture 23 - Buried GTAW and Rate controlling parameters of GTAW
- Lecture 24 - Introduction to consumable welding processes
- Lecture 25 - Melting rate of consumable wires
- Lecture 26 - Physics of droplet transfer in consumable welding
- Lecture 27 - Modes of droplet transfer - Part 1
- Lecture 28 - Modes of droplet transfer - Part 2
- Lecture 29 - Modes of droplet transfer - Part 3
- Lecture 30 - Shielded Metal Arc Welding
- Lecture 31 - Flux cored arc welding - Introduction

- Lecture 32 - Electrode fluxes and process characteristics of flux cored arc welding
- Lecture 33 - Flux cored arc welding - Process characteristics
- Lecture 34 - Advances in gas metal arc welding - Pulsed GMAW
- Lecture 35 - Advances in gas metal arc welding - Controlled dip short circuiting processes
- Lecture 36 - Submerged arc welding
- Lecture 37 - Resistance welding - Fundamentals
- Lecture 38 - Resistance spot welding - Part 1
- Lecture 39 - Resistance spot welding - Part 2
- Lecture 40 - Resistance spot welding - Part 3
- Lecture 41 - Resistance spot welding - Part 4
- Lecture 42 - Variants in resistance welding - Part 1
- Lecture 43 - Variants in resistance welding - Part 2
- Lecture 44 - Laser welding process - Introduction - Part 1
- Lecture 45 - Laser welding process - Part 2
- Lecture 46 - Laser welding process - Part 3
- Lecture 47 - Laser welding process - Part 4
- Lecture 48 - Electron beam welding process
- Lecture 49 - Other welding processes - Electroslag welding
- Lecture 50 - Magnetically Impelled Arc Butt (MIAB) welding
- Lecture 51 - Aluminothermic (thermit) welding
- Lecture 52 - Introduction to solid state welding processes - Friction welding
- Lecture 53 - Friction stir welding - Part 1
- Lecture 54 - Friction stir welding - Part 2
- Lecture 55 - Other solid state welding processes
- Lecture 56 - Joining processes for Plastics - Part 1
- Lecture 57 - Joining processes for Plastics - Part 2
- Lecture 58 - Adhesive bonding of plastics
- Lecture 59 - Welding nomenclatures

- Lecture 1 - Importance of studying creep
- Lecture 2 - Basics of plastic deformation and characteristics of dislocations - Part 1
- Lecture 3 - Basics of plastic deformation and characteristics of dislocations - Part 2
- Lecture 4 - Basics of plastic deformation and characteristics of dislocations - Part 3
- Lecture 5 - Creep and different factors that influence creep deformation - Part 1
- Lecture 6 - Creep and different factors that influence creep deformation - Part 2
- Lecture 7 - Creep and different factors that influence creep deformation - Part 3
- Lecture 8 - Creep and different factors that influence creep deformation - Part 4
- Lecture 9 - Creep and different factors that influence creep deformation - Part 5
- Lecture 10 - Creep and different factors that influence creep deformation - Part 6
- Lecture 11 - Mechanisms of Creep - Part 1
- Lecture 12 - Mechanisms of Creep - Part 2
- Lecture 13 - Mechanisms of Creep - Part 3
- Lecture 14 - Mechanisms of Creep - Part 4
- Lecture 15 - Mechanisms of Creep - Part 5
- Lecture 16 - Transitions in Creep Mechanisms and Creep Constitutive Equation
- Lecture 17 - Deformation Mechanism Maps - Part 1
- Lecture 18 - Deformation Mechanism Maps - Part 2
- Lecture 19 - Modeling the Useful Creep Life of Materials/Components - Part 1
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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Designing Learner-Centric MOOCs (Multi-Disciplinary)

Co-ordinators : Prof.Sridhar Iyer, Prof.Sahana Murthy, Dr.Jayakrishnan M., Dr.Sameer Sahasrabudhe

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[Lecture 55 - Capital Budgeting Decisions \(Continued...\)](#)

[Lecture 56 - Start up Valuation - I](#)

[Lecture 57 - Start up Valuation - II](#)

[Lecture 58 - Human Resource Management - I](#)

[Lecture 59 - Human Resource Management - II](#)

[Lecture 60 - Growth Strategies](#)

Lecture 1 - Roadmap for patent creation - Introduction

Lecture 2 - Roadmap for patent creation - Property and IP

Lecture 3 - Roadmap for patent creation - IPR

Lecture 4 - Roadmap for patent creation - IP and future areas

Lecture 5 - Roadmap for patent creation - Patent - Introduction

Lecture 6 - Patent searching and analysis

Lecture 7 - Patent-Definition

Lecture 8 - Novelty

Lecture 9 - Non obviousness

Lecture 10 - Industrial application

Lecture 11 - Parts of patent document

Lecture 12 - Terminologies and codes used in a patent document

Lecture 13 - How to read a patent ? - I

Lecture 14 - How to read a patent ? - II

Lecture 15 - How to read a patent ? - III

Lecture 16 - Roadmap for patent creation - IP identification tool

Lecture 17 - Roadmap for patent creation - Patentability tool

Lecture 18 - Roadmap for patent creation - IP audit framework

Lecture 19 - Roadmap for patent creation - Public patent databases

Lecture 20 - Roadmap for patent creation - Capsule version

Lecture 21 - Types of patent

Lecture 22 - Patent filing procedure in India

Lecture 23 - Patent timelines - India and PCT

Lecture 24 - Inventions not patent in India

Lecture 25 - Indicators for patentability

Lecture 26 - Use of patent database for research/project topic identification

Lecture 27 - Importance of laboratory notebook

Lecture 28 - In which technical category my invention falls - IPC

Lecture 29 - Patent - Statutory differences between India, Europe and USA

Lecture 30 - Identification of inventor and applicant and their rights

Lecture 31 - Developing your own IP system

[Lecture 32 - When to publish and when to patent \(confidentiality\)](#)

[Lecture 33 - Statutory exceptions \(anticipation\)](#)

[Lecture 34 - Procedure for patent filing \(Forms and fees\)](#)

[Lecture 35 - Interaction with IP attorney \(Initial drafting, FER reply and hearing\)](#)

[Lecture 36 - Research/project planning](#)

[Lecture 37 - Post patent filing requirements](#)

[Lecture 38 - Patent commercialization](#)

[Lecture 39 - Capsule version](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Accreditation and Outcome based Learning (Multi-Disciplinary)

Co-ordinators : Prof. Shyamal Kumar Das Mandal

Lecture 1 - Introduction

Lecture 2 - Challenges and Needs of 21st Century Education

Lecture 3 - Accreditation

Lecture 4 - Accreditation (Continued...)

Lecture 5 - Outcome based Learning

Lecture 6 - Important Steps in Outcome based education

Lecture 7 - Introduction to Taxonomies of Learning and Cognitive Domains of Learning

Lecture 8 - Psychomotor Domain and Affective Domain of Learning

Lecture 9 - Instructional Objectives or Outcome

Lecture 10 - Need and Use of Instructional Objectives or Outcome

Lecture 11 - Example of Different Instructional Objectives or Outcome and their Cognitive Level

Lecture 12 - Outcome-based Curriculum Design

Lecture 13 - Outcome-based Curriculum Design (Continued...)

Lecture 14 - Outcome-based Curriculum Design software framework

Lecture 15 - Course outcome, Module outcome and lecture/unit outcome and teaching learning process

Lecture 16 - Mapping of outcome based curriculum with Graduate attribute

Lecture 17 - Introduction to Assessment and Evaluation

Lecture 18 - Formative Assessment and Summative Assessments

Lecture 19 - Test Item analysis

Lecture 20 - Test Item analysis (Continued...)

Lecture 21 - Evaluation Rubrics

Lecture 22 - Mission and Vision, Program Educational Objectives (PEOs), Program Outcome (PO) and their Consistency

Lecture 23 - Mapping of course outcome and Program Outcome

Lecture 24 - Attainment of Program outcome and course outcome

Lecture 25 - Calculation of direct attainment

Lecture 26 - Calculation of Indirect Attainment

Lecture 27 - Introduction to Tutored Video Instruction (TVI)

Lecture 28 - TVI Learning Improvement Data - as reported in literature

Lecture 29 - Use of TVI as ELNET-3L program

Lecture 30 - Lessons on Good Teaching from ELNET-3L

Lecture 31 - Evaluation of Teaching Quality

- [Lecture 32 - Evaluation of Teaching Quality - A Research Proposal](#)
- [Lecture 33 - Evaluation of Teaching Quality - A Research Proposal \(Continued...\)](#)
- [Lecture 34 - Evaluation of Teaching Quality - A Research Proposal \(Continued...\)](#)
- [Lecture 35 - Assessment and Evaluation - to Improve Teaching](#)
- [Lecture 36 - Item Analysis - Theory and Practice](#)
- [Lecture 37 - Learning Styles and Learning Approaches](#)
- [Lecture 38 - Good Teaching Attributes and Characteristics](#)
- [Lecture 39 - Teacher Effectiveness Research](#)
- [Lecture 40 - Teacher Effectiveness Research \(Continued...\)](#)
- [Lecture 41 - Teaching Learning Process using Outcome based Education](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts (Multi-Disciplinary)

Co-ordinators : Prof. Brajesh Kumar Dubey

- Lecture 1 - Sustainability Concepts - Innovations and Challenges
- Lecture 2 - Sustainability Concepts - Innovations and Challenges
- Lecture 3 - Basics and Sustainability Concepts and Evolution
- Lecture 4 - Engineering for Sustainability
- Lecture 5 - Life Cycle Thinking and Circular Economy
- Lecture 6 - Mass Concentration Units
- Lecture 7 - Partial Pressure Units
- Lecture 8 - Other Types of Units
- Lecture 9 - Units (Continued...), Qualitative and Quantitative Measurements
- Lecture 10 - Quantative Measurements Basics
- Lecture 11 - Ecology
- Lecture 12 - Energy Flow and Ecological Concepts
- Lecture 13 - Population
- Lecture 14 - Population, Consumption and Biodiversity
- Lecture 15 - Environmental Chemistry
- Lecture 16 - Mass Balance and Reactor Systems
- Lecture 17 - Mass Balance in Continuous Reactor / Continuous Stirred Tank Reactor (CSTR) and Plug Flow Reactor
- Lecture 18 - Plug Flow Reactor and Energy Flow
- Lecture 19 - Energy Balance and Earth Overshot Day
- Lecture 20 - Mass Transport Processes
- Lecture 21 - Oxygen Demand in Environmental Systems
- Lecture 22 - BOD Examples, Oxygen Levels in Surface Waters, COD
- Lecture 23 - Environmental Health Basics and SDGs
- Lecture 24 - Field Applications
- Lecture 25 - Nutrient Cycle
- Lecture 26 - Environmental Risk
- Lecture 27 - Risk Assessment Steps and EIA Introduction
- Lecture 28 - Environmental Risk Assessments with Concepts of EIA and LCA
- Lecture 29 - Environmental Risk Assessments with Concepts of EIA and LCA (Continued...)
- Lecture 30 - Environmental Risk Assessments with Concepts of EIA and LCA (Continued...)

[Lecture 31 - Water Quantity](#)

[Lecture 32 - Water Availability and Usage](#)

[Lecture 33 - Population Forecasting](#)

[Lecture 34 - Water Quality](#)

[Lecture 35 - Water Quality \(Continued...\)](#)

[Lecture 36 - Plain Sedimentation](#)

[Lecture 37 - Coagulation](#)

[Lecture 38 - Review of Sedimentation and Rapid Sand Filtration](#)

[Lecture 39 - Disinfection and Water Supply](#)

[Lecture 40 - Water Treatment Plant Visit](#)

[Lecture 41 - Wastewater collection and characterization](#)

[Lecture 42 - Sewerage System and Sewage Characteristics](#)

[Lecture 43 - BOD Concepts and Preliminary Treatment of Wastewater](#)

[Lecture 44 - Wastewater Treatment - I](#)

[Lecture 45 - Activated Sludge Process and Sludge Disposal](#)

[Lecture 46 - Introduction to Solid Waste Management](#)

[Lecture 47 - Introduction to Solid Waste Management \(Continued...\)](#)

[Lecture 48 - Components of Solid Waste Management](#)

[Lecture 49 - Collection and Treatment](#)

[Lecture 50 - Waste Disposal and Summary](#)

[Lecture 51 - Basics of Air Pollution Issues - Global and Local](#)

[Lecture 52 - Air Pollutants and Air Pollution Index](#)

[Lecture 53 - Global Warming and Climate Change](#)

[Lecture 54 - Air Pollution Models](#)

[Lecture 55 - SDGs, Noise and Soil Pollution](#)

[Lecture 56 - Present Issues and Few Case Studies](#)

[Lecture 57 - Case Study - Solid Waste Management](#)

[Lecture 58 - Case Study - Industrial Pollution and Disasters](#)

[Lecture 59 - Case Study - Global Food Waste Initiatives](#)

[Lecture 60 - Case Study - Global Food Waste and Resource Recovery](#)

Lecture 1 - Introduction to Biophotonics - Part I

Lecture 2 - Introduction to Biophotonics - Part II

Lecture 3 - Introduction to Biophotonics - Part III

Lecture 4 - Nature of Light - Part I (As Wave)

Lecture 5 - Nature of Light - Part II (As Particle)

Lecture 6 - Fact of Matter - Part I

Lecture 7 - Fact of Matter - Part II

Lecture 8 - Basic of Light-Matter Interaction

Lecture 9 - Molecular Materials

Lecture 10 - Introduction to Fluorescence

Lecture 11 - The Cell

Lecture 12 - The Central Dogma

Lecture 13 - Genetic Code

Lecture 14 - Building Blocks

Lecture 15 - Remaining Topics

Lecture 16 - Light-Matter Interactions in Molecules (Basic of Spectroscopy)

Lecture 17 - Light-Matter Interactions in Molecules (Basic of Spectroscopy) (Continued...)

Lecture 18 - Interaction of Light with Cells

Lecture 19 - Interaction of Light with Tissues

Lecture 20 - Photoprocesses in Biopolymers

Lecture 21 - Laser Principles and Operation

Lecture 22 - Types of Lasers

Lecture 23 - Nonlinear Optical Processes

Lecture 24 - In Vivo Photoexcitation

Lecture 25 - Examples and Applications

Lecture 26 - Introduction

Lecture 27 - Microscopy Techniques

Lecture 28 - Near Field Microscopy and Optical Coherence Tomography

Lecture 29 - Fluorophores and Fluorescence Microscopy Techniques

Lecture 30 - The Future: AFM-IR

Lecture 31 - Biosensing Background

[Lecture 32 - Optical Fiber Sensors](#)

[Lecture 33 - Metamaterials](#)

[Lecture 34 - Metamaterials as Biosensors](#)

[Lecture 35 - Biosensing with Optical Nano-antennas](#)

[Lecture 36 - Introduction to Photodynamic Therapy \(PDT\)](#)

[Lecture 37 - Application of Photodynamic Therapy \(PDT\)](#)

[Lecture 38 - Light Irradiation for Photodynamic Therapy \(PDT\)](#)

[Lecture 39 - Real Life Examples of Photodynamic Therapy \(PDT\)](#)

[Lecture 40 - Future of PDT and Photothermal Therapy \(PTT\)](#)

[Lecture 41 - Laser Based Tissue Engineering](#)

[Lecture 42 - Laser Tissue Contouring: Dermatological Application](#)

[Lecture 43 - Laser Tissue Welding and Tissue Regeneration](#)

[Lecture 44 - Laser Tissue Contouring: Ophthalmic Application](#)

[Lecture 45 - Laser in Dentistry](#)

[Lecture 46 - Tools for Micromanipulation](#)

[Lecture 47 - The Optical/Laser Tweezer](#)

[Lecture 48 - Design of Optical Tweezers](#)

[Lecture 49 - Optical Scissors](#)

[Lecture 50 - Selected Examples of Application](#)

[Lecture 51 - Introduction to nanotechnology](#)

[Lecture 52 - Processes of Nanotechnology](#)

[Lecture 53 - Nano-Lithography: The Art of Small](#)

[Lecture 54 - Thin Film Deposition](#)

[Lecture 55 - Bionanophotonics Applications](#)

[Lecture 56 - Introduction to Optogenetics](#)

[Lecture 57 - Controlling the Brain with Light](#)

[Lecture 58 - Optical Neuroimaging and Tomography](#)

[Lecture 59 - Functional Near Infrared Spectroscopy \(fNIRS\) of the Brain](#)

[Lecture 60 - Summary and Revisiting Few topics](#)

- Lecture 1 - Introduction to Vacuum, Natural Vacuum
- Lecture 2 - History of Vacuum Technology
- Lecture 3 - Kinetic Theory of Gases, Physical Parameters of Vacuum and Regions of Vacuum
- Lecture 4 - Vacuum Process Applications - I
- Lecture 5 - Vacuum Process Applications - II
- Lecture 6 - Pumping Speed and Throughput Concepts
- Lecture 7 - Rotary Vacuum Pump
- Lecture 8 - Diffusion Pump
- Lecture 9 - Roots Vacuum Pump
- Lecture 10 - Rotary Piston Pump
- Lecture 11 - Liquid Ring Pump
- Lecture 12 - Steam Jet Ejector
- Lecture 13 - Diaphragm Pump
- Lecture 14 - Claw Pump
- Lecture 15 - Screw Pump
- Lecture 16 - Scroll Pump, Sorption Concepts and Pumps
- Lecture 17 - Ion Pumping-Sputter Ion Pump
- Lecture 18 - Turbomolecular Pump
- Lecture 19 - Cryopumps
- Lecture 20 - Selection Criteria of Vacuum Pumps
- Lecture 21 - Primary vs Secondary Gauges, U Tube/McLeod gauges (Primary)
- Lecture 22 - Bourdon/Capacitance Gauges (Mechanical Deflection)
- Lecture 23 - Thermo-couple/Pirani gauges (Thermal Conductivity)
- Lecture 24 - Spinning Rotor/Ionization/Bayard Alpert Gauges
- Lecture 25 - Penning/ Inverted Magnetron gauges, Gauge calibration
- Lecture 26 - Vacuum Materials (Metals, Glasses, Ceramics, Greases and Oils)
- Lecture 27 - Vacuum Components (Flanges, Couplings, Seals, Valves)
- Lecture 28 - Vacuum Chamber Design
- Lecture 29 - Fabrication Techniques for Vacuum Systems
- Lecture 30 - Testing of Vacuum Systems for Mechanical Failures, Gas Leaks and Outgassing
- Lecture 31 - Gas Flow at Low Pressures, Conductance and Effective Pumping Speed Concepts

- Lecture 32 - Conductance Calculations in Viscous Flow Region
- Lecture 33 - Molecular Flow
- Lecture 34 - Transition and Choked Flows
- Lecture 35 - Conductance and Pump Down Calculations in Vacuum Systems
- Lecture 36 - Design Aspects of Vacuum Systems for Different Applications - Part I
- Lecture 37 - Design Aspects of Vacuum Systems for Different Applications - Part II
- Lecture 38 - Design of a Vacuum Furnace for Metallurgical Processing
- Lecture 39 - Leak Detection in Vacuum Systems
- Lecture 40 - Magnetic Deflection Leak Detector and Quadrupole Residual Gas Analyzer
- Lecture 41 - Vacuum Processes in Chemical and Pharmaceutical Industries
- Lecture 42 - Vacuum for Food Processing
- Lecture 43 - Vacuum Technology in the Packaging Industry
- Lecture 44 - Vacuum in Wood Industry
- Lecture 45 - Vacuum Systems for Medical and Dental Applications
- Lecture 46 - Vacuum for Desalination of Sea Water and Treatment of Waste Water
- Lecture 47 - Vacuum Technology for Power Sector
- Lecture 48 - Vacuum Technology In Oil and Gas Industries
- Lecture 49 - Vacuum Technology in LNG industry
- Lecture 50 - Vacuum Technology for Cryogenic Applications
- Lecture 51 - Vacuum Technology in High Speed Transportation (Hyperloop and Maglev)
- Lecture 52 - Vacuum technology for Metallurgical applications
- Lecture 53 - Vacuum Technology for Analytical Instruments
- Lecture 54 - Vacuum based coating units for thin film deposition
- Lecture 55 - Vacuum for solar energy (Thermal and PV)
- Lecture 56 - Vacuum Technology for semiconductor chip manufacturing
- Lecture 57 - Vacuum Technology for Display Systems
- Lecture 58 - Vacuum Technology for Nuclear Applications - Part I
- Lecture 59 - Vacuum Technology for Nuclear Applications - Part II
- Lecture 60 - Vacuum technology for Space Applications

- Lecture 1 - Brief history of public health
- Lecture 2 - Scope and Evolution of Health Promotion and Education
- Lecture 3 - Ottawa Charter
- Lecture 4 - Principles of health promotion
- Lecture 5 - Settings and audiences for health promotion
- Lecture 6 - Concepts of Health Behavior
- Lecture 7 - Health Risk Behavior Vs Health Promotion Behavior
- Lecture 8 - Concepts of Health Communication - Part I
- Lecture 9 - Concepts of Health Communication - Part II
- Lecture 10 - Health Literacy
- Lecture 11 - Information Education and Communication (IEC)
- Lecture 12 - Behavior Change Communication (BCC) - Part I
- Lecture 13 - Behavior Change Communication (BCC) - Part II
- Lecture 14 - Social and Behavior Change Communication (SBCC) - Part I
- Lecture 15 - Social and Behavior Change Communication (SBCC) - Part II
- Lecture 16 - Need Assessment for Health Promotion
- Lecture 17 - Approaches for Health Promotion and Behavior Change
- Lecture 18 - Models of Individual Health Behavior
- Lecture 19 - Models of Inter-Personal Health Behaviour
- Lecture 20 - Community and Group Models of Health Behavior Change
- Lecture 21 - Planning HPE Intervention - Part I
- Lecture 22 - Planning HPE Intervention - Part II
- Lecture 23 - Implementing HPE Intervention - Part I
- Lecture 24 - Implementing HPE Intervention - Part II
- Lecture 25 - Monitoring HPE Intervention
- Lecture 26 - Principles of Designing Messages
- Lecture 27 - Processes and Approaches of Designing Messages - Part I
- Lecture 28 - Processes and Approaches of Designing Messages - Part II
- Lecture 29 - Overview of Pretesting
- Lecture 30 - Pretesting of Health Promotion and Education Tools
- Lecture 31 - Health Education Methods - Part I

[Lecture 32 - Health Education Methods - Part II](#)

[Lecture 33 - Health Education Material - Part I](#)

[Lecture 34 - Health Education Material - Part II](#)

[Lecture 35 - Technology-based approaches to health behavior change](#)

[Lecture 36 - Evaluation of Theory-based HPE Interventions - Part I](#)

[Lecture 37 - Evaluation of Theory-based HPE Interventions - Part II](#)

[Lecture 38 - Analyzing Health Behavior Change Data](#)

[Lecture 39 - RE-AIM Framework for Health Promotion Program Evaluation](#)

[Lecture 40 - Health Impact Assessment](#)

Lecture 1 - Introduction to Neuroanatomy

Lecture 2 - Cerebellum

Lecture 3 - Basal Ganglia

Lecture 4 - Thalamus and Hypothalamus

Lecture 5 - Cerebral Cortex

Lecture 6 - Synapse and Neurotransmitters - 1

Lecture 7 - Synapse and Neurotransmitters - 2

Lecture 8 - Limbic System

Lecture 9 - Physiology of Emotions

Lecture 10 - Reticular Formation

Lecture 11 - Electrical activity of brain

Lecture 12 - Descriptive Psychopathology

Lecture 13 - Principles of Personality Development

Lecture 14 - Schizophrenia

Lecture 15 - Mood Disorders - 1

Lecture 16 - Mood Disorders - 2

Lecture 17 - Anxiety Disorders - I

Lecture 18 - Anxiety Disorders - II

Lecture 19 - Eating Disorders

Lecture 20 - Physiology of sleep

Lecture 21 - Sleep Disorders

Lecture 22 - Learning and Memory - 1

Lecture 23 - Learning and Memory - 2

Lecture 24 - Neurocognitive Disorders - I

Lecture 25 - Neurocognitive Disorders - II

Lecture 26 - Substance - I

Lecture 27 - Substance - II

Lecture 28 - Physiology of sensations

Lecture 29 - Psychosomatic Illness

Lecture 30 - Emergency Psychiatry

Lecture 31 - Child Psychiatry - I

[Lecture 32 - Child Psychiatry - II](#)

[Lecture 33 - Psychotherapy - I](#)

[Lecture 34 - Psychotherapy - II](#)

[Lecture 35 - Psychological Tests](#)

[Lecture 36 - Anti-psychotic drugs](#)

[Lecture 37 - Antidepressants](#)

[Lecture 38 - Mood Stabilizer](#)

[Lecture 39 - Anti-anxiety drugs](#)

[Lecture 40 - Forensic Psychiatry](#)

[Lecture 1 - Introduction to Reliability Engineering](#)

[Lecture 2 - Introduction to Reliability Engineering](#)

[Lecture 3 - Introduction to Reliability Engineering](#)

[Lecture 4 - Probability Basics](#)

[Lecture 5 - Probability Basics \(Continued...\)](#)

[Lecture 6 - Constant Failure Rate Model - I](#)

[Lecture 7 - Constant Failure Rate Model - II](#)

[Lecture 8 - Constant Failure Rate Model - III](#)

[Lecture 9 - Two Parameter Exponential Distribution](#)

[Lecture 10 - Weibull Distribution \(2 Parmeter\)](#)

[Lecture 11 - Burn-in Screening for Weibull](#)

[Lecture 12 - Weibull Distribution](#)

[Lecture 13 - Normal Distribution](#)

[Lecture 14 - Lognormal Distribution](#)

[Lecture 15 - System Reliability Modelling](#)

[Lecture 16 - System Reliability Modelling \(Continued...\)](#)

[Lecture 17 - System Reliability Modelling \(Continued...\)](#)

[Lecture 18 - System Reliability Modelling \(Continued...\)](#)

[Lecture 19 - System Reliability Modelling \(Continued...\)](#)

[Lecture 20 - System Reliability Modelling \(Continued...\)](#)

[Lecture 21 - Markov Analysis](#)

[Lecture 22 - Markov Analysis \(Continued...\)](#)

[Lecture 23 - Markov Analysis \(Continued...\)](#)

[Lecture 24 - Markov Analysis \(Continued...\)](#)

[Lecture 25 - Markov Analysis \(Continued...\)](#)

[Lecture 26 - Failure Data Analysis: Non-Parametric Approach](#)

[Lecture 27 - Failure Data Analysis: Non-Parametric Approach \(Continued...\)](#)

[Lecture 28 - Failure Data Analysis: Non-Parametric Approach \(Continued...\)](#)

[Lecture 29 - Failure Data Analysis: Non-Parametric Approach \(Continued...\)](#)

[Lecture 30 - Failure Data Analysis \(Parametric\)](#)

[Lecture 31 - Failure data analysis \(Parametric\) \(Continued...\)](#)

[Lecture 32 - Failure data analysis \(Parametric\) \(Continued...\)](#)

[Lecture 33 - Goodness of fit](#)

[Lecture 34 - Goodness of Fit \(GoF\) Tests](#)

[Lecture 35 - Goodness of Fit \(GoF\) Tests \(Continued...\)](#)

[Lecture 36 - Maintainability and Availability](#)

[Lecture 37 - Maintainability and Availability \(Continued...\)](#)

[Lecture 38 - Maintainability and Availability \(Continued...\)](#)

[Lecture 39 - Maintainability and Availability \(Continued...\)](#)

[Lecture 40 - Summary of the course Introduction to Reliability Engineering](#)

Lecture 1 - Introduction

Lecture 2 - Biosensors and its Application

Lecture 3 - Translational Research and Nano Biosensing

Lecture 4 - Nanomaterials for Healthcare Biosensing

Lecture 5 - Signal Amplification for Ultrasensitive Biosensors

Lecture 6 - Signal Amplification for Ultrasensitive Biosensors (Continued...)

Lecture 7 - Signal Amplification for Ultrasensitive Biosensors (Continued...)

Lecture 8 - Signal Amplification for Ultrasensitive Biosensors (Continued...)

Lecture 9 - Different Measurement Techniques for Electrochemical Biosensors

Lecture 10 - Limit of Detection and Wash-Free Detection for Biosensors

Lecture 11 - Wash-Free Detection for Biosensors (Continued...)

Lecture 12 - Label-Free Detection for Biosensors

Lecture 13 - Label-free detection and Multiplex Biosensors

Lecture 14 - Multiplex Biosensors (Continued...)

Lecture 15 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 16 - Enhanced electrocatalytic activity for biosensors

Lecture 17 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 18 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 19 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 20 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 21 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 22 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 23 - Effect of pretreatment on PCB and biosensor development

Lecture 24 - Impact of surface Roughness of PCB and PCB for Glucose sensors

Lecture 25 - Tutorial on Biosensors Fabrication

Lecture 26 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 27 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 28 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 29 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 30 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 31 - Self-Powered Biosensors

[Lecture 32 - Biosensors for Safety and Security](#)

[Lecture 33 - Research Proposal and Ethical Clearance](#)

[Lecture 34 - Special Chemistry for Biosensing](#)

[Lecture 35 - Tutorial - 2](#)

[Lecture 36 - Tutorial - 3](#)

[Lecture 37 - Tutorial - 4](#)

[Lecture 38 - Lab Demonstration - 1](#)

[Lecture 39 - Lab Demonstration - 2](#)

[Lecture 40 - Lab Demonstration - 3](#)

- Lecture 1 - Adolescent Health Statistics
- Lecture 2 - Introduction to Nutrition and Dietetics
- Lecture 3 - Role of Macronutrients
- Lecture 4 - Role of Micronutrients
- Lecture 5 - Basics of Adolescent Mental Health
- Lecture 6 - Physiological and Psychological changes during Adolescence
- Lecture 7 - Special Nutritional Requirements in Adolescents
- Lecture 8 - Malnutrition in Adolescents and their effects in Adult life
- Lecture 9 - Adolescent Immunization
- Lecture 10 - High risk behaviour in Adolescents
- Lecture 11 - Nutrition Care Process
- Lecture 12 - Dietary Counseling and Nutrition Planning
- Lecture 13 - Common Micronutrient Deficiency in Adolescents
- Lecture 14 - Eating Disorders in Adolescents
- Lecture 15 - National Initiatives related to Adolescents
- Lecture 16 - Behavior Modification for Weight Management
- Lecture 17 - Adolescents And Physical Activity
- Lecture 18 - Combating Special Situations
- Lecture 19 - Legislations for Adolescents
- Lecture 20 - Innovations for Holistic Well-being of Adolescents

- Lecture 1 - Basics of Health Promotion
- Lecture 2 - Basic Principles of Health Promotion
- Lecture 3 - The Health Promotion Research Process
- Lecture 4 - Process of Health Promotion Research: Integrity and Rigor
- Lecture 5 - Ethics in Health Promotion Research
- Lecture 6 - Health Behavior and Health Behavior Change
- Lecture 7 - Theory, Research and Behavior Change Techniques
- Lecture 8 - Intervention Mapping
- Lecture 9 - Ecological Models of Health Behavior
- Lecture 10 - Social Science Techniques
- Lecture 11 - Precede-Proceed Model
- Lecture 12 - Models of Individual Health Behavior - I
- Lecture 13 - Models of Individual Health Behavior - II
- Lecture 14 - Models of Interpersonal Health Behavior
- Lecture 15 - Community and Group Models of Health Behavior Change
- Lecture 16 - Research design and techniques
- Lecture 17 - Observational research designs
- Lecture 18 - Experimental Research Designs
- Lecture 19 - Experimental Research Designs: Issues and Challenges
- Lecture 20 - Measurements in Health promotion
- Lecture 21 - Qualitative methods in Health Promotion - Part I
- Lecture 22 - Qualitative Methods in Health Promotion - Part II
- Lecture 23 - Qualitative Methods in Health Promotion - Part III
- Lecture 24 - Qualitative Methods in Health Promotion - Part IV
- Lecture 25 - Qualitative Methods in Health Promotion - Part V
- Lecture 26 - Introduction to Mixed Methods Research
- Lecture 27 - The Convergent Design
- Lecture 28 - The Explanatory Sequential Design
- Lecture 29 - The Exploratory Sequential Design (Continued...)
- Lecture 30 - The Embedded Design
- Lecture 31 - Different study tools and their application in health promotion research

- Lecture 32 - Formulating an appropriate study tool (Quantitative data collection tools)
- Lecture 33 - Validity and reliability of study tools in quantitative research - Part I
- Lecture 34 - Validity and reliability of study tools in quantitative research - Part II
- Lecture 35 - Formulating an appropriate study tool(Qualitative data collection tools)
- Lecture 36 - Designing messages - Part I
- Lecture 37 - Designing messages - Part II
- Lecture 38 - Materials and Methods of Intervention Delivery - Part I
- Lecture 39 - Materials and Methods of Intervention Delivery - Part II
- Lecture 40 - Pretesting of an intervention tool
- Lecture 41 - BCC and SBCC - Part I
- Lecture 42 - BCC and SBCC - Part II
- Lecture 43 - BCC and SBCC - Part III
- Lecture 44 - BCC and SBCC - Part IV
- Lecture 45 - BCC and SBCC - Part V
- Lecture 46 - Community-Based Participatory Research in context to Health Promotion - Part I
- Lecture 47 - Community-Based Participatory Research in context to Health Promotion - Part II
- Lecture 48 - Community-Based Participatory Research in context to Health Promotion - Part III
- Lecture 49 - Community-Based Participatory Research in context to Health Promotion - Part IV
- Lecture 50 - Community-Based Participatory Research in context to Health Promotion - Part V
- Lecture 51 - Quantitative analytical methods - Part I
- Lecture 52 - Quantitative analytical methods - Part II
- Lecture 53 - Quantitative analytical methods - Part III
- Lecture 54 - Analysis of Qualitative data
- Lecture 55 - Analyzing Mixed Methods data
- Lecture 56 - Developing a research proposal in health promotion
- Lecture 57 - Report writing in health Promotion: An Overview
- Lecture 58 - Report writing: quantitative research in health promotion - Part I
- Lecture 59 - Report writing: quantitative research in health promotion - Part II
- Lecture 60 - Report Writing: Qualitative and Mixed Methods research

Lecture 1 - Introduction

Lecture 2 - Urban Heritage - Global Conventions and Declarations

Lecture 3 - Historical Urban Landscape (HUL) - Approach, Toolkit, and Actions

Lecture 4 - Urban Heritage - The Indian Context

Lecture 5 - SDG(s) 11(.4) - Transdisciplinary Possibilities, Pathways, and Actions

Lecture 6 - Historicizing lakes of Bangalore - social-ecological perspectives

Lecture 7 - Urban environmentalisms - lake-based and rights-based

Lecture 8 - Example 1: The Jakkur Lake

Lecture 9 - Example 2: The Puttenahalli Lake

Lecture 10 - Example 3: The Kaikondrahalli Lake

Lecture 11 - Kolkata's heritage - Applying the urban ecological heritage lens

Lecture 12 - Kolkata and EKW - conveying the co-evolutionary narrative

Lecture 13 - Living Systems infrastructure of Kolkata

Lecture 14 - Case study 1: The Nalban and Goltala Fisheries

Lecture 15 - Case study 2: Baro Chaynavi Cooperative

Lecture 16 - Case study 3: Jhagrashisha

Lecture 17 - EKW as heritage - Lessons from a Practical Empirical Implementation Project - I

Lecture 18 - EKW as heritage - Lessons from a Practical Empirical Implementation Project - I

Lecture 19 - Conclusions

Lecture 1 - Introduction

Lecture 2 - Experiment 1: Teaching of Serial Manipulator

Lecture 3 - Experimentation I

Lecture 4 - Experiment 1: Teaching of Serial Manipulator (Continued...)

Lecture 5 - Experiment 2: Control of Tracked Mobile Manipulator

Lecture 6 - Experimentation II

Lecture 7 - Experiment 2: Control of Tracked Mobile Manipulator (Continued...)

Lecture 8 - Experiment 3: Path and Gait Planning of Six-legged Robot

Lecture 9 - Experimentation III

Lecture 10 - Experiment 3: Path and Gait Planning of Six-legged Robot (Continued...)

Lecture 11 - Experiment 4: Navigation of Drone

Lecture 12 - Experimentation IV

Lecture 13 - Experimentation IV (Continued...)

Lecture 14 - Experiment 5: Path and Gait Planning of 25 dof NAO Humanoid Robot

Lecture 15 - Experimentation V

Lecture 16 - Experiment 5: Path and Gait Planning of 25 dof NAO Humanoid Robot (Continued...)

Lecture 17 - Current Trends in Robotics Research

Lecture 18 - Summary of the Course

- Lecture 1 - Interface between Medical Profession and Law
- Lecture 2 - Role of Medical practitioners in Justice Administration
- Lecture 3 - Dos and Don'ts of Doctors
- Lecture 4 - Dos and Don'ts for Legal Practitioners
- Lecture 5 - Knowledge exchange between Medical and Legal Practitioners
- Lecture 6 - Consent in Law
- Lecture 7 - Types of Consent in Medical Field
- Lecture 8 - Ethics in Medical Profession
- Lecture 9 - Importance of Documentation in Medical practice
- Lecture 10 - Legal Implications of Improper Documentation
- Lecture 11 - Legal Responsibilities of Medical Practitioners
- Lecture 12 - Medical Negligence and Legal Implications
- Lecture 13 - Legal Implications of Medical Malpractice
- Lecture 14 - Landmark Judgments on Medical Negligence
- Lecture 15 - Testimony of Doctors in Medical Negligence
- Lecture 16 - Healthcare Policy and Law
- Lecture 17 - Clinical Establishment Law
- Lecture 18 - Legal liability of Hospitals/Clinical Establishments
- Lecture 19 - Legal responsibility in Diagnostics
- Lecture 20 - Penalties for non-compliance
- Lecture 21 - Role of IPR in promoting medical innovation and technologies
- Lecture 22 - Health Policy formulation and Role of IPR
- Lecture 23 - Intellectual Property and Access to Medicine
- Lecture 24 - Neglected diseases and Role of IPR
- Lecture 25 - Patenting Therapeutic Practices and Techniques
- Lecture 26 - Duties of Doctor in Courts
- Lecture 27 - Evidence Law and Medical experts
- Lecture 28 - Admissibility of Forensic Evidence
- Lecture 29 - Various Legal procedures in Medical practice
- Lecture 30 - Collection, preservation and dispatch of Forensic Evidence
- Lecture 31 - Ethical insight into different aspects of Surrogacy practice

[Lecture 32 - Surrogacy Regulation in India](#)

[Lecture 33 - Assisted Reproductive Technology Regulation in India](#)

[Lecture 34 - Pre-Conception and Pre-Natal Diagnostic](#)

[Lecture 35 - Penalties for non-compliance](#)

[Lecture 36 - Ethical Issues in Organ Transplantation](#)

[Lecture 37 - Law governing organ transplantation](#)

[Lecture 38 - Comparative Law on Organ Transplantation](#)

[Lecture 39 - Medico-Legal Issues in Clinical Trials](#)

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- Lecture 1 - Overview of Obstetrics
- Lecture 2 - Anatomy of Vulva or pudendum
- Lecture 3 - Anatomy of Vagina
- Lecture 4 - Anatomy of Cervix and Uterus
- Lecture 5 - Anatomy of Uterus
- Lecture 6 - Anatomy of fallopian tubes and ovary
- Lecture 7 - Anatomy of plvic floor and perineum
- Lecture 8 - Gametogenesis
- Lecture 9 - Fertilisation and Embryogenesis
- Lecture 10 - Implantation
- Lecture 11 - Placentation (normal and abnormal)
- Lecture 12 - Placentation (normal and abnormal) (Continued...)
- Lecture 13 - Umbilical cord and Fetal membranes - Part 1
- Lecture 14 - Umbilical cord and Fetal membranes - Part 2
- Lecture 15 - FETUS (physiology and circulation)
- Lecture 16 - Physiological changes in pregnancy - Part 1
- Lecture 17 - Physiological changes in pregnancy - Part 2
- Lecture 18 - Physiological changes in pregnancy - Part 3
- Lecture 19 - Hormones in pregnancy
- Lecture 20 - Hormones in pregnancy (Continued...)
- Lecture 21 - Diagnosis of pregnancy - 1
- Lecture 22 - Diagnosis of Pregnancy - 2
- Lecture 23 - Obstetrical Examination
- Lecture 24 - Obstetrical Examinationon antenatal mother (Clinical Study)
- Lecture 25 - Maternal Pelvis \$ Foetal Skill - Part 1
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- Lecture 27 - Pre-conceptional counselling and care
- Lecture 28 - Nutrition in Pregnancy
- Lecture 29 - Antenatal Care - Part 1
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- [Lecture 32 - Antenatal Assessment of Fetal Well-Being - Part 1](#)
- [Lecture 33 - Antenatal Assessment of Fetal Well-Being - Part 2](#)
- [Lecture 34 - Antenatal Assessment of Fetal Well-Being - Part 3](#)
- [Lecture 35 - Prenatal Screening and Diagnosis of aneuploidies](#)
- [Lecture 36 - Invasive and non-invasive Prenatal Diagnostic Test](#)
- [Lecture 37 - Invasive and non-invasive Prenatal Diagnostic Test \(Continued...\)](#)
- [Lecture 38 - Fetal Imaging and Amniotic Fluid Study](#)
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- [Lecture 40 - Teratology, Teratogens and feto-toxic agents - Part 1](#)
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- [Lecture 42 - Normal Labour - Stages and cause of onset](#)
- [Lecture 43 - Physiology of Labor](#)
- [Lecture 44 - Events of Normal Labour](#)
- [Lecture 45 - Mechanism of Normal Labour](#)
- [Lecture 46 - Mechanism of Normal Labour \(Continued...\)](#)
- [Lecture 47 - Clinical course of Labour](#)
- [Lecture 48 - Monitoring of Normal Labour - Part 1](#)
- [Lecture 49 - Monitoring of Normal Labour - Part 2](#)
- [Lecture 50 - Labour Analgesia](#)
- [Lecture 51 - Labour Analgesia \(Continued...\)](#)
- [Lecture 52 - Abnormal Labour](#)
- [Lecture 53 - Intrapartum Fetal Monitoring - Partogram](#)
- [Lecture 54 - Intrapartum Fetal Monitoring - Cardiotocography \(CTG\)](#)
- [Lecture 55 - Intrapartum Fetal Monitoring - Cardiotocography \(CTG\) \(Continued...\)](#)
- [Lecture 56 - Induction and Augmentation of Labour](#)
- [Lecture 57 - WHO Labour Guide](#)
- [Lecture 58 - Episiotomy](#)
- [Lecture 59 - Instrumental Vaginal Delivery](#)
- [Lecture 60 - Obstetric anal sphincter injuries OASIS](#)
- [Lecture 61 - Lower Segment Caesarean Section](#)
- [Lecture 62 - Normal Puerperal changes](#)
- [Lecture 63 - Management of Puerperium](#)
- [Lecture 64 - Post-Natal care and postpartum contraception](#)

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[Lecture 67 - Government health programmes related to Maternal Health \(Continued...\)](#)

[Lecture 68 - Comprehensive Abortion Care \(MTP Amendment Act 2021\)](#)

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- Lecture 2 - Types of recommender system - I
- Lecture 3 - Types of recommender system - II
- Lecture 4 - Data Collection
- Lecture 5 - Data Description
- Lecture 6 - Data preprocessing
- Lecture 7 - Dimensionality Reduction
- Lecture 8 - Introduction to machine learning - I
- Lecture 9 - Introduction to machine learning - II
- Lecture 10 - Introduction to machine learning - III
- Lecture 11 - Distance and Similarity
- Lecture 12 - Distance and Similarity (Continued...)
- Lecture 13 - User-Based Approach
- Lecture 14 - Item-Based Approach
- Lecture 15 - Additional Topics in Neighbourhood Based Approach
- Lecture 16 - Association rule based model
- Lecture 17 - UV Decomposition
- Lecture 18 - The latent factor model
- Lecture 19 - Basic latent factor models
- Lecture 20 - Other advanced models
- Lecture 21 - Introduction to content based recommender system: Foundations
- Lecture 22 - Feature Engineering - I
- Lecture 23 - Feature Engineering - II
- Lecture 24 - Feature Engineering - III
- Lecture 25 - Feature Engineering - IV
- Lecture 26 - Decision Trees for content based recommendation
- Lecture 27 - Naïve Bayes classifier for content based recommendation
- Lecture 28 - kNN Classifier for Recommender System
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- Lecture 31 - Introduction to evaluation of recommender system

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Lecture 2 - DNA Replication and Repair Mechanism

Lecture 3 - Transcription (RNA Synthesis)

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Lecture 5 - Nucleic Acid Isolation and Detection Methods

Lecture 6 - PCR (Polymerase Chain Reaction) Fundamentals

Lecture 7 - Realtime PCR - Part 1

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Lecture 9 - Variations of the PCR - Part 1

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Lecture 11 - DNA Cloning and Recombinant DNA technology - I

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Lecture 16 - DNA Microarray

Lecture 17 - FISH (Fluorescence in situ Hybridization)

Lecture 18 - Methods to study DNA-protein interaction - I

Lecture 19 - Methods to study DNA-protein interaction - II

Lecture 20 - Epigenetics and DNA methylation analysis

Lecture 21 - DNA Sequencing - Part 1 - Maxam Gilbert Sequencing

Lecture 22 - DNA Sequencing - Part 2 - Sanger Sequencing

Lecture 23 - Next Generation Sequencing - Part 1

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Lecture 26 - Overview, Importance, Methods in Proteomics

Lecture 27 - Proteomic Techniques - High performance liquid chromatography (HPLC)

Lecture 28 - Proteomic Techniques - Mass Spectrometry

Lecture 29 - Proteomic Techniques - Differential in-gel electrophoresis

Lecture 30 - Proteomic Techniques - Protein Microarray

Lecture 31 - Label-based Protein Quantification Technologies - Part 1

- Lecture 32 - Label-based Protein Quantification Technologies - Part 2
- Lecture 33 - Label free methods of protein quantification
- Lecture 34 - Next Generation Proteomics
- Lecture 35 - Proteomic Data Analysis and Bioinformatic Tools
- Lecture 36 - Syndromic Panels and Multiplex Assay : Molecular identification of Microorganism
- Lecture 37 - Molecular Diagnostics in Antimicrobial Resistance Testing
- Lecture 38 - RNA Sequencing: Role in Infectious diseases - I
- Lecture 39 - RNA Sequencing: Role in Infectious diseases - II
- Lecture 40 - Point of Care (POC) diagnostics in Infectious diseases
- Lecture 41 - Molecular genetics in tumorigenesis
- Lecture 42 - Liquid biopsies in cancer detection
- Lecture 43 - Digital PCR in Cancer detection
- Lecture 44 - Mutation Detection Methods
- Lecture 45 - Isothermal Nucleic Acid Amplification
- Lecture 46 - Genetic Testing and Inherited Disorders - Part 1
- Lecture 47 - Genetic Testing and Inherited Disorders - Part 2
- Lecture 48 - Prenatal diagnostics and NIPT
- Lecture 49 - Reproductive genetics and genetic counselling
- Lecture 50 - Genetic counselling and patient education
- Lecture 51 - Serial Analysis of Gene Expression
- Lecture 52 - Metabolomics in Molecular Diagnostics
- Lecture 53 - Immunoassay and Luminex Multiplex Assay
- Lecture 54 - Molecular diagnostics in Metabolic, Cardiovascular and Gastrointestinal disorders
- Lecture 55 - Molecular diagnostics in Endocrine, Neurodegenerative and Transplantation disorders
- Lecture 56 - Pharmacogenomics and Personalized Medicine
- Lecture 57 - Quality control (QC) in molecular diagnostics
- Lecture 58 - Ethical concerns in molecular diagnostics
- Lecture 59 - Artificial Intelligence and Machine learning in Genomics
- Lecture 60 - Integration of Multiomics Data in Molecular Diagnostics

Lecture 0 - Neuroscience of Human Movement

Lecture 1 - Membrane Physiology - Part 1

Lecture 2 - Membrane Physiology - Part 2

Lecture 3 - Nernst Equation

Lecture 4 - Goldman Equation

Lecture 5 - Action Potential - Part 1

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Lecture 10 - Review of Action Potential and Neurotransmitters

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Lecture 20 - Motor Units - PIC and EMG

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Lecture 24 - Excitation and Inhibition within Spinal Cord - Part 1

Lecture 25 - Excitation and Inhibition within Spinal Cord - Part 2

Lecture 26 - Monosynaptic Reflexes - Part 1

Lecture 27 - Monosynaptic Reflexes - Part 2

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Lecture 29 - Oligosynaptic and Polysynaptic Reflexes - Part 1

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- Lecture 1 - How is TB affecting public health Globally and Nationally
- Lecture 2 - Epidemiology of TB-Session - 1
- Lecture 3 - Epidemiology of TB-Session - 2
- Lecture 4 - Pathogenesis of TB-Session - 1
- Lecture 5 - Pathogenesis of TB-Session - 2
- Lecture 6 - Clinical manifestations of TB-Session - 1
- Lecture 7 - Clinical manifestations of TB-Session - 2
- Lecture 8 - Clinical manifestations of TB-Session - 3
- Lecture 9 - Bacteriological Diagnosis of Tuberculosis - Smear and Culture
- Lecture 10 - Demonstration of processing of sputum specimen for culture for diagnosis of tuberculosis
- Lecture 11 - Demonstration of sputum smear examination for diagnosis of tuberculosis
- Lecture 12 - Demonstration of solid culture method for diagnosis of tuberculosis
- Lecture 13 - Demonstration of liquid culture method for diagnosis of tuberculosis in sputum
- Lecture 14 - Phenotypic drug susceptibility testing in Tuberculosis
- Lecture 15 - Demonstration of drug susceptibility testing of first line anti-TB drugs by liquid culture
- Lecture 16 - Molecular Diagnosis of Tuberculosis-Session - 1
- Lecture 17 - Molecular Diagnosis of Tuberculosis-Session - 2
- Lecture 18 - Demonstration of Xpert MTB-RIF assay for diagnosis of tuberculosis from sputum specimens
- Lecture 19 - Demonstration of Line Probe Assay (LPA) (Direct detection of tuberculosis and resistance to isoniazid and rifampicin) in sputum
- Lecture 20 - Radiology in diagnosis of Tuberculosis-Session - 1
- Lecture 21 - Radiology in diagnosis of Tuberculosis-Session - 2
- Lecture 22 - Radiology in diagnosis of Tuberculosis-Session - 3
- Lecture 23 - Radiology in diagnosis of Tuberculosis-Session - 4
- Lecture 24 - Approach to diagnosis of Pulmonary TB
- Lecture 25 - Case Discussion-Approach to diagnosis of TB in a person with presumptive pulmonary TB
- Lecture 26 - Case Discussion-Approach to diagnosis of pulmonary TB in a patient with negative sputum smear for AFB
- Lecture 27 - Approach to diagnosis of Extra-pulmonary TB
- Lecture 28 - Case Discussion-Approach to diagnosis of TB in a person with swelling in the neck
- Lecture 29 - Case Discussion-Approach to diagnosis of TB spine
- Lecture 30 - Diagnosis of Childhood Tuberculosis-Session - 1

Lecture 31 - Diagnosis of Childhood Tuberculosis-Session - 2

Lecture 32 - Video demonstration of gastric fluid aspiration technique in a child

Lecture 33 - Case Discussion-Approach to diagnosis of TB in a child with presumptive pulmonary TB

Lecture 34 - Case Discussion-Approach to diagnosis of TB meningitis in a child

Lecture 35 - Drugs for treating Tuberculosis and Principles of Chemotherapy-Session - 1

Lecture 36 - Drugs for treating Tuberculosis and Principles of Chemotherapy-Session - 2

Lecture 37 - Treatment of Drug Sensitive Pulmonary Tuberculosis

Lecture 38 - Case discussion-Approach to treatment of drug sensitive TB

Lecture 39 - Management of drug resistant Tuberculosis-Session - 1

Lecture 40 - Management of drug resistant Tuberculosis-Session - 2

Lecture 41 - Case discussion-Approach to treatment of Multi-drug resistant TB (MDR-TB)/ Extensively drug resistant TB (XDR-TB)

Lecture 42 - Management of Extra-pulmonary Tuberculosis-Session - 1

Lecture 43 - Management of Extra-pulmonary Tuberculosis-Session - 2

Lecture 44 - Panel discussion-Practical difficulties in the management of Extra-pulmonary TB

Lecture 45 - Management of patients with HIV-TB coinfection-Session - 1

Lecture 46 - Management of patients with HIV-TB coinfection-Session - 2

Lecture 47 - Case discussion-Approach to management of HIV-TB

Lecture 48 - Management of TB in special situations

Lecture 49 - Case discussion-Approach to management of TB in pregnancy

Lecture 50 - Treatment of Pediatric Tuberculosis-Session - 1

Lecture 51 - Treatment of Pediatric Tuberculosis-Session - 2

Lecture 52 - Management of Adverse effects to anti-TB drugs-Session - 1

Lecture 53 - Management of Adverse effects to anti-TB drugs-Session - 2

Lecture 54 - Case discussion-Approach to management of jaundice during anti-TB treatment

Lecture 55 - Case discussion-Approach to management of skin rashes during anti-TB treatment

Lecture 56 - Non-tuberculous Mycobacteria- Diagnosis and Clinical management-Session - 1

Lecture 57 - Non-tuberculous Mycobacteria - Diagnosis and Clinical Management Session - 2

Lecture 58 - Newer Anti-TB drugs and regimens-Session - 1

Lecture 59 - Newer Anti-TB drugs and regimens-Session - 2

Lecture 60 - Management of Latent TB Infection-Session - 1

Lecture 61 - Management of Latent TB Infection-Session - 2

Lecture 62 - Airborne infection control in tuberculosis-Session - 1

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[Lecture 64 - Vaccine for Tuberculosis-Session - 1](#)

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[Lecture 66 - Services offered by Revised National TB Control Programme \(RNTCP\)-Session - 1](#)

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[Lecture 70 - Tuberculosis notification-Session - 1](#)

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[Lecture 74 - Standards for TB Care in India-Session - 1](#)

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[Lecture 76 - Global Tuberculosis Control Strategies](#)

Lecture 1 - Sustainability

Lecture 2 - Dams

Lecture 3 - Dams

Lecture 4 - Adayar River

Lecture 5 - Adayar River

Lecture 6 - Urbanisation in Western Ghats and Biodiesel

Lecture 7 - Use And Throw Plastic

Lecture 8 - Nano Materials Information Technology

Lecture 9 - Definition of Health Risk

Lecture 10 - Transport Of Pollutants in the Environment

Lecture 11 - Assesment of Risk

Lecture 12 - Remediation and Liability

Lecture 13 - Remendiation and Liability

Lecture 14 - Life Cycle Analysis

Lecture 15 - Energy and Environment module - 1

Lecture 16 - Energy and Environment module - 2

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Lecture 19 - Energy and Environment module - 5

Lecture 20 - Energy and Environment module - 6

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Lecture 23 - Drinking Water Supply: Need and Challenges

Lecture 24 - Water Quality Standards And Philosophy of Water Treatment

Lecture 25 - Water Treatment: Point Of Use Filters

Lecture 26 - Wastewater Management in Developing Urban Environments: Indian Scenario

Lecture 27 - Wastewater Recycling: A Sustainable Option For Water Management

Lecture 28 - Sustainable Water Management In Urban Areas - Part 1

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Lecture 1 - Introduction

Lecture 2 - Overview of Learning Modules

Lecture 3 - Course Plan

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- Lecture 32 - Analysis of Bisection Method
- Lecture 33 - Bonus: Excel Solution for Bisection Method
- Lecture 34 - Regula-Falsi Method
- Lecture 35 - Bonus: Excel Solution for Regula-Falsi Method
- Lecture 36 - Regula-Falsi vs. Secant Method
- Lecture 37 - Bonus: Excel Solution for Secant Method
- Lecture 38 - Some special cases
- Lecture 39 - Fixed-Point Iteration
- Lecture 40 - Newton-Raphson Method
- Lecture 41 - Analysis of Fixed-Point Iteration
- Lecture 42 - Analysis of Newton-Raphson
- Lecture 43 - Problems with Newton-Raphson
- Lecture 44 - Multi-Variable Fixed-Point Iteration
- Lecture 45 - Multi-Variable Newton-Raphson
- Lecture 46 - Out of Syllabus: Improvements to NR Methods
- Lecture 47 - Out of Syllabus: Roots of a polynomial
- Lecture 48 - Summary
- Lecture 49 - Introduction: Regression and Interpolation
- Lecture 50 - Linear Regression in One Variable
- Lecture 51 - Recap: Formula for Linear Regression
- Lecture 52 - Bonus: Linear Regression using MS-Excel
- Lecture 53 - Linear Regression in Multiple Variables
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- Lecture 55 - Polynomial Regression
- Lecture 56 - Functional Regression
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- Lecture 58 - Interpolation: Introduction and A Na^{ve} Extension
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- Lecture 65 - Summary: Regression and Interpolation
- Lecture 66 - Numerical Differentiation: Introduction
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- Lecture 68 - Derivation using Method of undetermined coefficients
- Lecture 69 - Three-point differentiation formulae
- Lecture 70 - Bonus: Differentiation using MS-Excel
- Lecture 71 - Truncation vs. Round-Off Errors
- Lecture 72 - Numerical Differentiation Examples
- Lecture 73 - Summary of Numerical Differentiation
- Lecture 74 - Numerical Integration: Introduction
- Lecture 75 - Trapezoidal rule and Derivation
- Lecture 76 - Simpson's Rules for Integration
- Lecture 77 - Bonus: MS-Excel for Numerical Integration
- Lecture 78 - Error Analysis for Simpson's Rules
- Lecture 79 - Numerical Integration Examples
- Lecture 80 - Bonus: Integration using MS-Excel
- Lecture 81 - Summary of Newton Cotes Formulae
- Lecture 82 - Richardson's Extrapolation
- Lecture 83 - Gauss Quadrature
- Lecture 84 - Summary of Numerical Integration
- Lecture 85 - Introduction to ODE-IVP
- Lecture 86 - Motivation using an Example (Bonus)
- Lecture 87 - Euler's Methods and Second-Order Methods
- Lecture 88 - Second-Order Runge-Kutta Methods
- Lecture 89 - Summary of RK-2
- Lecture 90 - Higher order RK Methods
- Lecture 91 - Bonus: ODE-IVP using MS-Excel
- Lecture 92 - Bonus: RK-2 and RK-4 Methods using MS-Excel
- Lecture 93 - Summary and Recap
- Lecture 94 - Introduction to Predictor-Corrector Methods
- Lecture 95 - Stability of Implicit Methods: Overview
- Lecture 96 - Stability Analysis of Euler's Methods
- Lecture 97 - Extension to multiple variables

[Lecture 98 - Local vs. Global Truncation Errors](#)

[Lecture 99 - Richardson's Extrapolation](#)

[Lecture 100 - Stiff System of ODEs: Introduction](#)

[Lecture 101 - Adaptive Step-sizing](#)

[Lecture 102 - Adaptive step-sizing and Embedded Methods](#)

[Lecture 103 - Bonus: Errors and Extrapolation using MS-Excel](#)

[Lecture 104 - Summary and Recap \(Weeks 10 and 11\)](#)

[Lecture 105 - Introduction to ODE-BVP](#)

[Lecture 106 - Shooting Method: An Overview](#)

[Lecture 107 - Finite Difference Method: An Overview](#)

[Lecture 108 - Solution using Shooting Method](#)

[Lecture 109 - Algorithm for Shooting Method](#)

[Lecture 110 - Problems with Shooting Method](#)

[Lecture 111 - Solving ODE-BVP using Finite Difference Method](#)

[Lecture 112 - Microsoft Excel based Solution](#)

[Lecture 113 - Recap of Week-12 \(ODE-BVP\)](#)

- Lecture 1 - Introduction to health research
- Lecture 2 - Formulating research question
- Lecture 3 - Literature review
- Lecture 4 - Measures of disease frequency
- Lecture 5 - Descriptive study designs
- Lecture 6 - Analytical study designs
- Lecture 7 - Experimental study designs: Clinical trials
- Lecture 8 - Validity of epidemiological studies
- Lecture 9 - Qualitative research methods: An overview
- Lecture 10 - Measurement of study variables
- Lecture 11 - Sampling methods
- Lecture 12 - Calculating sample size and power
- Lecture 13 - Selection of study population
- Lecture 14 - Study plan and project management
- Lecture 15 - Designing data collection tools
- Lecture 16 - Principles of data collection
- Lecture 17 - Data management
- Lecture 18 - Overview of data analysis
- Lecture 19 - Ethical framework for health research
- Lecture 20 - Conducting clinical trails
- Lecture 21 - Preparing a concept paper for research projects
- Lecture 22 - Elements of a protocol for research studies

- Lecture 1 - Basic concepts and definitions - Part 1
- Lecture 2 - Basic concepts and definitions - Part 2
- Lecture 3 - Basic concepts and definitions - Part 3
- Lecture 4 - Tutorial problems on exact and inexact differential
- Lecture 5 - Basic concepts and definitions - Part 4
- Lecture 6 - Work - Part 1
- Lecture 7 - Work - Part 2
- Lecture 8 - Work - Part 3
- Lecture 9 - Work - Part 4
- Lecture 10 - Work - Part 5
- Lecture 11 - Tutorial problem on 'Work' - Part 1
- Lecture 12 - Tutorial problem - Part 2
- Lecture 13 - Tutorial problem on 'Work' - Part 3
- Lecture 14 - Tutorial problem on 'Work' - Part 4
- Lecture 15 - Zeroth law of thermodynamics
- Lecture 16 - Methods of temperature measurement
- Lecture 17 - Modes of heat transfer
- Lecture 18 - Tutorial problem on 'Modes of heat transfer'
- Lecture 19 - Tutorial problem on 'Methods of temperature measurement'
- Lecture 20 - First law of thermodynamics
- Lecture 21 - Tutorial problem - Part 1
- Lecture 22 - Tutorial problem - Part 2
- Lecture 23 - Heat and work interactions for a system
- Lecture 24 - Tutorial problem - Part 1
- Lecture 25 - Pure substance
- Lecture 26 - Tutorial problem - Part 2
- Lecture 27 - Ideal gas - Part 1
- Lecture 28 - Ideal gas - Part 2
- Lecture 29 - Tutorial problem - Part 3
- Lecture 30 - Tutorial problem - Part 4
- Lecture 31 - Tutorial problem - Part 5

- Lecture 32 - Specific heats at constant pressure and constant volume
- Lecture 33 - Tutorial problem - Part 6
- Lecture 34 - Tutorial problem - Part 7
- Lecture 35 - Ideal gas - Part 3
- Lecture 36 - Ideal gas - Part 4
- Lecture 37 - Ideal gas - Part 5
- Lecture 38 - Tutorial problem - Part 1
- Lecture 39 - Tutorial problem - Part 2
- Lecture 40 - Tutorial problem - Part 3
- Lecture 41 - Tutorial problem - Part 4
- Lecture 42 - Beyond ideal gases - Part 1
- Lecture 43 - Beyond ideal gases - Part 2
- Lecture 44 - Two phase system - Part 1
- Lecture 45 - Two phase system - Part 2
- Lecture 46 - Two phase system: water and steam
- Lecture 47 - Tutorial problems (2 numbers)
- Lecture 48 - Tutorial problem - Part 1
- Lecture 49 - Tutorial problem - Part 2
- Lecture 50 - Tutorial problem - Part 3
- Lecture 51 - Tutorial problems on two-phase systems (2 numbers)
- Lecture 52 - Tutorial problem (1 number)
- Lecture 53 - Rate equation of the first law of thermodynamics for a control mass and a control volume
- Lecture 54 - Energy equation for a steady-state, steady-flow process in selected engineering devices
- Lecture 55 - Tutorial problems (3 numbers)
- Lecture 56 - Tutorial problem - Part 1
- Lecture 57 - Tutorial problem - Part 2
- Lecture 58 - Quasi-static process revisited: Work against an external force
- Lecture 59 - Second law of thermodynamics: limitations of the first law of thermodynamics
- Lecture 60 - Second law of thermodynamics: direct and reverse heat engine
- Lecture 61 - Second law of thermodynamics: Kelvin-Planck and Clausius statements
- Lecture 62 - Second law of thermodynamics: reversible process
- Lecture 63 - Second law of thermodynamics: Carnot's cycle and theorems
- Lecture 64 - Second law of thermodynamics: absolute temperature scale

- Lecture 65 - Tutorial problems (2 numbers)
- Lecture 66 - Tutorial problem (1 number)
- Lecture 67 - Tutorial problem (1 number)
- Lecture 68 - Tutorial problem (2 numbers)
- Lecture 69 - Second law of thermodynamics: Clausius's inequality
- Lecture 70 - Entropy - Part 1
- Lecture 71 - Tutorial problem (1 number)
- Lecture 72 - Entropy - Part 2
- Lecture 73 - Entropy - Part 3
- Lecture 74 - Entropy - Part 4
- Lecture 75 - Tutorial problem (1 number)
- Lecture 76 - Tutorial problem (1 number)
- Lecture 77 - Tutorial problems (2 numbers)
- Lecture 78 - Entropy - Part 5
- Lecture 79 - Entropy - Part 6
- Lecture 80 - Entropy - Part 7
- Lecture 81 - Exergy - Part 1
- Lecture 82 - Exergy - Part 2
- Lecture 83 - Exergy - Part 3
- Lecture 84 - Thermodynamics cycles: Rankine cycle
- Lecture 85 - Tutorial problem (1 number)
- Lecture 86 - Thermodynamics cycles: Brayton cycle
- Lecture 87 - Tutorial problem (1 number)
- Lecture 88 - Thermodynamics cycles: vapor compression refrigeration cycle
- Lecture 89 - Tutorial problem (1 number)

Lecture 1 - Courses Overview

Lecture 2 - Medical device and in vitro diagnostics: Introduction and types of devices including combination devices

Lecture 3 - Medical Device Rules, 2017: Implications on medical devices

Lecture 4 - Classification of medical devices

Lecture 5 - Labelling of medical devices and in vitro diagnostics

Lecture 6 - Standards of medical device, quality assurance and testing

Lecture 7 - Regulatory requirements of biocompatibility of medical devices and ISO 10993

Lecture 8 - Clinical investigation of medical devices, regulation of investigational medical devices

Lecture 9 - Quality assurance and quality management system

Lecture 10 - How to obtain a licence to manufacture a medical device?

Lecture 11 - ISO 14971 (Medical devices: Application of risk management to medical devices)

Lecture 12 - Inspection of medical device and IVD establishments

Lecture 13 - Import and export of medical devices and IVDs

Lecture 14 - Medical device regulation: International practices

**NPTEL : NOC:Current Regulatory Requirements for Conducting Clinical Trials in India for Investigational New Drugs
(Version 2.0) (Multi-Disciplinary)**

Co-ordinators : Prof. Nandini K Kumar, Prof. Y. K. Gupta, Prof. D. K. Sable, Prof. Arun B. Ramteke, Prof. Rubina Bose, Prof. Sucheta Banerjee Kurundkar, Prof. Vishnu Rao

Lecture 1 - Courses Overview

Lecture 2 - Overview of Indian regulatory system

Lecture 3 - Overview of Drugs and Cosmetics Act and Rules thereunder

Lecture 4 - Overview of New Drugs and Clinical Trials Rules, 2019

Lecture 5 - Pre-Clinical Data Requirements

Lecture 6 - Rules Governing Clinical Trials

Lecture 7 - Phases of clinical trial, forms, and fees

Lecture 8 - Regulatory pathway and data requirements for NDCT, 2019

Lecture 9 - BA/BE study and study centers: Legal provisions

Lecture 10 - Guidelines to conduct BA/BE studies

Lecture 11 - Ethics Committee registration and re-registration

Lecture 12 - Ethical Considerations

Lecture 13 - Good Clinical Practice

Lecture 14 - Requirements for import/manufacture of new drug/IND for conducting clinical trials in India

Lecture 15 - Requirements for import/manufacture of new drug/IND for sale/ distribution and unapproved new drug for patients

Lecture 16 - Important issues

Lecture 17 - Special concern

Lecture 18 - Clinical trial related guidelines (NDCT Rules)

Lecture 19 - Content of Proposed Clinical Trial Protocol

Lecture 20 - Content of a Clinical Trial Report

Lecture 21 - Post Marketing Assessment and Clinical Trial Compensation

Lecture 22 - Common observations during submission of CT/BA/BE protocol

Lecture 23 - Common observations during CT/BA/BE centre inspections

Lecture 24 - Drug development process: Overview

Lecture 25 - Salient feature of NDCT 2019 - what's new in NDCT?

Lecture 26 - Online Submission 23A: Sugam

Lecture 27 - Online Submission (CTRI)

Lecture 28 - Tables Given in NDCT 2019 and its Content

[Lecture 1 - Course Background: Model Predictive Control](#)

[Lecture 2 - Course Outline](#)

[Lecture 3 - Additional MATLAB Video - Array Operations](#)

[Lecture 4 - Additional MATLAB Video - Array Operations](#)

[Lecture 5 - Recap: Linear Algebra](#)

[Lecture 6 - Recap: Differential and Difference Equations](#)

[Lecture 7 - Recap: Process Control Basics](#)

[Lecture 8 - Introduction to Model Predictive Control](#)

[Lecture 9 - MPC: Salient Features](#)

[Lecture 10 - MPC: Historical Perspective](#)

[Lecture 11 - Vectors and Matrices](#)

[Lecture 12 - Vector Spaces](#)

[Lecture 13 - Linear Operation](#)

[Lecture 14 - Null and Image Spaces](#)

[Lecture 15 - Eigenvalues and Eigenvectors](#)

[Lecture 16 - Eigenvalue Decomposition and Tutorial](#)

[Lecture 17 - Recap of Week-2](#)

[Lecture 18 - Model Classification](#)

[Lecture 19 - Discrete-Time Models Overview](#)

[Lecture 20 - Discrete-Time Models](#)

[Lecture 21 - Finite Impulse Response Models](#)

[Lecture 22 - Finite Step Response Models](#)

[Lecture 23 - Recap and Plan for Week-4](#)

[Lecture 24 - State Space and Step Response Models](#)

[Lecture 25 - Nonlinear Models and Model Linearization](#)

[Lecture 26 - Model Types and Model Conversion](#)

[Lecture 27 - Model Conversion - 2](#)

[Lecture 28 - Model Conversion: TF to SS](#)

[Lecture 29 - How to handle MIMO systems](#)

[Lecture 30 - Discretization of State-Space Models](#)

[Lecture 31 - Introduction to Dynamic Matrix Control \(DMC\)](#)

[Lecture 32 - The DMC Algorithm: Future Predictions](#)

[Lecture 33 - The DMC Algorithm: Objective and Constraints](#)

[Lecture 34 - The DMC Algorithm: Optimization](#)

[Lecture 35 - Coding for DMC Algorithm: Setup](#)

[Lecture 36 - Coding for DMC Algorithm: Populate Matrices](#)

[Lecture 37 - Recap of DMC Algorithm](#)

[Lecture 38 - Extensions of DMC Algorithm](#)

[Lecture 39 - LTI Models and Coordinate Transform](#)

[Lecture 40 - LTI Models: Stability](#)

[Lecture 41 - LTI Models: Controllability](#)

[Lecture 42 - LTI Models: Conditions for controllability](#)

[Lecture 43 - Tutorial by Arvind \(Recap of Controllability\)](#)

[Lecture 44 - LTI Models: Observability](#)

[Lecture 45 - Linear Control: Introduction](#)

[Lecture 46 - Pole Placement Controller](#)

[Lecture 47 - Linear Quadratic Regulator: Batch Solution](#)

[Lecture 48 - LQR: Dynamic Programming Solution](#)

[Lecture 49 - State Estimation: Introduction](#)

[Lecture 50 - Stochastic Processes and Random Variables](#)

[Lecture 51 - State Estimation: Pole Placement Observer](#)

[Lecture 52 - Kalman Filter: Terminology](#)

[Lecture 53 - Kalman Filter: Derivation](#)

[Lecture 54 - Recap of Modules 7-9](#)

[Lecture 55 - Recap and Plan for this week](#)

[Lecture 56 - Linear Quadratic Gaussian](#)

[Lecture 57 - LQG Derivation and Separation Principle](#)

[Lecture 58 - Setpoint Tracking in LQ Control](#)

[Lecture 59 - Disturbance Rejection in LQ Control](#)

[Lecture 60 - Disturbance Modeling for Estimation](#)

[Lecture 61 - Estimation with Disturbance Modeling](#)

[Lecture 62 - Recap and Plan for this week](#)

[Lecture 63 - State-Space MPC: Deterministic case](#)

[Lecture 64 - Extension to Measured Disturbances](#)

[Lecture 65 - Offset-Free State Space MPC](#)

[Lecture 66 - Comparison of State-Space MPC with DMC](#)

[Lecture 67 - State-Space MPC: Disturbance Modeling](#)

[Lecture 68 - Disturbance Modeling: Background and Setup](#)

[Lecture 69 - Stochastic Output-Feedback State-Space MPC](#)

[Lecture 70 - Bonus Video: Disturbance Modeling for State Space MPC](#)

[Lecture 71 - Self-Guided Tutorial of MPC Toolbox](#)

[Lecture 72 - Help Session: Using MPC Toolbox](#)

[Lecture 73 - Recap of LQ Control and Linear MPC](#)

[Lecture 74 - Linear MPC - Key Features and Results](#)

[Lecture 75 - Practical Issues: Inferential Control](#)

[Lecture 76 - Practical Issues: Measurement Delay](#)

[Lecture 77 - Other Practical Issues](#)

[Lecture 78 - Some Classical Examples of MPC](#)

Lecture 1 - What is Science? - Part 1

Lecture 2 - What is Science? - Part 2

Lecture 3 - Subjective Thinking Versus Objective Thinking

Lecture 4 - Idealism Versus Materialism

Lecture 5 - Causality - Part 1

Lecture 6 - Causality - Part 2

Lecture 7 - Logical Reasoning: Inductive Logic

Lecture 8 - Logical Reasoning: Deductive Logic - Part 1

Lecture 9 - Logical Reasoning: Deductive Logic - Part 2

Lecture 10 - Logical Reasoning: Syllogistic Logic - Part 1

Lecture 11 - Logical Reasoning: Syllogistic Logic - Part 2

Lecture 12 - Logical Reasoning: Syllogism Logic, Truth and Validity

Lecture 13 - Historical Perspective: Emergence of Materialism and Idealism - Part 1

Lecture 14 - Historical Perspective: Emergence of Materialism and Idealism - Part 2

Lecture 15 - Historical Perspective:Renaissance to the Development of Mechanical Materialism - Part 1

Lecture 16 - Historical Perspective:Renaissance to the Development of Mechanical Materialism - Part 2

Lecture 17 - Historical Perspective: The Advent of Empiricism and the Idea of Evolution

Lecture 18 - Historical Perspective: Science in Ancient India

Lecture 19 - Historical Perspective: The Advent of Scientific Materialism - Part 1

Lecture 20 - Historical Perspective: The Advent of Scientific Materialism - Part 2

Lecture 21 - Historical Perspective: The Rise and Fall of Positivism - Part 1

Lecture 22 - Historical Perspective: The Rise and Fall of Positivism - Part 2

Lecture 23 - What Scientists Actually Do - Part 1

Lecture 24 - What Scientists Actually Do - Part 2

Lecture 25 - Falsifiability and Reproducibility - Part 1

Lecture 26 - Falsifiability and Reproducibility - Part 2

Lecture 27 - Proposing a Hypothesis - Part 1

Lecture 28 - Proposing a Hypothesis - Part 2

Lecture 29 - Elements of Scientific Measurement - Part 1

Lecture 30 - Elements of Scientific Measurement - Part 2

Lecture 31 - The Central Limit Theorem and its Applications - Part 1

- Lecture 32 - The Central Limit Theorem and its Applications - Part 2
- Lecture 33 - Error Bars and Confidence Interval - Part 1
- Lecture 34 - Error Bars and Confidence Interval - Part 2
- Lecture 35 - Measurement of a Proportion - Part 1
- Lecture 36 - Measurement of a Proportion - Part 2
- Lecture 37 - Examples of Proportion Measurement
- Lecture 38 - Box and Whisker Plot
- Lecture 39 - Propagation of Errors - Part 1
- Lecture 40 - Propagation of Errors - Part 2
- Lecture 41 - Issues in Hypothesis Testing - Part 1
- Lecture 42 - Issues in Hypothesis Testing - Part 2
- Lecture 43 - Statistical Methods in Hypothesis Testing: Z-Test and T-Test - Part 1
- Lecture 44 - Statistical Methods in Hypothesis Testing: Z-Test and T-Test - Part 2
- Lecture 45 - Hypothesis Testing: The Chi-Square Test - Part 1
- Lecture 46 - Hypothesis Testing: The Chi-Square Test - Part 2
- Lecture 47 - Hypothesis Testing: The Chi-Square Test - Part 3
- Lecture 48 - Hypothesis Testing: The Chi-Square Test - Part 4
- Lecture 49 - Theoretical Research: Functional Relationships from Experimental Data - Part 1
- Lecture 50 - Theoretical Research: Functional Relationships from Experimental Data - Part 2
- Lecture 51 - Theoretical Research: Mathematical Models of Physical Systems
- Lecture 52 - Order of Magnitude Calculations
- Lecture 53 - Theoretical Research: Modeling Using Dimensional Analysis - Part 1
- Lecture 54 - Theoretical Research: Modeling Using Dimensional Analysis - Part 2
- Lecture 55 - An Example of Mathematical Modeling
- Lecture 56 - Importance of Theory-Building in Science
- Lecture 57 - Scientific Writing: Journal Papers - Part 1
- Lecture 58 - Scientific Writing: Journal Papers - Part 2
- Lecture 59 - Scientific Writing: Journal Papers - Part 3
- Lecture 60 - Scientific Writing: Journal Papers - Part 4
- Lecture 61 - Scientific Writing: PhD Thesis
- Lecture 62 - Scientific Writing: Text Stylistics
- Lecture 63 - Presentation in Scientific Conferences - Part 1
- Lecture 64 - Presentation in Scientific Conferences - Part 2

[Lecture 65 - Writing Grant Proposals - Part 1](#)

[Lecture 66 - Writing Grant Proposals - Part 2](#)

[Lecture 67 - Ethical Conduct in Science: Aspects of Scientific Ethics](#)

[Lecture 68 - Ethical Conduct in Science: Research Misconduct](#)

[Lecture 69 - Ethical Conduct in Science: Ethics in Scientific Publication - Part 1](#)

[Lecture 70 - Ethical Conduct in Science: Ethics in Scientific Publication - Part 2](#)

[Lecture 71 - Ethical Conduct in Science: Cases of Scientific Misconduct - Part 1](#)

[Lecture 72 - Ethical Conduct in Science: Cases of Scientific Misconduct - Part 2](#)

Lecture 1 - Vasovagal Syncope

Lecture 2 - Vasovagal Syncope - Clinical Scenario

Lecture 3 - Postural Hypotension

Lecture 4 - Postural Hypotension - Clinical Scenario

Lecture 5 - Hyperventilation

Lecture 6 - Hyperventilation - Clinical Scenario

Lecture 7 - Asthma - Status Asthmaticus - Part 1

Lecture 8 - Asthma - Status Asthmaticus - Part 2

Lecture 9 - Asthma - Clinical Scenario

Lecture 10 - Chest Pain Of Cardiac Origin - Myocardial Infarction And Anigina Pectoris - Part 1

Lecture 11 - Chest Pain Of Cardiac Origin - Myocardial Infarction And Anigina Pectoris - Part 2

Lecture 12 - Chest Pain - Clinical Scenario

Lecture 13 - Acute Adrenal Insufficiency

Lecture 14 - Acute Adrenal Insufficiency - Clinical Scenario

Lecture 15 - Diabetes Mellitus

Lecture 16 - Diabetes Mellitus - Clinical Scenario

Lecture 17 - Throid Dysfunction

Lecture 18 - Allergies/Hypersensitivity Reaction - Part 1

Lecture 19 - Allergies/Hypersensitivity Reaction - Part 2

Lecture 20 - Epilepsy- Status Epilepticus

Lecture 21 - Chronic Kidney Disease

Lecture 22 - Hepatic Dysfunction

Lecture 23 - Basic Life Support - Part 1

Lecture 24 - Basic Life Support - Part 2

Lecture 1 - Introduction to Ornithology

Lecture 2 - Diversity and Classification - Part 1

Lecture 3 - Diversity and Classification - Part 2

Lecture 4 - Evolution and Speciation - Part 1

Lecture 5 - Evolution and Speciation - Part 2

Lecture 6 - Anatomy

Lecture 7 - Physiology

Lecture 8 - Colour

Lecture 9 - Life History

Lecture 10 - Foraging Behaviour

Lecture 11 - Mating and Breeding Behaviour

Lecture 12 - Social Behaviour

Lecture 13 - Methods of Science and Research Questions

Lecture 14 - Vocal Behaviour: Mechanisms - Part 1

Lecture 15 - Vocal Behaviour: Mechanisms - Part 2

Lecture 16 - Vocal Behaviour: Ecology and Evolution - Part 1

Lecture 17 - Vocal Behaviour: Ecology and Evolution - Part 2

Lecture 18 - Vocal Mimicry in Birds

Lecture 19 - Basics of Research Design

Lecture 20 - Bird Migration - LIVE Guest Lectuer

Lecture 21 - Bird Populations: Concepts

Lecture 22 - Bird Communities: Concepts - Part 1

Lecture 23 - Bird Communities: Concepts - Part 2

Lecture 24 - Interactive Session by Dr Mousumi Ghosh (NCF) and Dr Umesh Srinivasan (IISc)

Lecture 25 - Studying bird populations and communities - Part 1

Lecture 26 - Studying bird populations and communities - Part 2

Lecture 27 - Mixed Species Flocks - Live Session

Lecture 28 - Interactive session with Dr. Priti Bangal (NCF) and Dr. Umesh Srinivasan (IISc)

Lecture 29 - Introduction to Data Visualisation Analysis - Part 1

Lecture 30 - Introduction to Data Visualisation Analysis - Part 2

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[Lecture 31 - Basic Course in Ornithology - Guest Session on Avian Diseases](#)

[Lecture 32 - Biogeography](#)

[Lecture 33 - Macroecology](#)

[Lecture 34 - Macroecology - Case Study - LIVE](#)

[Lecture 35 - Week 10 Interactive session with Dr VV Robin and Dr Umesh Srinivasan](#)

[Lecture 36 - Bird Conservation - Concepts](#)

[Lecture 37 - Avian Conservation: Case study 1](#)

[Lecture 38 - Avian Conservation: Case study 2](#)

[Lecture 39 - Avian Conservation: Case study 3](#)

[Lecture 40 - Avian Conservation: Case study 4](#)

[Lecture 41 - Avian Conservation: Case study 5](#)

[Lecture 42 - LIVE - Citizen Science - Guest faculty by Dr Ashwin Viswanathan \(NCF\)](#)

[Lecture 43 - Molecular Techniques - Part 1](#)

[Lecture 44 - Molecular Techniques - Part 2](#)

- Lecture 1 - Craniofacial anatomy - Part 1
- Lecture 2 - Craniofacial anatomy - Part 2
- Lecture 3 - Tooth and It's Supporting Structures - Part 1
- Lecture 4 - Tooth and It's Supporting Structures - Part 2
- Lecture 5 - Specialised mucosa
- Lecture 6 - Saliva-Composition and functions
- Lecture 7 - Saliva Diagnostics
- Lecture 8 - Stem cells in the oro-dental region
- Lecture 9 - Stem cell isolation
- Lecture 10 - Mineralization dynamics - Part 1
- Lecture 11 - Mineralization dynamics - Part 2
- Lecture 12 - TMJ Anatomy and Function
- Lecture 13 - Oral defense mechanisms
- Lecture 14 - Mucosal and regional immunology
- Lecture 15 - Oral microbiome
- Lecture 16 - Evaluation of Oral microbiome
- Lecture 17 - Dysbiosis
- Lecture 18 - Molecular mechanisms in oral cancer
- Lecture 19 - Flow cytometry in cell and molecular biology
- Lecture 20 - Basics of Biomaterial science and engineering
- Lecture 21 - Biomimetics - Part 1
- Lecture 22 - Biomimetics - Part 2
- Lecture 23 - Biomaterials - Polymers
- Lecture 24 - Biomaterials - Metals
- Lecture 25 - Biomaterials - Ceramics and Colloids
- Lecture 26 - 3-D Bioprinting
- Lecture 27 - Protein mediated biomaterials
- Lecture 28 - Immune response to biomaterials
- Lecture 29 - Biomaterial Applications
- Lecture 30 - Biocompatible assays
- Lecture 31 - Immunoassay

Lecture 1 - Course overview

Lecture 2 - What is biomimicry ?

Lecture 3 - Why is biomimicry important ?

Lecture 4 - Nature's unifying patterns - Introduction

Lecture 5 - Case study

Lecture 6 - How to do biomimicry ?

Lecture 7 - Learning resources - Biomimicry Institute

Lecture 8 - Skills, attitudes and mindset for a biomimic

Lecture 9 - Course activity

Lecture 10 - Recap of Week 1

Lecture 11 - What are we mimicking ?

Lecture 12 - Function and Strategy

Lecture 13 - Approaches to biomimicry

Lecture 14 - From Problem to Solution

Lecture 15 - Using the UNSDG to identify challenges

Lecture 16 - Recap of Week 2

Lecture 17 - Step 1 - Define the problem

Lecture 18 - Step 2 - Biologize the problem

Lecture 19 - Step 3 - Discover strategies in nature

Lecture 20 - Applying the Biomimicry Design Spiral

Lecture 21 - Step 4 - Abstract design strategies from nature

Lecture 22 - Step 5 - Emulate nature's strategies in your solution

Lecture 23 - Step 6 - Evaluate feasibility

Lecture 24 - How to apply the biomimicry process ?

Lecture 25 - Recap of Week 4

Lecture 26 - Nature's Unifying Patterns I

Lecture 27 - Systems Thinking - Introduction

Lecture 28 - Systems Thinking - Understanding consequences

Lecture 29 - Nature's Unifying Patterns II

Lecture 30 - Tools - Mind mapping

Lecture 31 - Using biomimicry to design a solution

[Lecture 32 - Recap of Week 6](#)

[Lecture 33 - Developing creative confidence](#)

[Lecture 34 - Learning from the biomimicry process](#)

[Lecture 35 - The need for creativity in our lives](#)

[Lecture 36 - Unlocking your creativity](#)

[Lecture 37 - Taking your biomimicry ideas to market](#)

[Lecture 38 - The journey so far](#)

[Lecture 39 - Finding the hero in you](#)

[Lecture 40 - Course wrap-up](#)

Lecture 1 - Introduction - Electrocardiogram - Interpretation and application in clinical practice

Lecture 2 - Basic Conduction of Heart

Lecture 3 - ECG Lead system

Lecture 4 - Recording of a Standard ECG (Lead placements and measurements)

Lecture 5 - Waveforms, Intervals and Segments

Lecture 6 - Vector Electrocardiography

Lecture 7 - From Action Potentials to Arrhythmias

Lecture 8 - Pathophysiology, Myocardial Ischemia / Injury

Lecture 9 - Myocardial Infarction (MI), Pathophysiology

Lecture 10 - Drug effects on ECG

Lecture 11 - Patient identification, preparation and interpretation of ECG

Lecture 12 - Sinus rhythms and Bradyarrhythmias

Lecture 13 - Approach to tachyarrhythmias

Lecture 14 - AV Blocks and Bundle Branch Block

Lecture 15 - Chamber enlargement and Heart Failure

Lecture 16 - Electrolyte Abnormalities on ECG

Lecture 17 - Recognizing signs and ECG changes in Myocardial Ischemia/Injury

Lecture 18 - ECG changes in myocardial infarction

Lecture 19 - Miscellaneous ECG findings and cardiac arrest

Lecture 20 - Pacemaker Rhythms

Lecture 1 - Introduction to the One Health Concept and National and International health/public health agencies

Lecture 2 - Global Health vs One Health

Lecture 3 - Basics of Research Ethics

Lecture 4 - Integrated human and animal disease surveillance systems

Lecture 5 - Emerging infectious diseases

Lecture 6 - Process of disease emergence and assessment of the risk factors

Lecture 7 - Mechanisms of pathogen cross over across species boundaries

Lecture 8 - Importance of disease detection, Identification and monitoring in public health

Lecture 9 - Introduction to disease vectors and basics of Medical Entomology

Lecture 10 - The factors influencing an emerging disease

Lecture 11 - Antimicrobial resistance a global threat and Importance of antibiotic stewardship program

Lecture 12 - Introduction of Food safety and food borne diseases

Lecture 13 - What are zoonotic diseases and its role in our changing world

Lecture 14 - The integration of human, animal and ecosystem health in control and prevention of these diseases

Lecture 15 - Community engagement for zoonotic disease control in humans and animals through One Health

Lecture 16 - Basics of Epidemiological Studies

Lecture 17 - Rapid Response system, Disaster Management and Outbreak Investigation Plans

Lecture 18 - Basic statistical methods and their application and the measurement of disease frequency

Lecture 19 - Principles of survey design and the concepts of sampling and Mixed method research

Lecture 20 - Introduction to health policy

Lecture 21 - Risk Communication and Pandemic Preparedness

Lecture 22 - Role of community in disease control and ways for community engagement

Lecture 23 - Uses of different types of media for communication

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NPTEL : NOC:Canning Technology, Value Addition of Seafood (Fish Processing) (Multi-Disciplinary)

Co-ordinators : Dr. Abhilash Sasidharan, Dr. Maya Raman

- Lecture 1 - Course overview Canning technology and Value addition of sea food
- Lecture 2 - Introduction and the concept of canning technology
- Lecture 3 - History of canning technology - Part 1
- Lecture 4 - History of canning technology - Part 2
- Lecture 5 - Canning Technology and Value Addition Containers and their Properties - Part 1
- Lecture 6 - Canning Technology and Value Addition Containers and their Properties - Part 2
- Lecture 7 - Canning Technology and Value Addition Containers and their Properties - Part 3
- Lecture 8 - Canning Technology and Value Addition Containers and their Properties - Part 4
- Lecture 9 - Canning Technology and Value Addition - Canning process - Part 1
- Lecture 10 - Canning Technology and Value Addition - Canning process - Part 2
- Lecture 11 - Canning Technology and Value Addition - Thermal process calculations - Part 1
- Lecture 12 - Canning Technology and Value Addition - Thermal process calculations - Part 2
- Lecture 13 - Microbiology and spoilage of canned food - Part 1
- Lecture 14 - Microbiology and spoilage of canned food - Part 2
- Lecture 15 - Process of seafood canning - Part 1
- Lecture 16 - Process of seafood canning - Part 2
- Lecture 17 - Seafood pre-processing - Part 1
- Lecture 18 - Seafood pre-processing - Part 2
- Lecture 19 - Additives - Part 1
- Lecture 20 - Additives - Part 2
- Lecture 21 - SOP for seafood canning - Part 1
- Lecture 22 - SOP for seafood canning - Part 2
- Lecture 23 - SOP for seafood canning - Part 3
- Lecture 24 - Nutritional quality of seafood
- Lecture 25 - Muscle structure of seafood
- Lecture 26 - Spoilage in seafood
- Lecture 27 - Preservation methods
- Lecture 28 - Value addition in thermally processed foods
- Lecture 29 - Quality standards for seafood value added products - Part 1
- Lecture 30 - Quality standards for seafood value added products - Part 2
- Lecture 31 - Quality standards for seafood value added products - Part 3

Lecture 1 - Course overview

Lecture 2 - Introduction

Lecture 3 - Paper as packaging material - Part 1

Lecture 4 - Paper as packaging material - Part 2

Lecture 5 - Paper as packaging material - Part 3

Lecture 6 - Glass as packaging material

Lecture 7 - Metal as packaging material - Part 1

Lecture 8 - Metal as packaging material - Part 2

Lecture 9 - Plastic as packaging material - Part 1

Lecture 10 - Plastic as packaging material - Part 2

Lecture 11 - Introduction to packaging system

Lecture 12 - Product characteristics and packaging requirements

Lecture 13 - Rigid, semi-rigid, flexible packaging forms - Part 1

Lecture 14 - Rigid, semi-rigid, flexible packaging forms - Part 2

Lecture 15 - Designing of packaging material

Lecture 16 - Testing of packaging material - Part 1

Lecture 17 - Testing of packaging material - Part 2

Lecture 18 - Testing of packaging material - Part 3

Lecture 19 - Testing of packaging material - Part 4

Lecture 20 - Testing of package performance

Lecture 21 - Principles developing safe and protective packing

Lecture 22 - Transport worthiness test - Part 1

Lecture 23 - Transport worthiness test - Part 2

Lecture 24 - Transport worthiness test - Part 3

Lecture 25 - Safety aspects of food packaging

Lecture 26 - Packaging accessories and advances in packaging

Lecture 27 - Active packaging - Part 1

Lecture 28 - Active packaging - Part 2

Lecture 29 - MA and Aseptic packaging

Lecture 30 - Edible packaging - Part 1

Lecture 31 - Edible packaging - Part 2

[Lecture 32 - Vacuum packing machine](#)

[Lecture 33 - CA and MA packing machine](#)

[Lecture 34 - Gas packing machine](#)

[Lecture 35 - Seal and shrink packing machine](#)

[Lecture 36 - Form fill sealing machine](#)

[Lecture 37 - Aseptic packaging systems](#)

[Lecture 38 - Retort pouches](#)

[Lecture 39 - Bottling machine - Part 1](#)

[Lecture 40 - Bottling machine - Part 2](#)

[Lecture 41 - Carton making machine](#)

[Lecture 42 - Package printing machines - Part 1](#)

[Lecture 43 - Package printing machines - Part 2](#)

Lecture 1 - Introduction

Lecture 2 - Fragility

Lecture 3 - Resilience

Lecture 4 - Interpreting Vulnerability, precarity of work and Access Equality for Equal Opportunity - Part I

Lecture 5 - Interpreting Vulnerability, precarity of work and Access Equality for Equal Opportunity - Part II

Lecture 6 - Social Vulnerability and Group Vulnerability

Lecture 7 - Willed Vulnerability - Endurance Sports

Lecture 8 - Illness, Storytelling and Embodiment

Lecture 9 - Illness, Storytelling and Embodiment Reading - Audre Lorde's : The Cancer Journals

Lecture 10 - Group Discussion - Vulnerable Bodies

Lecture 11 - The Aesthetics of Vulnerability - I

Lecture 12 - The Aesthetics of Vulnerability - II Traumatic Materialism

Lecture 13 - The Aesthetics of Vulnerability - III Melodrama

Lecture 14 - Vulnerability Aesthetics The Sublime

Lecture 15 - The Aesthetics of Vulnerability - Discussion

Lecture 16 - Biopolitics, biopower and vulnerability - I

Lecture 17 - Biopolitics, biopower and vulnerability - II

Lecture 18 - Pandemics and Biopolitics

Lecture 19 - Biopolitics and vulnerable populations in Contemporary Literature

Lecture 20 - Discussion on Biopolitics

Lecture 21 - Ecoprecarity

Lecture 22 - Ecodystopia - I

Lecture 23 - Ecodystopia - II

Lecture 24 - Discussion on Ecoprecarity and Ecodystopias - I

Lecture 25 - Discussion on Ecoprecarity and Ecodystopias - II

Lecture 26 - Aging and Vulnerability in Literature

Lecture 27 - Aging and Vulnerability - 2

Lecture 28 - Aging and Vulnerability - 3

Lecture 29 - Discussion on Vulnerability and Aging - 1

Lecture 30 - Discussion on Vulnerability and Aging - 2

Lecture 31 - Childhood and Vulnerability - 1

[Lecture 32 - Childhood and Vulnerability - 2](#)

[Lecture 33 - Childhood and Vulnerability - 3](#)

[Lecture 34 - Discussion on Childhood and Vulnerability - I](#)

[Lecture 35 - Discussion on Childhood and Vulnerability - II](#)

[Lecture 36 - Imperial Vulnerability - I](#)

[Lecture 37 - Imperial Vulnerability - II](#)

[Lecture 38 - Posthuman Vulnerability](#)

[Lecture 39 - Contemporary Genres of Resilience - The Graphic Novel - I](#)

[Lecture 40 - Contemporary Genres of Resilience - The Graphic Novel - II](#)

- Lecture 1 - Functional Anatomy of the Respiratory Tract
- Lecture 2 - Mechanics of Respiration - Section 1
- Lecture 3 - Mechanics of Respiration - Section 2
- Lecture 4 - Ventilation, Perfusion Ventilation Perfusion Relationship
- Lecture 5 - Essential Principles of Spirometer
- Lecture 6 - Types of Pulmonary function tests
- Lecture 7 - Obstructive Lung Diseases: Pathophysiology
- Lecture 8 - Restrictive lung Diseases: Pathophysiology
- Lecture 9 - Drug Effects on Pulmonary Function
- Lecture 10 - Lung Disorders in Children
- Lecture 11 - Assessment of Lung Functions in Children
- Lecture 12 - Static and Dynamic lung function tests
- Lecture 13 - Interpretation of Normal Pulmonary Function Tests
- Lecture 14 - Indications for Pulmonary Function Testing
- Lecture 15 - Obstructive Airway Diseases - Approach
- Lecture 16 - Clinical Diagnosis of Restrictive Lung Disease - Part 1
- Lecture 17 - Clinical Diagnosis of Restrictive Lung Disease - Part 1
- Lecture 18 - Essential Criteria For a Good Pulmonary Function Testing
- Lecture 19 - Interpretation of pulmonary function tests in Restrictive lung disease
- Lecture 20 - Interpretation of PFT in Obstructive lung diseases
- Lecture 21 - Diffusion Capacity of Lungs for Carbon Monoxide DLCO
- Lecture 22 - Radiological assessment of obstructive and restrictive lung disorders
- Lecture 23 - Laboratory Video - Pulmonary Function tests - Interpretation and application in clinical practice

Lecture 1 - Overview of TALE and Good Engineer

Lecture 2 - Education and Teaching

Lecture 3 - Learning, Instruction and Assessment

Lecture 4 - What is OBE?

Lecture 5 - Accreditation

Lecture 6 - Outcomes

Lecture 7 - Program Outcomes - 1

Lecture 8 - Program Outcomes - 2

Lecture 9 - Taxonomy of Learning

Lecture 10 - Cognitive Levels

Lecture 11 - General Categories of Knowledge

Lecture 12 - Metacognitive Knowledge

Lecture 13 - Vincenti Categories of Engineering Knowledge

Lecture 14 - Affective and Psychomotor Domains

Lecture 15 - Taxonomy Table

Lecture 16 - Course Outcomes - 1

Lecture 17 - Course Outcomes - 2

Lecture 18 - Course Outcomes - POs and PSOs

Lecture 19 - Attainment of COs

Lecture 20 - Attainment of POs and PSOs

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:Teaching and Learning in General Programs (Multi-Disciplinary)

Co-ordinators : Prof. N.J. Rao

Lecture 1 - Teaching and Learning in General Programs (TALG)

Lecture 2 - Education and Teaching

Lecture 3 - Learning, Assessment and Instruction

Lecture 4 - Outcome Based Education (OBE)

Lecture 5 - Accreditation

Lecture 6 - Program Outcomes

Lecture 7 - POs and PSOs

Lecture 8 - Taxonomy of Learning: Cognitive Levels - 1

Lecture 9 - Taxonomy of Learning: Cognitive Levels - 2

Lecture 10 - Taxonomy of Learning: Knowledge Categories

Lecture 11 - Taxonomy of Learning: Metacognitive Knowledge

Lecture 12 - Affective Domain

Lecture 13 - Psychomotor Domain

Lecture 14 - Taxonomy Tables

Lecture 15 - Course Outcomes - 1

Lecture 16 - Course Outcomes - 2

Lecture 17 - Tagging the Course Outcomes

Lecture 18 - Attainment of Course Outcomes

Lecture 19 - Attainment of POs and PSOs

Lecture 1 - Engineering Programs, NBA Accreditation and Engineering Courses

Lecture 2 - Course Design

Lecture 3 - ISD and ADDIE

Lecture 4 - Analysis Phase - 1

Lecture 5 - Analysis Phase - 2

Lecture 6 - Design Phase

Lecture 7 - Technology and Targets

Lecture 8 - Assessment Pattern and Assessment Instruments

Lecture 9 - Item Banks

Lecture 10 - Development Phase

Lecture 11 - Instruction Material and Learning Material

Lecture 12 - Implement Phase - 1

Lecture 13 - Implement Phase - 2

Lecture 14 - Evaluate Phase

Lecture 15 - Course Exit Survey

Lecture 16 - Evaluating Laboratories and Electives

Lecture 17 - Exit Surveys for Projects

Lecture 18 - Summary Feedback

Lecture 19 - Instruction: An Overview

Lecture 20 - Instructional Situations

Lecture 21 - How Brains Learn - 1

Lecture 22 - How Brains Learn - 2

Lecture 23 - How Brains Learn - 3

Lecture 24 - Instructional Components - 1

Lecture 25 - Instructional Components - 2

Lecture 26 - Merrill's Principles of Learning

Lecture 27 - ID based on Merrill's Principles

Lecture 28 - Direct Approach to Instruction

Lecture 29 - Project Based Approach to Instruction

Lecture 30 - Problem Based Approach to Instruction

Lecture 31 - Experiential Approach to Instruction

[Lecture 32 - Simulation Approach to Instruction](#)

[Lecture 33 - Instruction for Design](#)

[Lecture 34 - Instruction for Metacognitive Learning](#)

[Lecture 35 - So, what should a teacher do?](#)

DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : NOC:NBA Accreditation and Teaching Learning in Engineering (NATE) (Multi-Disciplinary)

Co-ordinators : Prof. N J Rao, Prof. K. Rajanikanth

Lecture 1 - NATE

Lecture 2 - NBA Accreditation

Lecture 3 - Outcome Based Education

Lecture 4 - Self Assessment Report

Lecture 5 - Education, Teaching, Learning, Instruction, and Assessment

Lecture 6 - PEOs and POs (1-5)

Lecture 7 - POs (6-9)

Lecture 8 - POs (10-12)

Lecture 9 - PSOs

Lecture 10 - Taxonomy of Learning

Lecture 11 - Cognitive Processes - 1

Lecture 12 - Cognitive Processes - 2

Lecture 13 - Categories of Knowledge - 1

Lecture 14 - Categories of Knowledge - 2

Lecture 15 - Taxonomy Table

Lecture 16 - Affective and Psychomotor Domains

Lecture 17 - Course Outcomes - 1

Lecture 18 - Course Outcomes - 2

Lecture 19 - Tagging Course Outcomes

Lecture 20 - Computing Attainment of COs

Lecture 21 - Computing PO and PSO Attainment

Lecture 22 - Course Design Component of Teaching as per Fink's Model

Lecture 23 - ISD and ADDIE Models

Lecture 24 - ADDIE - Analysis Phase 1

Lecture 25 - ADDIE - Analysis Phase 2

Lecture 26 - ADDIE - Design Phase

Lecture 27 - Technology for Assessment; Setting Targets

Lecture 28 - Assessment Plan and Assessment Instruments

Lecture 29 - Item Banks

Lecture 30 - ADDIE- Development Phase

Lecture 31 - ADDIE - Implement Phase 1

[Lecture 32 - ADDIE - Implement Phase 2](#)

[Lecture 33 - Exit Surveys - 1](#)

[Lecture 34 - Exit Surveys - 2](#)

[Lecture 35 - ADDIE - Evaluate Phase](#)

[Lecture 36 - Instruction An Overview](#)

[Lecture 37 - Instructional Situations](#)

[Lecture 38 - How Brains Learn](#)

[Lecture 39 - Instructional Components](#)

[Lecture 40 - Principles of Instruction Design](#)

[Lecture 41 - Direct Instruction - 1](#)

[Lecture 42 - Direct Instruction - 2](#)

[Lecture 43 - Project Based Approach to Instruction](#)

[Lecture 44 - Problem Based Approach to Instruction](#)

[Lecture 45 - Instruction for Design thinking](#)

[Lecture 46 - Simulation Approach to Instruction](#)

[Lecture 47 - Instruction for Metacognitive Learning](#)

[Lecture 48 - So, What Should the teacher do?](#)

[Lecture 49 - NBA Criterion 1 Vision, Mission, PEOs - 1](#)

[Lecture 50 - NBA Criterion 1 Vision, Mission, PEOs - 2](#)

[Lecture 51 - NBA Criterion 2 Teaching-Learning Processes - 1](#)

[Lecture 52 - NBA Criterion 2 Teaching-Learning Processes - 2](#)

[Lecture 53 - NBA Criterion 3 COs and POs - 1](#)

[Lecture 54 - NBA Criterion 3 COs and POs - 2](#)

[Lecture 55 - NBA Criterion 4 Students' Performance](#)

[Lecture 56 - NBA Criterion 5 Faculty Information and Contributions](#)

[Lecture 57 - NBA Criterion 6 Facilities and Technical Support](#)

[Lecture 58 - NBA Criterion 7 Continuous Improvement](#)

[Lecture 59 - NBA Criterion 8 First Year Academics](#)

[Lecture 60 - NBA Criterion 9 Student Support Systems](#)

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Lecture 2 - Introduction to Nanotechnology (Continued...)

Lecture 3 - Synthetic Methodologies

Lecture 4 - Synthetic Methodologies (Continued...)

Lecture 5 - Synthetic Methodologies (Continued...)

Lecture 6 - Synthetic Methodologies (Continued...)

Lecture 7 - Synthetic Methodologies (Continued...)

Lecture 8 - Synthetic Methodologies (Continued...)

Lecture 9 - Template Methods - I

Lecture 10 - Template Methods - II

Lecture 11 - Spray Pyrolysis

Lecture 12 - V-L-S Method

Lecture 13 - Lithography - I

Lecture 14 - Lithography - II

Lecture 15 - Fullerenes and Carbon Nanotubes - I

Lecture 16 - Fullerenes and Carbon Nanotubes - II

Lecture 17 - Fullerenes and Carbon Nanotubes - III

Lecture 18 - Metal and Metal Oxide Nanowires - I

Lecture 19 - Metal and Metal Oxide Nanowires - II

Lecture 20 - Metal and Metal Oxide Nanowires - III

Lecture 21 - Self Assembly of Nanostructures - I

Lecture 22 - Self Assembly of Nanostructures - II

Lecture 23 - Self Assembly of Nanostructures - III

Lecture 24 - Core Shell Nanostructures - I

Lecture 25 - Core Shell Nanostructures - II

Lecture 26 - Core Shell Nanostructures - III

Lecture 27 - Nanocomposites - I

Lecture 28 - Nanocomposites - II

Lecture 29 - Photocatalysis - I

Lecture 30 - Photocatalysis - II

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[Lecture 32 - Dielectric Properties - I](#)

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[Lecture 37 - Optical Properties - I](#)

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[Lecture 40 - Concluding Lecture](#)

[Lecture 1 - Introduction to Nanomaterials](#)

[Lecture 2 - Introduction to Nanomaterials](#)

[Lecture 3 - Introduction to Nanomaterials](#)

[Lecture 4 - Introduction to Nanomaterials](#)

[Lecture 5 - Introduction to Nanomaterials](#)

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[Lecture 11 - Surface Effects and Physical properties of nanomaterials](#)

[Lecture 12 - Surface Effects and Physical properties of nanomaterials](#)

[Lecture 13 - Surface Effects and Physical properties of nanomaterials](#)

[Lecture 14 - Surface Effects and Physical properties of nanomaterials](#)

[Lecture 15 - Surface Effects and Physical properties of nanomaterials](#)

[Lecture 16 - Defect Structure & Mechanical Behaviour of Nanomaterials](#)

[Lecture 17 - Defect Structure & Mechanical Behaviour of Nanomaterials](#)

[Lecture 18 - Defect Structure & Mechanical Behaviour of Nanomaterials](#)

[Lecture 19 - Defect Structure & Mechanical Behaviour of Nanomaterials](#)

[Lecture 20 - Defect Structure & Mechanical Behaviour of Nanomaterials](#)

[Lecture 21 - Electrical, Magnetic and Optical Properties of Nanomaterials](#)

[Lecture 22 - Electrical, Magnetic and Optical Properties of Nanomaterials](#)

[Lecture 23 - Electrical, Magnetic and Optical Properties of Nanomaterials](#)

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[Lecture 26 - Atomic Bonding](#)

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[Lecture 28 - Carbon Nanostructures](#)

[Lecture 29 - Multi-Scale Hierarchy](#)

[Lecture 30 - Self Assembly](#)

[Lecture 31 - Nanomaterials in Nature: Bone](#)

[Lecture 32 - Surfaces and Interfaces](#)

[Lecture 33 - Non-wetting](#)

[Lecture 34 - Nanomaterials Science and Nanomanufacturing](#)

[Lecture 35 - Surface Adsorption Isotherms \(Langmuir/Bet\)](#)

[Lecture 36 - Reciprocal Lattice](#)

[Lecture 37 - Transmission Electron Microscopy](#)

[Lecture 38 - Transmission Electron Microscopy](#)

[Lecture 39 - Auger Electron Spectroscopy](#)

[Lecture 40 - X-Ray Photoelectron Spectroscopy \(XPS\)](#)

[Lecture 41 - Electron Energy Loss Spectroscopy \(EELS\)](#)

[Lecture 42 - Deformation Behavior of Nanomaterials](#)

[Lecture 43 - Fracture and Creep](#)

[Lecture 44 - Nanomechanics](#)

[Lecture 45 - Nanotribology](#)

Lecture 1 - Introduction

Lecture 2 - Physical Oceanography - I

Lecture 3 - Physical Oceanography - II

Lecture 4 - Physical Oceanography - III

Lecture 5 - Physical Oceanography - IV

Lecture 6 - Sediments & Open Ocean

Lecture 7 - Open Ocean - I

Lecture 8 - Open Ocean - II

Lecture 9 - Physical Properties of Water

Lecture 10 - Water and Waves

Lecture 11 - Waves - I

Lecture 12 - Waves - II

Lecture 13 - Waves - III

Lecture 14 - Introduction to Offshore Structures - I

Lecture 15 - Introduction to Offshore Structures - II

Lecture 16 - Waves - IV

Lecture 17 - The Wave Spectra

Lecture 18 - The Wave Spectra (Continued...1)

Lecture 19 - The Wave Spectra (Continued...2)

Lecture 20 - Offshore Structures - I

Lecture 21 - Offshore Structures - II

Lecture 22 - Offshore Structures - III

Lecture 23 - Floating Offshore Structures

Lecture 24 - Drilling from Platforms

Lecture 25 - Drilling and Topsides

Lecture 26 - Topsides

Lecture 27 - Mooring Systems

Lecture 28 - Mooring Systems (Continued...1)

Lecture 29 - Static Analysis of Mooring Cable

Lecture 30 - Static Analysis of Mooring Cable (Continued...)

Lecture 31 - Mooring Systems (Continued...2)

[Lecture 32 - Mooring Systems \(Continued...3\)](#)

[Lecture 33 - Mooring Systems \(Continued...4\)](#)

[Lecture 34 - Mooring Systems \(Continued...5\)](#)

[Lecture 35 - Mooring Systems \(Continued...6\)](#)

[Lecture 36 - Fixed Offshore Structures](#)

[Lecture 37 - Fixed Offshore Structures \(Continued...\)](#)

[Lecture 38 - Structural Analysis of Jacket Platforms](#)

[Lecture 39 - Structural Analysis of Jacket Platforms \(Continued...1\)](#)

[Lecture 40 - Structural Analysis of Jacket Platforms \(Continued...2\)](#)

[Lecture 41 - Jacket Pile Selection](#)

[Lecture 42 - Jacket Pile Selection \(Continued...1\)](#)

[Lecture 43 - Jacket Pile Selection \(Continued...2\)](#)

[Lecture 44 - Floating Platform Design](#)

[Lecture 45 - Semi-Submersibles](#)

[Lecture 46 - Semi-Submersibles & TLPs](#)

[Lecture 47 - Tension Leg Platform](#)

[Lecture 48 - Tension Leg Platform \(Continued...\)](#)

[Lecture 49 - SPAR Platform](#)

Lecture 1 - Introduction

Lecture 2 - Archimedes Principle

Lecture 3 - Archimedes Principle (Continued...)

Lecture 4 - Numerical Integration

Lecture 5 - Problems in Stability - I

Lecture 6 - Problems in Stability - II

Lecture 7 - Problems in Stability - III

Lecture 8 - Problems in Integration

Lecture 9 - Free Surface Effect

Lecture 10 - Inclining Experiment

Lecture 11 - Hydrostatic Curves - I

Lecture 12 - Hydrostatic Curves - II

Lecture 13 - Stability Curve

Lecture 14 - Dynamical Stability - I

Lecture 15 - Dynamical Stability - II

Lecture 16 - Healing Moment - I

Lecture 17 - Healing Moment - II

Lecture 18 - Healing Moment - III

Lecture 19 - Dynamical Stability - III

Lecture 20 - Discussion

Lecture 21 - Righting Stability - I

Lecture 22 - Righting Stability - II

Lecture 23 - Trim Calculations - I

Lecture 24 - Trim Calculations - II

Lecture 25 - Trim Stability - I

Lecture 26 - Trim Stability - II

Lecture 27 - Dry Docking - I

Lecture 28 - Dry Docking - II

Lecture 29 - Bilging - I

Lecture 30 - Bilging - II

Lecture 31 - Bilging - III

[Lecture 32 - Bilging - IV](#)

[Lecture 33 - Safety Regulations](#)

[Lecture 34 - Safety Regulations \(Continued...\)](#)

[Lecture 35 - Safety Regulations \(Continued...\)](#)

[Lecture 36 - Ship Stability on Waves](#)

[Lecture 37 - Ship Stability on Waves \(Continued...\)](#)

[Lecture 38 - Ship Stability on Waves \(Continued...\)](#)

[Lecture 39 - Wave Theory](#)

[Lecture 40 - Conclusion](#)

Lecture 1 - Introduction to ships & offshore structures

Lecture 2 - Characteristics of shipbuilding industry

Lecture 3 - Structural Requirement

Lecture 4 - Basic Structural Components

Lecture 5 - Structural Subassemblies

Lecture 6 - Bulkheads

Lecture 7 - Decks & Shells

Lecture 8 - Structural Assemblies Double Bottom Construction

Lecture 9 - Wing Tanks & Duct Keels

Lecture 10 - Fore & Aft Construction

Lecture 11 - General Cargo Carrier

Lecture 12 - Bulk Carrier

Lecture 13 - Structural Details

Lecture 14 - Container Ship

Lecture 15 - RO-RO Ship

Lecture 16 - Oil Tanker

Lecture 17 - Structural Alignment & Continuity

Lecture 18 - Steel Material Preparation

Lecture 19 - Shot Blasting

Lecture 20 - Acid Pickling

Lecture 21 - Plate Cutting

Lecture 22 - Plate & Section Forming - I

Lecture 23 - Plate & Section Forming - II

Lecture 24 - Line Heating

Lecture 25 - Fusion Welding & Power Source

Lecture 26 - Welding Parameters & their Effects

Lecture 27 - Welding Methods

Lecture 28 - Shielded Metal Arc Welding

Lecture 29 - Gas Metal Arc Welding - I

Lecture 30 - Gas Metal Arc Welding - II

Lecture 31 - Gas Tungsten Arc Welding

[Lecture 32 - Submerged Arc Welding](#)

[Lecture 33 - Electroslag Welding](#)

[Lecture 34 - Electrogas Welding](#)

[Lecture 35 - Friction Stir Welding](#)

[Lecture 36 - FSW Metallurgy](#)

[Lecture 37 - Welding Defects & NDT](#)

[Lecture 38 - Welding Distortions](#)

[Lecture 39 - Distortion Mechanism & Types of Distortion](#)

[Lecture 40 - Distortion Control & Mitigation](#)

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- Lecture 1 - Introduction to Marine Hydrodynamics
- Lecture 2 - Law of Conservation of Mass - Continuity of Equation
- Lecture 3 - Streamlines and Flow Direction
- Lecture 4 - Worked Examples on Various Types of Flow
- Lecture 5 - Equation of Motion (Law of Conservation of Momentum)
- Lecture 6 - Applications of Equations of Motion
- Lecture 7 - Applications of Equations of Motion (Continued...)
- Lecture 8 - Two Dimensional Flows
- Lecture 9 - Two Dimensional Flows (Continued...)
- Lecture 10 - Source, Sink and Doublet
- Lecture 11 - Worked Examples on Two Dimensional Flows
- Lecture 12 - Conformal Mapping and Joukowski Transformation
- Lecture 13 - Uniform Flow Past an Elliptic Cylinder
- Lecture 14 - Aerofoil theory
- Lecture 15 - Aerofoil theory (Continued...)
- Lecture 16 - Aerofoil theory (Continued...)
- Lecture 17 - Schwarz - Christoffel Transformation
- Lecture 18 - Motion of a cylinder
- Lecture 19 - Vertex Motion
- Lecture 20 - Irrotational Flow - A Bird's eyeview
- Lecture 21 - Introduction to Water Waves
- Lecture 22 - Basic Equation and Conditions of Water Waves
- Lecture 23 - Water particle kinematics in wave motion
- Lecture 24 - Capillary Gravity Waves
- Lecture 25 - Linearised Long Wave Equation
- Lecture 26 - Linearised Long Wave Equation (Continued...)
- Lecture 27 - Wave motion in two layer fluids
- Lecture 28 - Worked Examples on Wave Motion
- Lecture 29 - Worked Examples on Wave Motion (Continued...)
- Lecture 30 - Gravity wave transformation and energy rotation
- Lecture 31 - Gravity wave transformation and energy rotation (Continued...)

[Lecture 32 - Gravity wave transformation and energy rotation \(Continued...\)](#)

[Lecture 33 - Navier - Stokes equation of motion](#)

[Lecture 34 - Analysis of Basic Flow Problems](#)

[Lecture 35 - Analysis of Basic Flow Problems \(Continued...\)](#)

[Lecture 36 - Unsteady unidirectional flows](#)

[Lecture 37 - Unsteady unidirectional flows \(Continued...\)](#)

[Lecture 38 - An introduction to Boundary Layer Theory](#)

[Lecture 39 - Solution methods for Boundary Layer Equations](#)

[Lecture 40 - Solutions Methods for Boundary Layer Equations \(Continued...\)](#)

- Lecture 1 - Regular Water Waves - I
- Lecture 2 - Regular Water Waves - II
- Lecture 3 - Definition of Ship Motions & Encounter Frequency
- Lecture 4 - Single Degree of Freedom Motions in Regular Waves
- Lecture 5 - Uncoupled Heave, Pitch and Roll - I
- Lecture 6 - Uncoupled Heave, Pitch and Roll - II
- Lecture 7 - Uncoupled Heave, Pitch and Roll - III
- Lecture 8 - Uncoupled Heave, Pitch and Roll - IV
- Lecture 9 - Uncoupled Heave, Pitch and Roll - V
- Lecture 10 - Coupled Motions
- Lecture 11 - Irregular Waves
- Lecture 12 - Description of Irregular Waves by Spectrum
- Lecture 13 - Theoretical Wave Spectrum
- Lecture 14 - Ship Motion in Irregular Waves - I
- Lecture 15 - Ship Motion in Irregular Waves - II
- Lecture 16 - Ship Motion in Irregular Waves - III
- Lecture 17 - Description of Short-Crested Sea
- Lecture 18 - Motions in Short-Crested Sea
- Lecture 19 - Derived Responses & Dynamic Effects - I
- Lecture 20 - Derived Responses & Dynamic Effects - II
- Lecture 21 - Derived Responses & Dynamic Effects - III
- Lecture 22 - Seakeeping Considerations in Design
- Lecture 23 - Manoeuvring: Introduction & Basic Equations
- Lecture 24 - Dynamic Equations of Motion - I
- Lecture 25 - Dynamic Equations of Motion - II
- Lecture 26 - Hydrodynamic Derivatives
- Lecture 27 - Controls-Fixed Stability
- Lecture 28 - Stability & Cotrollability: Definitive Manoeuvres
- Lecture 29 - Definitive Manoeuvres - I
- Lecture 30 - Definitive Manoeuvres - II
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- Lecture 4 - Second Law of Thermodynamics
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- Lecture 6 - Property of Pure Substance, Steam Table
- Lecture 7 - Ideal Gas Laws, Different Processes
- Lecture 8 - Introduction to Vapour Power Cycle
- Lecture 9 - Vapour Power Cycle
- Lecture 10 - Steam Power Cycle, Steam Nozzle
- Lecture 11 - Basic Concept of Turbine, Velocity Diagram
- Lecture 12 - Steam Turbine-Impulse
- Lecture 13 - Reaction Turbine Compounding
- Lecture 14 - Comparison of Different Staging Arrangement
- Lecture 15 - Basics Laws of Fluid Mechanics
- Lecture 16 - Pipe Friction, Major Loss, Minor Loss
- Lecture 17 - Pipeline & Pipe Network
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- Lecture 19 - Psychometrics
- Lecture 20 - Psychometrics (Continued...)
- Lecture 21 - Psychometric Processes
- Lecture 22 - Psychometric Processes (Continued...), Air Conditioning
- Lecture 23 - Summer & Winter Air Conditioning
- Lecture 24 - Gas Power Cycles, Cycles for IC Engines
- Lecture 25 - Gas Turbine Cycles
- Lecture 26 - Modification of Brayton Cycle
- Lecture 27 - Introduction to Convective Heat Transfer Forced & Free Convection

- Lecture 1 - Components of Resistance - I
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- Lecture 5 - Wave Making Resistance
- Lecture 6 - Other Components of Resistance
- Lecture 7 - Model Experiments
- Lecture 8 - Shallow Water Effects
- Lecture 9 - Ship hull form and Resistance
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- Lecture 12 - Introduction to High Speed Crafts - Part I
- Lecture 13 - Introduction to High Speed Crafts - Part II
- Lecture 14 - Propeller in Open Water - Part I
- Lecture 15 - Propeller in Open Water - Part II
- Lecture 16 - Propeller 'behind' a ship
- Lecture 17 - Propeller experiments
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- Lecture 19 - Propeller Theories
- Lecture 20 - Cavitation
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- Lecture 22 - Regular Sea Waves - II
- Lecture 23 - Irregular sea Waves - I
- Lecture 24 - Irregular Sea Waves - II
- Lecture 25 - Ship Motion in Regular Waves - I
- Lecture 26 - Ship Motion in Regular Waves - II
- Lecture 27 - Ship Motion in Regular Waves - III
- Lecture 28 - Ship Motion in irregular Waves - I
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- Lecture 30 - Ship Motion in irregular Waves - III
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[Lecture 35 - Hydrodynamic Derivatives and Stability](#)

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- Lecture 2 - Introduction to Ship Structures - II
- Lecture 3 - Deflection of Structure Beam - I
- Lecture 4 - Deflection of Structure Beam - II
- Lecture 5 - Deflection of Structure Beam - III
- Lecture 6 - Deflection of Structure Beam - IV
- Lecture 7 - Statically Indeterminate Structures - I
- Lecture 8 - Statically Indeterminate Structures - II
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- Lecture 13 - Longitudinal Bending of Hull Girder - I
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- Lecture 26 - Ship Vibration - IV
- Lecture 27 - Ship Vibration - V
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- Lecture 29 - Hull Frequency Estimation from Basic Group (Continued...)
- Lecture 30 - Analysis of Bulkhead - I
- Lecture 31 - Analysis of Bulkhead - II

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[Lecture 34 - Method of Plastic Analysis](#)

[Lecture 35 - Calculation of Natural Frequency of Hull Girder](#)

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Lecture 2 - Global Water Availability and Uses

Lecture 3 - Water Availability and Uses in India

Lecture 4 - Surface Water and Ground Water Resources

Lecture 5 - Water Use Practices and Major Challenges

Lecture 6 - Background to Water Rights

Lecture 7 - Water Rights

Lecture 8 - Right to Sanitation

Lecture 9 - Rights to Water and Sanitation - Underline Principals and Implementation

Lecture 10 - Water Rights : Challenges

Lecture 11 - Water Sustainability : Basic Concept

Lecture 12 - The Dublin Statement on Water Sustainability

Lecture 13 - Action Agenda in the Dublin Statement on Water Sustainability

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Lecture 15 - Water Sustainability : Conflicts

Lecture 16 - Valuing Water : Economic Value of Water

Lecture 17 - Valuing Water : Use and Non-Use Values

Lecture 18 - Valuing Water : Valuation of Water

Lecture 19 - Valuing Water : Water Valuation Methods

Lecture 20 - Valuing Water : Full Value and Losses

Lecture 21 - Pricing Water : Sustainable Water Pricing

Lecture 22 - Pricing Water : Setting Water Tariffs

Lecture 23 - Pricing Water : Water Tariff Models

Lecture 24 - Pricing Water : Water Tariff Models

Lecture 25 - Pricing Water : Water Tariff Models

Lecture 26 - Water Pricing : Need of Reforms

Lecture 27 - Conflicts in Water Pricing

Lecture 28 - Conflicts in Water Pricing

Lecture 29 - Conflicts in Water Pricing

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- Lecture 32 - Economics of Water Projects : Economic Analysis
- Lecture 33 - Economics of Water Projects : Financial Analysis
- Lecture 34 - Economics of Water Projects : Benefit-Cost Analysis
- Lecture 35 - Economics of Demand and Sectoral Allocation
- Lecture 36 - Economics Evaluation of Water Projects
- Lecture 37 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 38 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 39 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 40 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 41 - Evaluation of Water Projects : Selection of Capital Budgeting Methods (Continued...)
- Lecture 42 - Evaluation of Water Projects : Selection of Capital Budgeting Methods (Continued...)
- Lecture 43 - Water Governance
- Lecture 44 - Elements, Dimensions and Principles of Water Governance
- Lecture 45 - Principles of Water Governance
- Lecture 46 - Principles of Water Governance and Effective Water Governance Schemes
- Lecture 47 - Effective Water Governance Schemes and its Benchmarking
- Lecture 48 - Decision Making and Implementation in Water Governance and its Benchmarking
- Lecture 49 - Water Governance in India : Historical Perspective
- Lecture 50 - Water Governance in India : Pre- and Post- Independent
- Lecture 51 - Water Governance in India : Water Programmes and Policies
- Lecture 52 - Water Governance in India : Water Programmes and Policies (Continued...)
- Lecture 53 - Water Governance in India : Environmental Protection and Water Reforms
- Lecture 54 - Water Dispute Management : Water Conflicts
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- Lecture 56 - Water Dispute Management : Interstate Water Dispute Resolution
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- Lecture 58 - Global Water Diplomacy : Trans-boundary Water
- Lecture 59 - Global Water Diplomacy : Conflict Vs Cooperation
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- Lecture 63 - Live Session-1
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- Lecture 3 - Propeller Geometry (Continued...)
- Lecture 4 - Propeller Theory - I
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- Lecture 7 - Propeller Theory - IV
- Lecture 8 - Propeller Theory - V
- Lecture 9 - Propeller Theory - VI
- Lecture 10 - Propeller Theory - VII
- Lecture 11 - Propeller in Open Water
- Lecture 12 - Dimensional Analysis and Similarity
- Lecture 13 - Propeller Open Water Characteristics
- Lecture 14 - Propeller Open Water Characteristics (Continued...)
- Lecture 15 - Methodical Propeller Series
- Lecture 16 - Hull-Propeller Interaction
- Lecture 17 - Hull-Propeller Interaction (Continued...)
- Lecture 18 - Ship Powering and Efficiency Components
- Lecture 19 - Engine-Propeller Matching - Part I
- Lecture 20 - Engine-Propeller Matching - Part II
- Lecture 21 - Propeller Model Tests - Part I
- Lecture 22 - Propeller Model Tests - Part II
- Lecture 23 - Propeller Model Tests - Part III
- Lecture 24 - Propeller Cavitation - Part I
- Lecture 25 - Propeller Cavitation - Part II
- Lecture 26 - Propeller Strength - Part I
- Lecture 27 - Propeller Strength - Part II
- Lecture 28 - Propeller Design - Part I
- Lecture 29 - Propeller Design - Part II
- Lecture 30 - Propeller Design - Part III
- Lecture 31 - Controllable Pitch Propeller

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[Lecture 33 - Ducted Propeller \(Continued...\)](#)

[Lecture 34 - Problems on Propeller Performance](#)

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[Lecture 36 - Waterjet Propulsion](#)

[Lecture 37 - Unconventional Propulsors](#)

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[Lecture 39 - Miscellaneous Topics](#)

[Lecture 40 - Energy Saving Devices](#)

Lecture 1 - Introduction

Lecture 2 - Introduction to Seakeeping - 1

Lecture 3 - Introduction to Seakeeping - 2

Lecture 4 - Seakeeping - 3

Lecture 5 - Seakeeping - 4

Lecture 6 - Seakeeping - 5

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Lecture 12 - Waves - 2

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Lecture 14 - Introduction to BEM

Lecture 15 - Introduction to BEM (Continued...)

Lecture 16 - Lower Order Panel Method

Lecture 17 - Lower Order Panel Method (Continued...)

Lecture 18 - Case Study - Part 1

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Lecture 20 - Demonstration of Panel Method Code

Lecture 21 - Frequency Domain Panel Method

Lecture 22 - Frequency Domain Panel Method (Continued...)

Lecture 23 - Frequency Domain Panel Method (Continued...)

Lecture 24 - Frequency Domain Panel Method (Continued...)

Lecture 25 - Frequency Domain Panel Method (Continued...)

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Lecture 27 - Frequency Domain Panel Method (Continued...)

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Lecture 30 - IRF Based Solution - Part 1

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- [Lecture 32 - Time Domain Solution Using IRF](#)
- [Lecture 33 - Time Domain Solution Using IRF \(Continued...\)](#)
- [Lecture 34 - Numerical Computation of IRF Based Method](#)
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- [Lecture 36 - Forward Speed Effects](#)
- [Lecture 37 - Strip Theory - Part 1](#)
- [Lecture 38 - Strip Theory - Part 2](#)
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- [Lecture 44 - Time Domain Panel Method](#)
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- [Lecture 47 - Time Domain Panel Method \(Continued...\)](#)
- [Lecture 48 - Time Domain Panel Method \(Continued...\)](#)
- [Lecture 49 - Non Linear Time Domain Panel Method](#)
- [Lecture 50 - Non Linear Time Domain Panel Method \(Continued...\)](#)
- [Lecture 51 - Time Domain Panel Method - Code Development](#)
- [Lecture 52 - Ship Hydroelasticity](#)
- [Lecture 53 - Hydroelasticity](#)
- [Lecture 54 - Hydroelasticity \(Continued...\)](#)
- [Lecture 55 - Hydroelasticity \(Continued...\)](#)
- [Lecture 56 - Semi Analytic Method](#)
- [Lecture 57 - Semi Analytic Method \(Continued...\)](#)
- [Lecture 58 - Including Non linear Forces in BEM Code](#)
- [Lecture 59 - Including Non linear Forces in BEM Code \(Continued...\)](#)
- [Lecture 60 - Closer](#)

NPTEL : Design of Offshore Structures (Ocean Engineering)

Co-ordinators : Dr. S. Nallayarasu

Lecture 1 - Loads On Offshore Structures - 1

Lecture 2 - Loads On Offshore Structures - 2

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Lecture 4 - Loads On Offshore Structures - 4

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Lecture 8 - Concepts of Fixed Offshore Platform Deck and Jacket - 1

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Lecture 11 - Concepts of Fixed Offshore Platform Deck and Jacket - 4

Lecture 12 - Concepts of Fixed Offshore Platform Deck and Jacket - 5

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Lecture 14 - Steel Tubular Member Design - 2

Lecture 15 - Steel Tubular Member Design - 3

Lecture 16 - Steel Tubular Member Design - 4

Lecture 17 - Steel Tubular Member Design - 5

Lecture 18 - Tubular Joint Design for Static and Cyclic Loads - 1

Lecture 19 - Tubular Joint Design for Static and Cyclic Loads - 2

Lecture 20 - Tubular Joint Design for Static and Cyclic Loads - 3

Lecture 21 - Tubular Joint Design for Static and Cyclic Loads - 4

Lecture 22 - Tubular Joint Design for Static and Cyclic Loads - 5

Lecture 23 - Tubular Joint Design for Static and Cyclic Loads - 6

Lecture 24 - Tubular Joint Design for Static and Cyclic Loads - 7

Lecture 25 - Tubular Joint Design for Static and Cyclic Loads - 8

Lecture 26 - Tubular Joint Design for Static and Cyclic Loads - 9

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Lecture 28 - Tubular Joint Design for Static and Cyclic Loads - 11

Lecture 29 - Tubular Joint Design for Static and Cyclic Loads - 12

Lecture 30 - Jackup RIGS-Analysis and Design - 1

Lecture 31 - Jackup RIGS-Analysis and Design - 2

[Lecture 32 - Jackup RIGS-Analysis and Design - 3](#)

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[Lecture 34 - Jackup RIGS-Analysis and Design - 5](#)

[Lecture 35 - Design Against Accidental Loads - 1](#)

[Lecture 36 - Design Against Accidental Loads - 2](#)

[Lecture 37 - Design Against Accidental Loads - 3](#)

[Lecture 38 - Design Against Accidental Loads - 4](#)

[Lecture 39 - Design Against Accidental Loads - 5](#)

[Lecture 40 - Design Against Accidental Loads - 6](#)

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Lecture 1 - Basics of Soil Mechanics - I

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Lecture 3 - Basics of Soil Mechanics - III

Lecture 4 - Basics of Soil Mechanics - IV

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Lecture 8 - Bearing Capacity of Foundations - I

Lecture 9 - Bearing Capacity of Foundations - II

Lecture 10 - Pile Foundation - I

Lecture 11 - Pile Foundation - II

Lecture 12 - Pile Foundation - III

Lecture 13 - Pile Foundation - IV

Lecture 14 - Pile Foundation - V

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Lecture 3 - Safety assurance and assessment

Lecture 4 - Safety assurance and assessment (Continued...)

Lecture 5 - Safety in design and operations

Lecture 6 - Organizing for safety

Lecture 7 - Hazard classification and assessment, Hazard evaluation and hazard control

Lecture 8 - HaZOP

Lecture 9 - HaZOP (Continued...)

Lecture 10 - Hazard evaluation and hazard control

Lecture 11 - Hazard Identification and Management in Oil & Gas Industry using HAZOP

Lecture 12 - FMEA

Lecture 13 - FMEA (Continued...)

Lecture 14 - Environmental Issues and Management

Lecture 15 - Impact of Oil and Gas Industry on Marine Environment

Lecture 16 - Oil Hydrocarbon in Marine Environment

Lecture 17 - Chemicals and Wastes from Offshore and Oil Industry

Lecture 18 - Dispersion Models “ Atmospheric Pollution

Lecture 19 - Atmospheric Pollution (Continued...)

Lecture 20 - Hazard Assessment and Accident Scenario

Lecture 21 - Dose Assessment, Safety Regulation

Lecture 22 - Toxic Release and Dispersion Modeling

Lecture 23 - Chemical Exposure Index (CEI)

Lecture 24 - Chemical Exposure Index (Continued.)

Lecture 25 - Quantitative Risk Assessment

Lecture 26 - Quantitative Risk Assessment (Liquid Release Models Case Study - Continued...)

Lecture 27 - Fire and Explosion Modeling

Lecture 28 - Fire and Explosion Modeling Flammability Diagrams

Lecture 29 - Explosion Modeling

Lecture 30 - Fire and Explosion Preventive Measures

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[Lecture 35 - Software Used in HSE an Over View](#)

- Lecture 1 - Layout of ports
- Lecture 2 - Continuation of layout of ports
- Lecture 3 - Visakhapatnam port
- Lecture 4 - Ships and size of ships
- Lecture 5 - Port planning
- Lecture 6 - Harbour layout
- Lecture 7 - Site characteristics & navigation channel
- Lecture 8 - Bathymetric survey
- Lecture 9 - Tide, surge, tsunami and wave
- Lecture 10 - Wave rose diagram
- Lecture 11 - Breakwater
- Lecture 12 - Design of breakwater - Part-1
- Lecture 13 - Design of breakwater - Part-2
- Lecture 14 - Berm breakwater
- Lecture 15 - Dredging & methods of disposal
- Lecture 16 - Berthing structures modelling
- Lecture 17 - Berthing structures - analyses
- Lecture 18 - Loads
- Lecture 19 - Types of berthing structures
- Lecture 20 - Design of berthing, structures-1
- Lecture 21 - Design of offshore berthing, structures-1
- Lecture 22 - Estimation of mooring, berthing and seismic forces
- Lecture 23 - Estimation seismic forces
- Lecture 24 - Active and passive earth pressure and differential water pressure
- Lecture 25 - Load combinations and design
- Lecture 26 - Fenders
- Lecture 27 - Mechanical handling system
- Lecture 28 - Single buoy mooring and open sea jetty - Part 1
- Lecture 29 - Single buoy mooring and open sea jetty - Part 2
- Lecture 30 - Slipway, drydock, floating dock, shiplift
- Lecture 31 - Soil structure interaction

Lecture 32 - Calculation of fixity depth

Lecture 33 - Pile load test

Lecture 34 - Ground improvement techniques

Lecture 35 - Analysis of pile with spring support

Lecture 36 - UPV,Half cell potential, Low high Integrity Test

Lecture 37 - Mooring Dolphin at KPT

Lecture 38 - Coastal structures and environmental management

Lecture 39 - BOQ and Cost Estimate

Lecture 40 - Proposed Mega Terminal Chennai

Lecture 41 - Preliminary Project Report on Shipyard

Lecture 42 - Procedures & clearances before implementation of a project

Lecture 43 - Detailed project report

Lecture 44 - Environmental studies of a project

Lecture 45 - Design of pile

Lecture 46 - Design and construction of diaphragm wall

Lecture 47 - Empirical relationship between spt and several soil properties

Lecture 48 - Model studies for a deep water port_case study

Lecture 1 - Syllabus and Introduction

Lecture 2 - Seaway Effects on Resistance

Lecture 3 - Ship Types and Powering Aspects

Lecture 4 - Frictional Resistance and Turbulence Stimulation

Lecture 5 - Wave Making Resistance

Lecture 6 - Bulbous Bow on Ship Resistance

Lecture 7 - Air and Wind Resistance Dimensional Analysis - I

Lecture 8 - Dimensional Analysis - II, Model Tests and Ship Resistance Prediction Methods - I

Lecture 9 - Model Tests and Ship Resistance Prediction Methods - II

Lecture 10 - Model Tests and Ship Resistance Prediction Methods - III

Lecture 11 - Resistance in Shallow Water

Lecture 12 - Canal Effects on Resistance Holtrap-Mennen Method for Ship Resistance Prediction

Lecture 13 - Ship Resistance Prediction Methods - I

Lecture 14 - Ship Resistance Prediction Methods - II

Lecture 15 - Resistance of Advanced Marine Vehicles - I

Lecture 16 - Resistance of Advanced Marine Vehicles - II

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Lecture 7 - Sediment charecteristics - II

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Lecture 18 - Coastal erosion protection measures - V

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Lecture 20 - Coastal erosion protection measures - VII

Lecture 21 - Coastal erosion protection measures - VIII

Lecture 22 - Coastal erosion protection measures - IX

Lecture 23 - Coastal erosion protection measures - X

Lecture 24 - Cheaper CEP methods - XI

Lecture 25 - Geosynthetics - I

Lecture 26 - Geosynthetics - II

Lecture 27 - Breakwaters - I

Lecture 28 - Breakwaters - II

Lecture 29 - Breakwaters - III

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Lecture 31 - Forces on coastal structures - I

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[Lecture 33 - Scour under marine structures](#)

[Lecture 34 - Physical modelling of coastal structures - I](#)

[Lecture 35 - Physical modelling of coastal structures - II](#)

[Lecture 36 - Tsunami - I](#)

[Lecture 37 - Tsunami - II](#)

NPTEL : Wave Hydrodynamics (Ocean Engineering)

Co-ordinators : Prof. V. Sundar

- Lecture 1 - Basic Fluid Dynamics - I
- Lecture 2 - Basic Fluid Dynamics - II
- Lecture 3 - Introduction
- Lecture 4 - Wave Motion - I
- Lecture 5 - Wave Motion - II
- Lecture 6 - Wave Motion - III
- Lecture 7 - Wave Motion Problems
- Lecture 8 - Standing Wave Theory
- Lecture 9 - Wave Deformation - I
- Lecture 10 - Wave Deformation - II
- Lecture 11 - Wave Deformation and Problems
- Lecture 12 - Random Waves
- Lecture 13 - Random Waves and Problems - I
- Lecture 14 - Random Waves and Problems - II
- Lecture 15 - Random Waves and Problems - III
- Lecture 16 - Simulation of Random Waves
- Lecture 17 - Directional waves
- Lecture 18 - Wave Loads on Structures - I
- Lecture 19 - Wave Loads on Structures - II
- Lecture 20 - Wave Loads on Structures and Problems - I
- Lecture 21 - Wave Loads on Structures and Problems - II
- Lecture 22 - Wave loads on Large Boies
- Lecture 23 - Finite Amplitude Wave Theories
- Lecture 24 - Hydrodynamic Testing Facility
- Lecture 25 - Hydrodynamic Testing Facility at IITM

- Lecture 1 - Introduction and objectives
- Lecture 2 - Fixed type offshore structures
- Lecture 3 - Compliant type offshore structures - I
- Lecture 4 - Compliant type offshore structures - II
- Lecture 5 - Drill ships and basics of drilling
- Lecture 6 - Subsea production systems
- Lecture 7 - Environmental loads - I
- Lecture 8 - Environmental loads - II
- Lecture 9 - Types of coastal structures - I
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- Lecture 11 - Summary of coastal structures
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- Lecture 13 - Outline of planning of ocean structures
- Lecture 14 - Introduction to design
- Lecture 15 - Construction techniques
- Lecture 16 - Dredging - I
- Lecture 17 - Dredging - II
- Lecture 18 - Uncertainties in analysis and design
- Lecture 19 - Design adequacy - Example I
- Lecture 20 - Design adequacy - Example II
- Lecture 21 - Dredging equipments' specifications
- Lecture 22 - Ocean Pollution
- Lecture 23 - Foundation and sea bed anchors
- Lecture 24 - Introduction to materials - I
- Lecture 25 - Introduction to materials - II
- Lecture 26 - Concrete in marine environment
- Lecture 27 - Concrete: problems and solutions
- Lecture 28 - Repair materials for marine structures
- Lecture 29 - Corrosion in concrete - I
- Lecture 30 - Corrosion in concrete - II
- Lecture 31 - Material sin repair and rehabilitation

[Lecture 32 - Materials for special repair](#)

[Lecture 33 - New materials for coastal embankments - I](#)

[Lecture 34 - New materials for coastal embankments - II](#)

[Lecture 35 - Non-destructive testing](#)

[Lecture 36 - Structural health monitoring](#)

[Lecture 37 - Wireless sensor networking](#)

[Lecture 38 - Repair and rehabilitation-Fenders](#)

- Lecture 1 - Introduction to different types of ocean structures - I
- Lecture 2 - Introduction to different types of ocean structures - II
- Lecture 3 - Introduction to different types of ocean structures - III
- Lecture 4 - Types of Compliant towers
- Lecture 5 - New Generation offshore and Coastal structures
- Lecture 6 - Environmental forces
- Lecture 7 - Wave forces, Current
- Lecture 8 - Introduction to Structural dynamics
- Lecture 9 - Characteristics of single degree - of - freedom model
- Lecture 10 - Methods of writing equation of motion
- Lecture 11 - Free and forced vibration of single degree - of - freedom systems
- Lecture 12 - Undamped and damped systems - I
- Lecture 13 - Undamped and damped systems - II
- Lecture 14 - Undamped and damped systems - III
- Lecture 15 - Comparison of methods
- Lecture 16 - Examples
- Lecture 17 - Numerical problems in single degree - of - freedom systems
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Lecture 40 - Shear center - 3

Lecture 41 - Curved section

Lecture 42 - Shear center for curved sections

Lecture 43 - Shear center for unsymmetric section

Lecture 44 - Curved beam - 1

Lecture 45 - Curved beam with large curvature - 1

Lecture 46 - Curved beam with large curvature - 2

Lecture 47 - Modified area factor for curved section

Lecture 48 - M factor for curved beams

Lecture 49 - Crane hook

Lecture 50 - Thin-walled section

Lecture 51 - Open thin-walled section

Lecture 52 - Lateral torsional buckling

Lecture 53 - Design for LTB-1

Lecture 54 - Design check for LTB-2

Lecture 55 - LTB example problem

Lecture 56 - Ice loads

Lecture 57 - Ice spectrum

Lecture 58 - Blast resistant design - 1

Lecture 59 - Blast resistant design - 2

Lecture 60 - Blast-resistant design - 3

Lecture 61 - Blast-resistant design - 4

Lecture 62 - Fire-resistant design - 1

Lecture 63 - Fire-resistant design - 2

Lecture 64 - Analysis under impact loads

Lecture 1 - Oscilloscope, Function Generator and Tilt meter

Lecture 2 - Strain Gauges and Load Cells

Lecture 3 - Wheatstone Bridge Circuit and RC Circuits on a Breadboard Design and Testing of Wheat - 1

Lecture 4 - Wheatstone Bridge Circuit and RC Circuits on a Breadboard Passive Low Pass RC Filter - 2

Lecture 5 - Wheatstone Bridge Circuit and RC Circuits on a Breadboard Rc High Pass Filter Lab - 3

Lecture 6 - Opamps, Differentiator and Integrator Circuits Design and Testing Integrator and Differ - 1

Lecture 7 - Opamps, Differentiator and Integrator Circuits Design and Testing Integrated and Differ - 2

- Lecture 1 - Introduction to Oil and Gas - 1
- Lecture 2 - Introduction to Oil and Gas - 2
- Lecture 3 - Drilling and Completion - 1
- Lecture 4 - Drilling and Completion - 2
- Lecture 5 - Well Completion
- Lecture 6 - Basics of Surface Facilities
- Lecture 7 - Fluid Properties
- Lecture 8 - Introduction to Separators - 1
- Lecture 9 - Introduction to Separators - 2
- Lecture 10 - Flow Control - 1
- Lecture 11 - Flow Control - 2
- Lecture 12 - Principle of Separation - 1
- Lecture 13 - Principle of Separation - 2
- Lecture 14 - Heat calculations for separation
- Lecture 15 - Fluid Properties and Two-Phase Separator - 1
- Lecture 16 - Fluid Properties and Two-Phase Separator - 2
- Lecture 17 - Introduction to Separators
- Lecture 18 - Horizontal Separator and Sizing - 1
- Lecture 19 - Horizontal Separator and Sizing - 2
- Lecture 20 - Horizontal Separator and Sizing: Numerical
- Lecture 21 - Three Phase Separation - 1
- Lecture 22 - Three Phase Separation - 2
- Lecture 23 - Vertical Separator Sizing - 1
- Lecture 24 - Vertical Separator Sizing - 2
- Lecture 25 - Horizontal and Vertical Separator: Numerical
- Lecture 26 - Heater Treater - 1
- Lecture 27 - Heater Treater - 2
- Lecture 28 - Gunbarrel
- Lecture 29 - Gunbarrel: Numericals
- Lecture 30 - Heat Calculation - 1
- Lecture 31 - Heat Calculation - 2

[Lecture 32 - Introduction to Electrostatic Treater - 1](#)

[Lecture 33 - Introduction to Electrostatic Treater - 2](#)

[Lecture 34 - Heater Treater and Gunbarrel - 1](#)

[Lecture 35 - Heater Treater and Gunbarrel - 2](#)

[Lecture 36 - Heater Treater and Gunbarrel: Numerical - Part 1](#)

[Lecture 37 - Heater Treater and Gunbarrel: Numerical - Part 2](#)

[Lecture 38 - Desalting of Crude Oil - 1](#)

[Lecture 39 - Desalting of Crude Oil - 2](#)

[Lecture 40 - Water Treatment - 1](#)

[Lecture 41 - Water Treatment - 2](#)

[Lecture 42 - Produced Water Treatment - 1](#)

[Lecture 43 - Produced Water Treatment - 2](#)

[Lecture 44 - Produced Water Treatment - 3](#)

[Lecture 45 - Produced Water Treatment: Numerical](#)

[Lecture 46 - Natural Gas Processing - 1](#)

[Lecture 47 - Natural Gas Processing - 2](#)

[Lecture 48 - Acid Gas Treating](#)

[Lecture 49 - Amine System for Gas Sweetening - 1](#)

[Lecture 50 - Amine System for Gas Sweetening - 2](#)

[Lecture 51 - Gas Dehydration](#)

[Lecture 52 - Crude Oil Storage Facilities - 1](#)

[Lecture 53 - Crude Oil Storage Facilities - 2](#)

[Lecture 54 - Crude Oil Storage Facilities - 3](#)

[Lecture 55 - Flow Measurement Techniques - 1](#)

[Lecture 56 - Flow Measurement Techniques - 2](#)

[Lecture 57 - Heat Transfer Mechanisms](#)

[Lecture 58 - Thermodynamic Laws](#)

[Lecture 59 - Introduction to Heat Exchanger - 1](#)

[Lecture 60 - Introduction to Heat Exchanger - 2](#)

[Lecture 61 - Introduction to Heat Exchanger - 3](#)

[Lecture 62 - Introduction to Heat Exchanger - 4](#)

[Lecture 63 - Pressure Vessel - 1](#)

[Lecture 64 - Pressure Vessel - 2](#)

[Lecture 65 - Pressure Vessel - 3](#)

[Lecture 66 - Wall Thickness Criteria](#)

[Lecture 67 - Introduction to Pumps - 1](#)

[Lecture 68 - Introduction to Pumps - 2](#)

[Lecture 69 - Introduction to Pumps - 3](#)

[Lecture 70 - Introduction to Reciprocating Pumps](#)

[Lecture 71 - Introduction to Compressor](#)

[Lecture 72 - Introduction to IC/CI Engine - 1](#)

[Lecture 73 - Introduction to IC/CI Engine - 2](#)

- Lecture 1 - Scalar field and its Gradient
- Lecture 2 - Line and Surface Integrals
- Lecture 3 - Divergence and Curl of Vector Fields
- Lecture 4 - Conservative Field, Stoke's Theorem
- Lecture 5 - Laplacian
- Lecture 6 - Electric Field Potential
- Lecture 7 - Gauss's Law, Potential
- Lecture 8 - Electric Field and Potential
- Lecture 9 - Potential and Potential Energy - I
- Lecture 10 - Potential and Potential Energy - II
- Lecture 11 - Potential and Potential Energy - III
- Lecture 12 - Coefficients of Potential and Capacitance
- Lecture 13 - Poission and Laplace Equation
- Lecture 14 - Solutions of Laplace Equation - I
- Lecture 15 - Solutions of Laplace Equation - II
- Lecture 16 - Solutions of Laplace Equation - III
- Lecture 17 - Special Techniques - I
- Lecture 18 - Special Techniques - II
- Lecture 19 - Special Techniques - III
- Lecture 20 - Dielectrics - I
- Lecture 21 - Dielectrics - II
- Lecture 22 - Dielectrics - III
- Lecture 23 - Equation of Continuity
- Lecture 24 - a) Force between current loops b) Magnetic Vector Potential
- Lecture 25 - Magnetic Vector Potential
- Lecture 26 - Boundary Conditions
- Lecture 27 - Magnetized Material
- Lecture 28 - Magentostatics (Continued...), Time Varying Field (Introduction)
- Lecture 29 - Faraday's Law and Inductance
- Lecture 30 - Maxwell's Equations
- Lecture 31 - Maxwell's Equations and Conservation Laws

[Lecture 32 - Conservation Laws](#)

[Lecture 33 - a\) Angular Momentum Conservation b\) Electromagnetic Waves](#)

[Lecture 34 - Electromagnetic Waves](#)

[Lecture 35 - Propagation of Electromagnetic Waves in a metal](#)

[Lecture 36 - Waveguides - I](#)

[Lecture 37 - Waveguides - II](#)

[Lecture 38 - Resonating Cavity](#)

[Lecture 39 - Radiation - I](#)

[Lecture 40 - Radiation - II](#)

NPTEL : Special Theory of Relativity (Physics)

Co-ordinators : Prof. Shiva Prasad

Lecture 1 - Problem with Classical Physics

Lecture 2 - Michelson-Morley Experiment

Lecture 3 - Postulates of Special Theory of Relativity and Galilean Transformation

Lecture 4 - Look out for a New Transformation

Lecture 5 - Lorentz Transformation

Lecture 6 - Length Contraction and Time Dilation

Lecture 7 - Examples of Length Contraction and Time Dilation

Lecture 8 - Velocity Transformation and Examples

Lecture 9 - A Three Event Problem

Lecture 10 - A Problem involving Light and Concept of Casuality

Lecture 11 - Problems involving Casuality and Need to Redefine Momentum

Lecture 12 - Minkowski Space and Four Vectors

Lecture 13 - Proper Time a Four Scalar

Lecture 14 - Velocity Four Vector

Lecture 15 - Momentum Energy Four Vector

Lecture 16 - Relook at Collision Problems

Lecture 17 - Zero Rest Mass Particle and Photon

Lecture 18 - Doppler Effect in Light

Lecture 19 - Example in C-Frame

Lecture 20 - Force in Relativity

Lecture 21 - Force Four-Vector

Lecture 22 - Electric & Magnetic Field Transformation

Lecture 23 - Example of EM Field Transformation

Lecture 24 - Current Density Four Vector and Maxwell Equation

- Lecture 1 - Why Quantum Computing?
- Lecture 2 - Postulates of Quantum Mechanics - I
- Lecture 3 - Postulates of Quantum Mechanics - II
- Lecture 4 - Qubit - The smallest unit
- Lecture 5 - Qubit - Bloch sphere representation
- Lecture 6 - Multiple Qubit States and Quantum Gates
- Lecture 7 - Quantum Gates
- Lecture 8 - Quantum Circuits
- Lecture 9 - No-Cloning Theorem and Quantum Teleportation
- Lecture 10 - Super Dense Coding
- Lecture 11 - Density Matrix - I
- Lecture 12 - Density Matrix - II
- Lecture 13 - Bloch Sphere and Density Matrix
- Lecture 14 - Measurement Postulates - I
- Lecture 15 - Measurement Postulates - II
- Lecture 16 - Simple Algorithms-Deutsch Algorithm
- Lecture 17 - Deutsch-Josza and Bernstein - Vazirani Algorithms
- Lecture 18 - Simon Problem
- Lecture 19 - Grover's Search Algorithm - I
- Lecture 20 - Grover's Search Algorithm - II
- Lecture 21 - Grover's Search Algorithm - III
- Lecture 22 - Grover's Search Algorithm - IV
- Lecture 23 - Quantum Fourier Transform
- Lecture 24 - Period Finding and QFT
- Lecture 25 - Implementing QFT
- Lecture 26 - Implementing QFT-3 qubits (and more)
- Lecture 27 - Shor's Factorization Algorithm
- Lecture 28 - Shor's Factorization Algorithm-Implementation
- Lecture 29 - Shor's Algorithm-Continued Fraction
- Lecture 30 - Quantum Error Correction - I
- Lecture 31 - Quantum Error Correction - II Three Qubit Code

[Lecture 32 - Quantum Error Correction - III Shor's 9 Qubit Code - I](#)

[Lecture 33 - Quantum Error Correction - IV Shor's 9 Qubit Code - II](#)

[Lecture 34 - Classical Information Theory](#)

[Lecture 35 - Shannon Entropy](#)

[Lecture 36 - Shannon's Noiseless Coding Theorem](#)

[Lecture 37 - Von Neumann Entropy](#)

[Lecture 38 - EPR and Bell's Inequalities - I](#)

[Lecture 39 - EPR and Bell's Inequalities - II](#)

[Lecture 40 - EPR and Bell's Inequalities - III](#)

[Lecture 41 - Cryptography-RSA Algorithm - I](#)

[Lecture 42 - Cryptography-RSA Algorithm - II](#)

[Lecture 43 - Quantum Cryptography - I](#)

[Lecture 44 - Quantum Cryptography - II](#)

[Lecture 45 - Experimental Aspects of Quantum Computing - I](#)

[Lecture 46 - Experimental Aspects of Quantum Computing - II](#)

Lecture 1 - Introduction

Lecture 2 - Algebraic Preliminaries

Lecture 3 - Basic Group Concepts and Low Order Groups - I

Lecture 4 - Basic Group Concepts and Low Order Groups - II

Lecture 5 - Lagrange's Theorem and Cayley's Theorem - I

Lecture 6 - Lagrange's Theorem and Cayley's Theorem - II

Lecture 7 - Factor Group Conjugacy Classes - I

Lecture 8 - Factor Group Conjugacy Classes - II

Lecture 9 - Cycle Structures and Molecular Notation - I

Lecture 10 - Cycle Structures and Molecular Notation - II

Lecture 11 - Cycle Structures and Classification - I

Lecture 12 - Cycle Structures and Classification - II

Lecture 13 - Point Group Notation and Factor Group - I

Lecture 14 - Point Group Notation and Factor Group - II

Lecture 15 - Representation Theory - I

Lecture 16 - Representation Theory - II

Lecture 17 - Representation Theory - III

Lecture 18 - Representation Theory - IV

Lecture 19 - Schur's Lemma and Orthogonality Theorem - I

Lecture 20 - Schur's Lemma and Orthogonality Theorem - II

Lecture 21 - Orthogonality For Characters - I

Lecture 22 - Orthogonality For Characters - II

Lecture 23 - Character Tables and Molecular Applications - I

Lecture 24 - Character Tables and Molecular Applications - II

Lecture 25 - Preliminaries About The Continuum - I

Lecture 26 - Preliminaries About The Continuum - II

Lecture 27 - Classical Groups - I

Lecture 28 - Classical Groups - II

Lecture 29 - Classical Groups-Topology - I

Lecture 30 - Classical Groups-Topology - II

Lecture 31 - $SO(3)$ And Matrix Exponent - I

- Lecture 32 - $SO(3)$ And Matrix Exponent - II
- Lecture 33 - Generators, Discussion Of Lie's Theorems - I
- Lecture 34 - Generators, Discussion Of Lie's Theorems - II
- Lecture 35 - Group Algebras; $SO(3)$ - $SU(2)$ Correspondence - I
- Lecture 36 - Group Algebras; $SO(3)$ - $SU(2)$ Correspondence - II
- Lecture 37 - $SO(3)$, $SU(2)$ Representations - I
- Lecture 38 - $SO(3)$, $SU(2)$ Representations - II
- Lecture 39 - Representation On Function Spaces - I
- Lecture 40 - Representation On Function Spaces - II
- Lecture 41 - Lorentz Boosts, $SO(3,1)$ Algebra - I
- Lecture 42 - Lorentz Boosts, $SO(3,1)$ Algebra - II
- Lecture 43 - Representation Of Lorentz Group And Clifford Algebra - I
- Lecture 44 - Representation Of Lorentz Group And Clifford Algebra - II
- Lecture 45 - $SU(3)$ And Lie's Classification - I
- Lecture 46 - $SU(3)$ And Lie's Classification - II
- Lecture 47 - Fundamental Symmetries Of Physics - I
- Lecture 48 - Fundamental Symmetries Of Physics - II

Lecture 1 - Introduction to Quantum Mechanics - I

Lecture 2 - Introduction to Quantum Mechanics - II

Lecture 3 - Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator - I

Lecture 4 - Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator - II

Lecture 5 - Tutorial 1 - Part I

Lecture 6 - Tutorial 1 - Part II

Lecture 7 - Bound States - I

Lecture 8 - Bound States - II

Lecture 9 - Conditions and Solutions for one Dimensional Bound States - I

Lecture 10 - Conditions and Solutions for one Dimensional Bound States - II

Lecture 11 - Tutorial 2

Lecture 12 - Linear Vector Space (LVS) - I

Lecture 13 - Linear Vector Space (LVS) - II

Lecture 14 - Linear Vector Space (LVS) - III

Lecture 15 - Basis for Operators and States in LVS - I

Lecture 16 - Basis for Operators and States in LVS - II

Lecture 17 - Tutorial 3 - Part I

Lecture 18 - Tutorial 3 - Part II

Lecture 19 - Function Spaces - I

Lecture 20 - Function Spaces - II

Lecture 21 - Postulates of Quantum Mechanics - I

Lecture 22 - Postulates of Quantum Mechanics - II

Lecture 23 - Tutorial 4 - Part I

Lecture 24 - Tutorial 4 - Part II

Lecture 25 - Classical vs Quantum Mechanics - I

Lecture 26 - Classical vs Quantum Mechanics - II

Lecture 27 - Compatible vs Incompatible Observable - I

Lecture 28 - Compatible vs Incompatible Observable - II

Lecture 29 - Tutorial 5 - Part I

Lecture 30 - Tutorial 5 - Part II

Lecture 31 - Tutorial 5 - Part III

[Lecture 32 - Schrodinger and Heisenberg Pictures - I](#)

[Lecture 33 - Schrodinger and Heisenberg Pictures - II](#)

[Lecture 34 - Solutions to other Coupled Potential Energies - I](#)

[Lecture 35 - Solutions to other Coupled Potential Energies - II](#)

[Lecture 36 - Tutorial 6 - Part I](#)

[Lecture 37 - Tutorial 6 - Part II](#)

[Lecture 38 - Hydrogen Atom and Wave Functions, Angular Momentum Operators, Identical Particles - I](#)

[Lecture 39 - Hydrogen Atom and Wave Functions, Angular Momentum Operators, Identical Particles - II](#)

[Lecture 40 - Identical Particles and Quantum Computer - I](#)

[Lecture 41 - Identical Particles and Quantum Computer - II](#)

[Lecture 42 - Tutorial 7 - Part I](#)

[Lecture 43 - Tutorial 7 - Part II](#)

[Lecture 44 - Harmonic Oscillator - I](#)

[Lecture 45 - Harmonic Oscillator - II](#)

[Lecture 46 - Ladder Operators - I](#)

[Lecture 47 - Ladder Operators - II](#)

[Lecture 48 - Tutorial 8 - Part I](#)

[Lecture 49 - Tutorial 8 - Part II](#)

[Lecture 50 - Stern-Gerlach Experiment - I](#)

[Lecture 51 - Stern-Gerlach Experiment - II](#)

[Lecture 52 - Oscillator Algebra](#)

[Lecture 53 - Tutorial 9 - Part I](#)

[Lecture 54 - Tutorial 9 - Part II](#)

[Lecture 55 - Angular Momentum - I](#)

[Lecture 56 - Angular Momentum - II](#)

[Lecture 57 - Rotations Groups - I](#)

[Lecture 58 - Rotations Groups - II](#)

[Lecture 59 - Tutorial 10 - Part I](#)

[Lecture 60 - Tutorial 10 - Part II](#)

[Lecture 61 - Addition of Angular Momentum - I](#)

[Lecture 62 - Addition of Angular Momentum - II](#)

[Lecture 63 - Clebsch-Gordan Coefficients - I](#)

[Lecture 64 - Clebsch-Gordan Coefficients - II](#)

[Lecture 65 - Tutorial 11 - Part I](#)

[Lecture 66 - Tutorial 11 - Part II](#)

[Lecture 67 - Clebsch-Gordan Coefficients - III](#)

[Lecture 68 - Tensor Operators and Wigner-Eckart Theorem - I](#)

[Lecture 69 - Tensor Operators and Wigner-Eckart Theorem - II](#)

[Lecture 70 - Tensor Operators and Wigner-Eckart Theorem - III](#)

[Lecture 71 - Tutorial 12](#)

- Lecture 1 - Quantum Theory Fundamental Quantisation - I
- Lecture 2 - Quantum Theory Fundamental Quantisation - II
- Lecture 3 - Path Integral Formulation - I
- Lecture 4 - Path Integral Formulation - II
- Lecture 5 - Path Integral Formulation - III
- Lecture 6 - Path Integral Formulation - IV
- Lecture 7 - Correlation Functions - I
- Lecture 8 - Correlation Functions - II
- Lecture 9 - Generating Functional, Forced Harmonic Oscillator - I
- Lecture 10 - Generating Functional, Forced Harmonic Oscillator - II
- Lecture 11 - Generating Function in Field Theory - I
- Lecture 12 - Generating Function in Field Theory - II
- Lecture 13 - Effective Potential - I
- Lecture 14 - Effective Potential - II
- Lecture 15 - Effective Potential - III
- Lecture 16 - Effective Potential - IV
- Lecture 17 - Asymptotic Theory - I
- Lecture 18 - Asymptotic Theory - II
- Lecture 19 - Asymptotic Condition Kallen-Lehmann representation - I
- Lecture 20 - Asymptotic Condition Kallen-Lehmann representation - II
- Lecture 21 - Gauge Invariance - Minimal Coupling
- Lecture 22 - Gauge Invariance - Geometric Picture
- Lecture 23 - Gauge Invariance - Abelian Case
- Lecture 24 - Gauge Invariance - Non-abelian case
- Lecture 25 - Yang Mills Theory - Coupling to Matter
- Lecture 26 - Yang Mills Theory - Physical Content
- Lecture 27 - Yang Mills Theory Constraint Dynamics - I
- Lecture 28 - Yang Mills Theory Constraint Dynamics - II
- Lecture 29 - Gauge Fixing and Faddeev Popov Ghosts - I
- Lecture 30 - Gauge Fixing and Faddeev Popov Ghosts - II
- Lecture 31 - Topological Vacuum of Yang Mills Theories - I

Lecture 32 - Topological Vacuum of Yang Mills Theories - II

- Lecture 1 - Introduction
- Lecture 2 - DNA packing and structure
- Lecture 3 - Shape and function
- Lecture 4 - Numbers and sizes
- Lecture 5 - Spatial scales and System variation
- Lecture 6 - Timescales in Biology
- Lecture 7 - Random walks and Passive diffusion
- Lecture 8 - Random walks to model Biology
- Lecture 9 - Derivation of FRAP equations
- Lecture 10 - Drift-diffusion equations
- Lecture 11 - Solutions of the drift-diffusion equations
- Lecture 12 - The cell signaling problem
- Lecture 13 - Cell Signalling and Capture Probability of absorbing sphere
- Lecture 14 - Capture probability of reflecting sphere
- Lecture 15 - Mean capture time
- Lecture 16 - Introduction to fluids, viscosity and reynolds number
- Lecture 17 - Introduction to the navier stokes equation
- Lecture 18 - Understanding reynolds number
- Lecture 19 - Life at low reynolds number
- Lecture 20 - Various phenomena at low reynolds number
- Lecture 21 - Bacterial flagellar motion
- Lecture 22 - Rotating flagellum
- Lecture 23 - Energy and equilibrium
- Lecture 24 - Binding problems
- Lecture 25 - Transcription and translation
- Lecture 26 - Internal states of macromolecules
- Lecture 27 - Protein modification problem
- Lecture 28 - Haemoglobin-Oxygen binding problem
- Lecture 29 - Freely jointed polymer model
- Lecture 30 - Entropic springs and persistence length
- Lecture 31 - Freely rotating chain model and radius of gyration

- Lecture 32 - The hierarchical chromatin packing model
- Lecture 33 - FISH and DNA looping
- Lecture 34 - Nucleosomes as barriers, Hi-C, and contact probabilities
- Lecture 35 - Deriving the full force extension curve
- Lecture 36 - Random walk models for proteins
- Lecture 37 - Hydrophobic polar protein model
- Lecture 38 - Diffusion in crowded environments
- Lecture 39 - Depletion interactions
- Lecture 40 - Examples and implications of depletion interactions
- Lecture 41 - Introduction to Biological dynamics
- Lecture 42 - Introduction to rate equations
- Lecture 43 - Separation of timescales in enzyme kinetics
- Lecture 44 - Structure and treadmilling of actins and microtubules
- Lecture 45 - Average length of polymers in equilibrium
- Lecture 46 - Growth rate of polymers
- Lecture 47 - Dynamic treadmilling in microtubules
- Lecture 48 - Introduction to molecular motors
- Lecture 49 - Force generation by molecular motors
- Lecture 50 - Models of motor motion
- Lecture 51 - molecular motors
- Lecture 52 - Free energies of motor for stepping
- Lecture 53 - Two state models
- Lecture 54 - cooperative transport of cargo
- Lecture 55 - Cytoskeleton as a motor
- Lecture 56 - translocation ratchet
- Lecture 57 - Spatial pattern in biology
- Lecture 58 - Some common spatial patterns in biology
- Lecture 59 - reaction diffusion and spatial pattern
- Lecture 60 - Pattern formation in reaction diffusion system with stability
- Lecture 61 - Condition for destabilization in pattern formation
- Lecture 62 - Schnakenberg kinetics

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Normal subgroup, Coset, Conjugate group

Lecture 4 - Factor group, Homomorphism, Isomorphism

Lecture 5 - Factor group, Homomorphism, Isomorphism

Lecture 6 - Conjugacy Classes

Lecture 7 - Permutation Groups

Lecture 8 - Cycle Structure

Lecture 9 - Cycle Structure (Continued...)

Lecture 10 - Young Diagram and Molecular Symmetry

Lecture 11 - Point Groups

Lecture 12 - Symmetries of Molecules, Schoenflies Notation

Lecture 13 - Symmetries of Molecules, Stereographic Projection

Lecture 14 - Examples of Molecular Symmetries and Proof of Cayley Theorem

Lecture 15 - Matrix Representation of Groups - I

Lecture 16 - Matrix Representation of Groups - II

Lecture 17 - Reducible and Irreducible Representation - I

Lecture 18 - Reducible and Irreducible Representation - II

Lecture 19 - Great Orthogonality Theorem and Character Table - I

Lecture 20 - Great Orthogonality Theorem and Character Table - II

Lecture 21 - Mulliken Notation, Character Table and Basis

Lecture 22 - Tensor Product of Representation

Lecture 23 - Tensor Product and Projection Operator - I

Lecture 24 - Tensor Product and Projection Operator - II

Lecture 25 - Tensor Product and Projection Operator with an example

Lecture 26 - Binary Basis and Observables

Lecture 27 - Selection Rules

Lecture 28 - Selection Rules and Molecular Vibrations

Lecture 29 - Molecular vibration normal modes: Classical Mechanics approach

Lecture 30 - Molecular vibration normal modes: Group Theory approach

Lecture 31 - Molecular vibration modes using projection operator

Lecture 32 - Vibrational representation of character

Lecture 33 - Infrared Spectra and Raman Spectra

Lecture 34 - Introduction to continuous group

Lecture 35 - Generators of translational and rotational transformation

Lecture 36 - Generators of Lorentz transformation

Lecture 37 - Introduction to $O(3)$ and $SO(3)$ group

Lecture 38 - $SO(n)$ and Lorentz group

Lecture 39 - Generalised orthogonal group and Lie algebra

Lecture 40 - Subalgebra of Lie algebra

Lecture 41 - $gl(2,C)$ and $sl(2,C)$ group

Lecture 42 - $U(n)$ and $SU(n)$ group

Lecture 43 - Symplectic group

Lecture 44 - $SU(2)$ and $SU(3)$ groups

Lecture 45 - Rank, weight and weight vector

Lecture 46 - Weight vector, root vector, comparison between $SU(2)$ and $SU(3)$ algebra

Lecture 47 - Root diagram, simple roots, adjoint representation

Lecture 48 - $SU(2)$ sub-algebra, Dynkin diagrams

Lecture 49 - Fundamental weights, Young diagrams, dimension of irreducible representation

Lecture 50 - Young diagrams and tensor products

Lecture 51 - Tensor product, Wigner - Eckart theorem

Lecture 52 - Tensor product of irreducible representation 1: Composite objects from fundamental particles

Lecture 53 - Tensor product of irreducible representation 2: Decimet and octet diagrams in the Quark Model

Lecture 54 - Clebsch - Gordan coefficients

Lecture 55 - 1) Quadrupole moment tensor (Wigner-Eckart theorem) 2) Decimet Baryon wavefunction

Lecture 56 - Higher dimensional multiplets in the quark model

Lecture 57 - Symmetry breaking in continuous groups

Lecture 58 - Dynamical symmetry in hydrogen atom: $SO(4)$ algebra

Lecture 59 - Hydrogen atom energy spectrum and degeneracy using Runge-Lenz vector

Lecture 1 - Neutrons as Probe of Condensed Matter

Lecture 2 - Sources for thermal neutrons used in neutron scattering

Lecture 3

Lecture 4 - Calculating Neutron Scattering cross-section

Lecture 5

Lecture 6 - Scattering theory and introducing dynamics in the formalism

Lecture 7 - Scattering theory and introducing dynamics in the formalism

Lecture 8 - Scattering theory and introducing dynamics in the formalism

Lecture 9 - Scattering law's correlation with double-Fourier transform of real space correlation function

Lecture 10 - Scattering law's correlation with double-Fourier transform of real space correlation function

Lecture 11 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 12 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 13 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 14 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 15 - Introducing resolution and components of neutron scattering facilities.

Lecture 16 - Introducing resolution and components of neutron scattering facilities.

Lecture 17 - Continue with neutron scattering set up and its components like collimators, filters, detectors etc

Lecture 18 - Continue with neutron scattering set up and its components like collimators, filters, detectors etc

Lecture 19 - Describe the operation of various kinds of neutron detectors

Lecture 20 - Describe the operation of various kinds of neutron detectors

Lecture 21 - Introducing neutron choppers, velocity selectors and polarizers, some important components of beam tailoring devices

Lecture 22 - Introducing neutron choppers, velocity selectors and polarizers, some important components of beam tailoring devices

Lecture 23 - Neutron polarizers and spin-flippers

Lecture 24 - Neutron polarizers and spin-flippers

Lecture 25 - Diffraction at various length scales at a reactor and at a spallation neutron source

Lecture 26 - Diffraction at various length scales at a reactor and at a spallation neutron source

Lecture 27 - Application of neutron crystallography

Lecture 28 - Application of neutron crystallography

Lecture 29 - Magnetism in solids

Lecture 30 - Magnetism in solids

Lecture 31 - Magnetic interaction in solids and magnetic neutron diffraction

[Lecture 32 - Magnetic interaction in solids and magnetic neutron diffraction](#)

[Lecture 33 - Magnetic interaction in solids and magnetic neutron diffraction](#)

[Lecture 34 - Magnetic neutron diffraction](#)

[Lecture 35 - Magnetic neutron diffraction](#)

[Lecture 36 - Neutron diffraction from liquid and amorphous systems](#)

[Lecture 37 - Neutron diffraction from liquid and amorphous systems](#)

[Lecture 38 - Small Angle Neutron Scattering \(SANS\) for mesoscopic structure](#)

[Lecture 39 - Small Angle Neutron Scattering \(SANS\) for mesoscopic structure](#)

[Lecture 40 - Small Angle Neutron Scattering \(SANS\) for mesoscopic structure](#)

[Lecture 41 - Small Angle Neutron Scattering \(SANS\) for mesoscopic structure](#)

[Lecture 42 - SANS for soft condensed matter](#)

[Lecture 43 - SANS for soft condensed matter](#)

[Lecture 44 - SANS for polymers, biological systems, nanoparticle aggregates, rocks, Superconducting vortex lattice](#)

[Lecture 45 - SANS for polymers, biological systems, nanoparticle aggregates, rocks, Superconducting vortex lattice](#)

[Lecture 46 - Neutron reflectometry for thin films](#)

[Lecture 47 - Neutron reflectometry for thin films](#)

[Lecture 48 - Neutron reflectometry for thin films](#)

[Lecture 49 - Details formalism to evaluate specular neutron reflectivity and comparison with x-ray reflectometry](#)

[Lecture 50 - Details formalism to evaluate specular neutron reflectivity and comparison with x-ray reflectometry](#)

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Lecture 31 - Superconductivity

[Lecture 32 - Superconductivity \(Continued...\)](#)

[Lecture 33 - Superconductivity \(Continued...\)](#)

[Lecture 34 - Nuclear g-factor](#)

[Lecture 35 - Nuclear g-factor \(Continued...\)](#)

[Lecture 36 - P-N Junction](#)

[Lecture 37 - P-N Junction \(Continued...\)](#)

[Lecture 38 - P-N Junction \(Continued...\)](#)

[Lecture 39 - Zeeman Effect](#)

[Lecture 40 - Zeeman Effect \(Continued...\)](#)

[Lecture 41 - Zeeman Effect \(Continued...\)](#)

[Lecture 42 - Sodium Yellow Doublet](#)

[Lecture 43 - Sodium Yellow Doublet \(Continued...\)](#)

[Lecture 44 - Study of Absorption Spectrum of Iodine Vapour](#)

[Lecture 45 - Study of Absorption Spectrum of Iodine Vapour \(Continued...\)](#)

[Lecture 46 - Study of Absorption Spectrum of Iodine Vapour \(Continued...\)](#)

[Lecture 47 - Determination of Wavelength of Spectral Lines using Constant Deviation Spectrometer](#)

[Lecture 48 - Determination of Wavelength of Spectral Lines using Constant Deviation Spectrometer \(Continued...\)](#)

[Lecture 49 - Photoelastic Property of Materials](#)

[Lecture 50 - Photoelastic Property of Materials \(Continued...\)](#)

[Lecture 51 - Photoelastic Property of Materials \(Continued...\)](#)

[Lecture 52 - Faraday Effect](#)

[Lecture 53 - Faraday Effect \(Continued...\)](#)

[Lecture 54 - Electron Diffraction](#)

[Lecture 55 - Electron Diffraction \(Continued...\)](#)

[Lecture 56 - Determination of Velocity of Light in Free Space](#)

[Lecture 57 - Determination of Velocity of Light in Free Space \(Continued...\)](#)

[Lecture 58 - X-Ray Diffraction and Crystal Structure](#)

[Lecture 59 - X-Ray Diffraction and Crystal Structure \(Continued...\)](#)

[Lecture 60 - X-Ray Diffraction and Crystal Structure \(Continued...\)](#)

[Lecture 61 - X-Ray Diffraction and Crystal Structure \(Continued...\)](#)

[Lecture 62](#)

Lecture 1 - Free electrons: Drude Theory

Lecture 2 - Weidemann Franz Law

Lecture 3 - Drude Model continued: Hall Effect

Lecture 4 - Schrodinger Equation: Boundary Conditions

Lecture 5 - Density of States

Lecture 6 - Properties of Degenerate Fermi Gas

Lecture 7 - Statistics Fermi-Dirac distribution and Maxwell-Boltzmann Distribution: comparison and Specific Heat

Lecture 8 - Sommerfeld Expansion and Band Formation: Temperature dependent densities, Chemical Potential, Specific Heat

Lecture 9 - Bonding and Band Formation: N=2 solid Molecular Orbitals, Linear combinations of Atomic Orbitals (LCAO)

Lecture 10 - Variational Method: Molecular Orbitals, Bonding and anti-bonding Orbitals

Lecture 11 - Bonding and Band Formation (LCAO)

Lecture 12 - Bonding and Band Formation (LCAO) (Continued...)

Lecture 13 - Bloch's Theorem

Lecture 14 - Proof of Bloch's Theorem

Lecture 15 - N atoms Solid

Lecture 16 - Brillouin Zones

Lecture 17 - Tight binding: lattice with a basis

Lecture 18 - Fermi Surfaces

Lecture 19 - Lattice with basis:Energy Spectrum

Lecture 20 - Energy spectrum (Continued...)

Lecture 21 - Graphene and Fermi Surfaces

Lecture 22 - Fermi Surfaces Instabilities

Lecture 23 - Low Dimensional Systems

Lecture 24 - Integer Quantum Hall Effect (IQHE)

Lecture 25 - Integer Quantum Hall Effect (Continued...)

Lecture 26 - Electron in a Strong Magnetic Field and IQHE

Lecture 27 - Spintronics: Introduction and Applications

Lecture 28 - Magnetism

Lecture 29 - Magnetism: Quantum Theory

Lecture 30 - Hund's Rule

Lecture 31 - Curie's Law and Van Vleck Paramagnetism

- Lecture 32 - Curie's law for any J, Susceptibility
- Lecture 33 - Susceptibility and Thermal Properties
- Lecture 34 - Adiabatic Demagnetisation
- Lecture 35 - Pauli Paramagnetism
- Lecture 36 - Paramagnetism of metals
- Lecture 37 - Exchange interaction for 2 electrons
- Lecture 38 - Exchange interactions of different types
- Lecture 39 - Magnetic Order
- Lecture 40 - Magnetic Order of different types and Heisenberg model
- Lecture 41 - Ising Model
- Lecture 42 - Mean Field Theory
- Lecture 43 - Spontaneous magnetisation and 1D Ising Model
- Lecture 44 - Symmetries of Ising model, Exact Solution
- Lecture 45 - Ferromagnetic Heisenberg Model
- Lecture 46 - Ground State and Magnons/Excitations
- Lecture 47 - Superconductivity
- Lecture 48 - London Equation
- Lecture 49 - Meisner Effect from London Equation
- Lecture 50 - Cooper problem
- Lecture 51 - Instability of the Fermi Surface
- Lecture 52 - BCS Theory Introduction
- Lecture 53 - BCS Theory, Excitation Spectrum
- Lecture 54 - BCS
- Lecture 55 - Tunneling and Ginzberg Landau Theory
- Lecture 56 - Electrodynamics of Superconductivity
- Lecture 57 - Type II superconductors
- Lecture 58 - Josephson junction
- Lecture 59 - Vortices, SQUID, Quantum Supremacy and Qubits
- Lecture 60 - Topological state of matter, XY Model, Topological Insulators

- Lecture 1 - Wave Equation, Maxwell's equation, Plane wave
- Lecture 2 - EM wave in vacuum, Poynting vector, Maxwell's equation in Dielectric Medium
- Lecture 3 - Poynting Vector, Maxwell's equation in dielectric medium (Continued...)
- Lecture 4 - Total Internal reflection, Evanescent wave
- Lecture 5 - Step-index fiber (SIF), Light guidance in SIF
- Lecture 6 - Light guidance in SIF (Skew Ray), V-Parameter, Discrete Ray
- Lecture 7 - Cutoff wavelength, Fiber characteristics
- Lecture 8 - Fiber Loss, dB units, Dispersion
- Lecture 9 - Dispersion, Ray Path constant
- Lecture 10 - Ray path constant, Ray equation
- Lecture 11 - Ray equation (Continued...)
- Lecture 12 - Ray transit time
- Lecture 13 - Ray transit time (Continued...)
- Lecture 14 - Material dispersion
- Lecture 15 - Material dispersion (Continued...)
- Lecture 16 - Material Dispersion (Continued...), Dispersion Coefficient
- Lecture 17 - Pulse Broadening
- Lecture 18 - Pulse Propagation in Dispersive Medium
- Lecture 19 - Pulse Propagation in Dispersive Medium (Continued...)
- Lecture 20 - Concept of Modes
- Lecture 21 - TE and TM Modes
- Lecture 22 - TE and TM Modes (Continued...)
- Lecture 23 - Modes in Slab waveguide
- Lecture 24 - Modes in Slab waveguide (Continued...)
- Lecture 25 - Modes in Slab waveguide (Continued...)
- Lecture 26 - Modes in Slab Waveguide (Continued...)
- Lecture 27 - Waveguide Dispersion
- Lecture 28 - Physical Understanding of Modes
- Lecture 29 - Power Associated with a Modes
- Lecture 30 - Modes in an Optical Fiber
- Lecture 31 - Modes in an optical fiber (Continued...)

- [Lecture 32 - Modes in an optical fiber \(Continued...\)](#)
- [Lecture 33 - LPlm mode structure](#)
- [Lecture 34 - Optical fiber mode morphology \(Continued...\)](#)
- [Lecture 35 - Effective area of mode, Fiber optics components](#)
- [Lecture 36 - Directional Coupler](#)
- [Lecture 37 - Coupled Mode Theory](#)
- [Lecture 38 - Coupled Mode Theory \(Continued...\)](#)
- [Lecture 39 - 3 dB power splitter](#)
- [Lecture 40 - Working principle of WDM coupler](#)
- [Lecture 41 - Fiber Bragg Grating](#)
- [Lecture 42 - Fiber Bragg Grating \(Continued...\)](#)
- [Lecture 43 - Reflectivity Calculation](#)
- [Lecture 44 - Reflectivity Calculation \(Continued...\)](#)
- [Lecture 45 - Reflectivity calculation of FBG \(Continued...\)](#)
- [Lecture 46 - Reflectivity calculation of FBG \(Continued...\)](#)
- [Lecture 47 - Reflectivity calculation of FBG \(Continued...\)](#)
- [Lecture 48 - Bandwidth of reflectivity](#)
- [Lecture 49 - Basic nonlinear optics](#)
- [Lecture 50 - Frequency mixing, Optical Kerr effect](#)
- [Lecture 51 - Optical Kerr effect \(Continued...\)](#)
- [Lecture 52 - Self Phase Modulation](#)
- [Lecture 53 - Self Phase Modulation \(Continued...\)](#)
- [Lecture 54 - Self Phase Modulation \(Continued...\)](#)
- [Lecture 55 - Pulse propagation in nonlinear waveguide](#)
- [Lecture 56 - Pulse propagation in nonlinear waveguide \(Continued...\)](#)
- [Lecture 57 - Pulse propagation in nonlinear dispersive waveguide](#)
- [Lecture 58 - Pulse propagation in nonlinear dispersive waveguide \(Continued...\)](#)
- [Lecture 59 - Concept of optical soliton](#)
- [Lecture 60 - Concept of optical soliton \(Continued...\)](#)

Lecture 1 - Introduction and relevance of the course

Lecture 2 - Energy sources

Lecture 3 - Solar Radiation

Lecture 4 - Solar Photovoltaic Systems

Lecture 5 - Origin of Band Structure and Energy Band Gap

Lecture 6 - Basics of Semiconductors

Lecture 7 - Construction of Solar Cells

Lecture 8 - Characterization of Solar Cells and Future Direction

Lecture 9 - Solar Heaters

Lecture 10 - Introduction to Wind Energy

Lecture 11 - Continuity Equation and its applications

Lecture 12 - Betz Criteria for extracting wind power

Lecture 13 - Wind turbines and their operation

Lecture 14 - Materials Aspects and future direction

Lecture 15 - Introduction to Hydroelectric Power

Lecture 16 - Hydroelectric Power Station and Turbines

Lecture 17 - Wave power and converters

Lecture 18 - Introduction to Tidal Power

Lecture 19 - Tidal Power and Geothermal Energy

Lecture 20 - Introduction to Energy Storage Systems

Lecture 21 - Thermal Energy Storage

Lecture 22 - Basics of Mechanical Energy Storage

Lecture 23 - Pumped Hydroelectric to Flywheels (Mechanical Energy Storage Systems)

Lecture 24 - Introduction to Li-ion battery

Lecture 25 - Characteristics and Parameters of Li-ion batteries

Lecture 26 - Cathode Materials for Li-ion batteries

Lecture 27 - Anode Materials for Li-ion batteries

Lecture 28 - Electrolytes and Separators for Li-batteries

Lecture 29 - From battery to supercapacitors

Lecture 30 - Construction, development and classification of Supercapacitors

Lecture 31 - Electric double layer capacitors (EDLCs)

[Lecture 32 - Pseudocapacitors](#)

[Lecture 33 - Electrochemical Techniques for Supercapacitors and Batteries](#)

[Lecture 34 - From material to a supercapacitor device](#)

[Lecture 35 - Effect of temperature on supercapacitor performance](#)

[Lecture 36 - Effect of external magnetic field and frequency on supercapacitors](#)

[Lecture 37 - Introduction to Fuel Cells](#)

[Lecture 38 - Explanation of Fuel cell systems](#)

[Lecture 39 - Microbial Fuel Cells](#)

[Lecture 40 - Nanotechnology and Nanomaterials for Energy Applications](#)

[Lecture 41 - Synthesis of nanomaterials](#)

[Lecture 42 - Carbon- and metal-oxide based nanomaterials](#)

[Lecture 43 - Nanocatalysts](#)

[Lecture 44 - Characterization techniques for solid materials](#)

[Lecture 45 - X-ray diffraction method](#)

[Lecture 46 - UV-Visible Spectroscopy](#)

[Lecture 47 - Fourier Transform Infrared Spectroscopy](#)

[Lecture 48 - SEM, TEM and XPS](#)

[Lecture 49 - Particle size and zeta potential analysis](#)

[Lecture 50 - BET analysis](#)

[Lecture 51 - Electrochemical Impedance Spectroscopy](#)

- Lecture 1 - Foundation of kinetic theory of gasses
- Lecture 2 - Maxwell's law for speed distribution of gas molecules
- Lecture 3 - Average speeds in an ideal gas assembly
- Lecture 4 - Principle of equipartition of energy
- Lecture 5 - Maxwell's law for energy distribution of gas molecules
- Lecture 6 - The mean free path of a gas assembly
- Lecture 7 - Expression for mean free path
- Lecture 8 - Experimental determination of mean free path
- Lecture 9 - Pressure and molecular flux from mean free path
- Lecture 10 - Problems on mean free path
- Lecture 11 - Transport in fluids: introduction
- Lecture 12 - Viscosity: transport of momentum
- Lecture 13 - Thermal conductivity: transport of thermal energy
- Lecture 14 - Diffusion coefficient: transport of mass
- Lecture 15 - Molecular effusion: theory and applications
- Lecture 16 - Brownian motion: concept, features, theory of fluctuation
- Lecture 17 - Brownian motion: mean square displacement and vertical distribution of particles
- Lecture 18 - Perrin's experiment on Brownian motion - Part 1
- Lecture 19 - Perrin's experiment on Brownian motion - Part 2
- Lecture 20 - Problems on Brownian motion, Rotational brownian motion
- Lecture 21 - Specific heat of solids: Dulong-Petit law and Einstein theory
- Lecture 22 - Limitation of Einstein theory of specific heat
- Lecture 23 - Debye theory of specific heat
- Lecture 24 - Behavior of real gasses
- Lecture 25 - Van der Waals equation of state
- Lecture 26 - Critical parameters from Van der Waal's equation
- Lecture 27 - Determination of Van der Waals' constants and Boyle temperature
- Lecture 28 - Other equations of state
- Lecture 29 - Measurement of temperature: Celsius scale, ideal gas scale, absolute zero
- Lecture 30 - The platinum resistance thermometer
- Lecture 31 - Basic concepts of classical thermodynamics

Lecture 32 - Basic concepts of classical thermodynamics (Continued...)

Lecture 33 - First law of thermodynamics

Lecture 34 - General description of work done and specific heat

Lecture 35 - General discussion on Heat conduction and elastic properties

Lecture 36 - Cyclic processes

Lecture 37 - The reversible heat engine: Carnot cycle

Lecture 38 - Refrigerator and Carnot Theorem

Lecture 39 - 2nd law and Clausius theorem

Lecture 40 - Concept of Entropy and mathematical form of 2nd law

Lecture 41 - The entropy principle

Lecture 42 - Efficiency of a cycle from T-S diagram

Lecture 43 - The Otto cycle

Lecture 44 - The Diesel cycle

Lecture 45 - Entropy and available energy

Lecture 46 - Thermodynamic relations

Lecture 47 - Application of thermodynamic relation

Lecture 48 - The free energy functions

Lecture 49 - Condition for thermodynamic equilibri

Lecture 50 - Thermodynamics of chemical reaction

Lecture 51 - Equilibrium between phases: The Clapeyron equation

Lecture 52 - 1st order phase transition along liquid-vapor equilibrium

Lecture 53 - Phase diagram and triple point

Lecture 54 - The 2nd latent heat equation

Lecture 55 - Gibbs phase rule and basics of second order phase transition

Lecture 56 - Basic concepts of radiation

Lecture 57 - Diffused radiation and Kirchhoff's law

Lecture 58 - Cavity radiation as a thermodynamic system: Stefan-Boltzmann law

Lecture 59 - Thermodynamics of cavity radiation

Lecture 60 - 3rd law of thermodynamics

- Lecture 1 - Introduction: Magnetism and superconductivity as macroscopic quantum phenomena
- Lecture 2 - Bohr magneton, BvL theorem
- Lecture 3 - An electron in a magnetic field, magnetism of isolated atoms
- Lecture 4 - Magnetism of isolated atoms (Continued...), Diamagnetism
- Lecture 5 - Magnetism of atoms-dia and paramagnetic susceptibilities. Hund's rules, Van Vleck paramagnetism
- Lecture 6 - Van Vleck paramagnetism (Continued...), Paramagnetism
- Lecture 7 - Curie's law for arbitrary J, adiabatic demagnetization
- Lecture 8 - Paramagnetism of conduction electrons - Pauli paramagnetism
- Lecture 9 - Ions in a solid: crystal field, orbital quenching, Jahn-Teller effect
- Lecture 10 - Jahn-Teller effect (Continued...), Magnetic resonance techniques NMR, ESR
- Lecture 11 - Resonance techniques (Continued...), Recapitulation and overview
- Lecture 12 - Recapitulation, interacting moments and long range order, dipolar exchange
- Lecture 13 - Interacting moments, 2-electron system, origin of exchange and spin Hamiltonian
- Lecture 14 - Spin Hamiltonian, Heisenberg model, Exchange interactions: direct
- Lecture 15 - GMR, spin model and mean-field theory, Ising model
- Lecture 16 - Ising model and its properties
- Lecture 17 - Ising model and its properties (Continued...), absence of LRO in $d=1$, mean-field theory
- Lecture 18 - Ising model recap, applications, exact solutions
- Lecture 19 - Exact solution of Ising model in $d=1$, exact results in $d=2$. Mermin-Wagner theorem
- Lecture 20 - Recap - Exact solution of Ising model. Mermin-Wagner theorem on the absence
- Lecture 21 - Ferromagnetic Heisenberg model ground state
- Lecture 22 - Ferromagnetic Heisenberg model, spin-waves and magnons
- Lecture 23 - Antiferromagnetic Heisenberg model, AF magnetic structures
- Lecture 24 - AF magnetic structures, susceptibility and excitations
- Lecture 25 - Antiferromagnets and frustration, spin glass
- Lecture 26 - Superconductivity: discovery, properties
- Lecture 27 - Superconductivity: Meissner effect, London Equation
- Lecture 28 - Electron-phonon interaction, Cooper problem
- Lecture 29 - Cooper problem, setting up the BCS theory
- Lecture 30 - BCS wave function, the Superconducting state and calculations of various properties
- Lecture 31 - BCS theory (Continued...), energy gap, transition temperature

[Lecture 32 - Consequences of BCS theory, gap vs T, Transition temperature, specific heat, tunnelling](#)

[Lecture 33 - Transition temperature, specific heat, tunnelling](#)

[Lecture 34 - Andreev reflection, Ginzburg-Landau Theory and electrodynamics of superconductors](#)

[Lecture 35 - Ginzburg-Landau theory, coherence length and Type I and II superconductors](#)

[Lecture 36 - Flux lattice, Flux quantization, Josephson junctions](#)

[Lecture 37 - Josephson effect and Josephson junctions](#)

[Lecture 38 - SQUID, Quantum computers and Josephson junction Qubits](#)

[Lecture 39 - High-Temperature Superconductivity: an enduring enigma](#)

[Lecture 40 - Overview and conclusion](#)

- Lecture 1 - Vector analysis, Scalar and vector fields, vector identities
- Lecture 2 - Vector Analysis (Continued...)
- Lecture 3 - Use of Levi-Civita Symbol, Coordinate system
- Lecture 4 - Coordinate system, Orthogonal Transformation
- Lecture 5 - Spherical Coordinate system, Line, surface and volume element
- Lecture 6 - Line, surface and volume element (Continued...)
- Lecture 7 - Line, surface and volume integral
- Lecture 8 - Differential calculus, Gradient
- Lecture 9 - Gradient operator, Concept of divergence
- Lecture 10 - Divergence operator, Divergence Theorem
- Lecture 11 - Curl operator, Stokes Theorem
- Lecture 12 - Gradient, Divergence and Curl (A recap), Vector identities
- Lecture 13 - Curvilinear coordinate system
- Lecture 14 - Curvilinear coordinate system (Continued...)
- Lecture 15 - Curvilinear coordinate system (Continued...)
- Lecture 16 - Delta Function
- Lecture 17 - Delta Function (Continued...)
- Lecture 18 - Helmholtz's Theorem
- Lecture 19 - Helmholtz's Theorem(Recap), Tutorial
- Lecture 20 - Tutorial (Continued...)
- Lecture 21 - Concept of charge, Charge density
- Lecture 22 - Coulomb's Law
- Lecture 23 - Coulomb's Law (Continued...), Charge distribution
- Lecture 24 - Charge distribution problem, Gauss's Law
- Lecture 25 - Topics More on Gauss's Law
- Lecture 26 - Application of Gauss's Law
- Lecture 27 - Electrostatic potential
- Lecture 28 - Electrostatic potential (Continued...)
- Lecture 29 - Electrostatic energy
- Lecture 30 - Electrostatic energy (Continued...)
- Lecture 31 - Electrostatic energy calculation

- Lecture 32 - Electrostatic dipole
- Lecture 33 - Electric dipole (Continued...)
- Lecture 34 - Multipole expansion
- Lecture 35 - Monopole and Dipole moment
- Lecture 36 - Quadrupole moment
- Lecture 37 - Dipole and Quadrupole moment (Continued...)
- Lecture 38 - Conductor
- Lecture 39 - Conductor (Continued...)
- Lecture 40 - Boundary condition
- Lecture 41 - Electrostatic pressure, Capacitor
- Lecture 42 - Energy of the Capacitor, Dielectric
- Lecture 43 - Dielectric (Continued...)
- Lecture 44 - Displacement Vector
- Lecture 45 - Electrostatic boundary value problem
- Lecture 46 - Electrostatic boundary value problem (Continued...)
- Lecture 47 - Electrostatic boundary value problem (Continued...), Image method
- Lecture 48 - Image method (Continued...)
- Lecture 49 - Charge particle in magnetic field
- Lecture 50 - Biot-Savart Law
- Lecture 51 - Application of Biot-Savart Law
- Lecture 52 - Ampere's Law
- Lecture 53 - Application of Ampere's Law
- Lecture 54 - Magnetic vector potential
- Lecture 55 - Magnetic vector potential (Continued...)
- Lecture 56 - Magnetic dipole moment
- Lecture 57 - Magnetic dipole moment (Continued...)
- Lecture 58 - Torque and potential energy of magnetic dipole, Magnetization
- Lecture 59 - Bound Current
- Lecture 60 - Magnetic materials
- Lecture 61 - Electromagnetic Induction
- Lecture 62 - Self and mutual inductance
- Lecture 63 - Wave equation, Maxwell's Equations
- Lecture 64 - Maxwell's Equation (Continued...)

[Lecture 65 - Maxwells Equation: a complete overview](#)

[Lecture 66 - Maxwells Equation: a complete overview \(Continued...\)](#)

[Lecture 67 - Lorentz Gauge, Maxwell's wave equation](#)

[Lecture 68 - Maxwell's wave equation \(Coninued...\)](#)

[Lecture 69 - Maxwell's Equation in matter](#)

[Lecture 70 - Maxwell's Equation in matter \(Continued...\)](#)

[Lecture 71 - Tutorial 2 \(Electrostatic\)](#)

[Lecture 72 - Tutorial 3 \(Magnetostatic\)](#)

[Lecture 73 - Tutorial 4 \(Magnetostatic and EM Wave\)](#)

Lecture 1 - Introduction to solid state materials - From conventional to functional

Lecture 2 - Ceramics and Composites - I

Lecture 3 - Ceramics and Composites - II

Lecture 4 - Polymers

Lecture 5 - Introduction to Nanomaterials and functionality

Lecture 6 - Synthesis protocols - I

Lecture 7 - Synthesis protocols - II

Lecture 8 - Synthesis protocols - III

Lecture 9 - Crystal structure - I

Lecture 10 - Crystal structure - II

Lecture 11 - Crystal structure - III

Lecture 12 - Crystal imperfections

Lecture 13 - Alloys and Melts

Lecture 14 - Theory of Solids

Lecture 15 - Nearly free electron model

Lecture 16 - Bonds in molecules and solids

Lecture 17 - Transformations kinetics and reaction rates

Lecture 18 - Thermodynamics

Lecture 19 - Phase and phase transitions

Lecture 20 - Diffusion and various properties

Lecture 21 - Mechanical properties of solids

Lecture 22 - Thermal Properties of Solids

Lecture 23 - Negative and Zero Expansion Ceramics

Lecture 24 - Heat Capacity

Lecture 25 - Thermogravimetric (TGA) analysis

Lecture 26 - Introduction to magnetism and Magnetic properties of solids

Lecture 27 - From magnetic to multiferroic materials

Lecture 28 - Magnetic materials and their applications

Lecture 29 - Magnetism at nanoscale

Lecture 30 - GMR materials

Lecture 31 - CMR materials

[Lecture 32 - Ferrofluids](#)

[Lecture 33 - Spintronics and devices](#)

[Lecture 34 - Introduction to the basic properties of liquids and melts](#)

[Lecture 35 - Heat capacity and diffusion of liquids and melts](#)

[Lecture 36 - Viscosity, electric and thermal conduction of liquids and melts](#)

[Lecture 37 - Sensors](#)

[Lecture 38 - Electrochemical Sensors](#)

[Lecture 39 - Introduction to energy storage devices and basics of supercapacitors](#)

[Lecture 40 - Supercapacitors - II](#)

[Lecture 41 - Magnetic supercapacitors](#)

[Lecture 42 - Battery - I](#)

[Lecture 43 - Battery - II](#)

[Lecture 44 - Solar Cells - I](#)

[Lecture 45 - Solar Cells - II](#)

[Lecture 46 - X-ray Diffraction \(XRD\)](#)

[Lecture 47 - Fourier Transform Infrared Spectroscopy](#)

[Lecture 48 - UV- Vis Spectroscopy](#)

[Lecture 49 - Scanning and Transmission Electron Microscopy](#)

[Lecture 50 - Summary](#)

Lecture 1 - Introduction to waves, 1D wave equation and its solutions

Lecture 2 - 1D Light waves

Lecture 3 - Characteristics of light waves - amplitude, absolute phase, wavelength and frequency

Lecture 4 - Phase, Phase velocity and Phase delay

Lecture 5 - Complex notation for the description light waves and superposition

Lecture 6 - Maxwell's equations to the 3D wave equation and its solutions

Lecture 7 - Recap of Week 1

Lecture 8 - 3D wave equation and plane waves

Lecture 9 - Complex notation for Electric fields, Superposition and interference

Lecture 10 - Fabry-Perot interferometer and its transmittance

Lecture 11 - Physical interpretation of FP transmittance

Lecture 12 - Recap of Fabry-Perot modes

Lecture 13 - Free spectral range of a Fabry-Perot etalon

Lecture 14 - Resonator modes and optical pulses - insight

Lecture 15 - Table - Top Coherent and Incoherent Imaging

Lecture 16 - Recap of Etalon free spectral range

Lecture 17 - Line width and finesse of an etalon

Lecture 18 - Actual resonator modes

Lecture 19 - Resonator configurations and stability

Lecture 20 - Recap of optical resonators

Lecture 21 - Introduction of light pulses

Lecture 22 - Complex amplitude, Gaussian pulse

Lecture 23 - Recap of light pulses

Lecture 24 - Introduction of Fourier Transforms

Lecture 25 - Tutorial 1

Lecture 26 - Motivating Fourier Transforms

Lecture 27 - Fourier Transform Properties

Lecture 28 - Frequency domain electric field

Lecture 29 - Recap of Fourier transform properties

Lecture 30 - Frequency domain description of pulses

Lecture 31 - Spectral Phase

Lecture 32 - Recap of spectral phase

Lecture 33 - Instantaneous Frequency and group delay

Lecture 34 - Phase wrapping, blanking, and Taylor series expansion

Lecture 35 - Recap of instantaneous frequency, phase wrapping, and phase blanking

Lecture 36 - Frequency domain phase expansion, group delay dispersion

Lecture 37 - Absolute Phase

Lecture 38 - Recap of concepts + discussion

Lecture 39 - Absolute Phase (revisited)

Lecture 40 - Carrier envelope phase, frequency comb

Lecture 41 - Discussion

Lecture 42 - Recap of concepts

Lecture 43 - First order phase

Lecture 44 - Second order phase

Lecture 45 - Recap of first order and second order phase

Lecture 46 - Chirped pulse: Instantaneous frequency and Fourier transform

Lecture 47 - Group delay, nonlinearly chirped pulse

Lecture 48 - Recap of chirped pulses

Lecture 49 - Quadratic chirp pulses

Lecture 50 - Higher order spectral phase

Lecture 51 - Recap and discussion on higher order phase

Lecture 52 - Relative importance of intensity and phase

Lecture 53 - Pulse propagation through a medium

Lecture 54 - Recap of pulse propagation and pulse length

Lecture 55 - Discussion of RMS pulse width and uncertainty principle

Lecture 56 - Time-bandwidth product

Lecture 57 - Recap of previous module

Lecture 58 - Introduction of Lorentz Oscillator Model

Lecture 59 - Effect of matter on light

Lecture 60 - Recap of Lorentz oscillator, Polarization tensor

Lecture 61 - Dynamics of electrons in the Lorentz oscillator

Lecture 62 - Solving the inhomogeneous wave equation

Lecture 63 - Inhomogeneous wave equation, absorption coefficient, refractive index

Lecture 64 - Nonlinear response of matter

[Lecture 65 - Origin of nonlinear optical effects](#)

[Lecture 66 - Wave equation in an inert gas](#)

[Lecture 67 - Perturbation theory and second harmonics](#)

[Lecture 68 - Numerical simulation strategy](#)

[Lecture 69 - Atoms in the presence of fields](#)

[Lecture 70 - Ionization models](#)

[Lecture 71 - Attosecond pulse generation and metrology](#)

[Lecture 72 - Nonlinear optics review](#)

[Lecture 73 - Nonlinear response of matter to light](#)

[Lecture 74 - Sum and difference frequency generation](#)

[Lecture 75 - Recap of sum and difference frequency generation, second harmonic generation](#)

[Lecture 76 - Generalized nonlinear effects, conservation laws in SHG](#)

[Lecture 77 - Phase matching in SHG, polarization dependent refractive index](#)

NPTEL : Special Topics in Atomic Physics (Physics)

Co-ordinators : Prof. P.C. Deshmukh

Lecture 1 - Introductory lecture about this course

Lecture 2 - Quantum Mechanics and Symmetry of the Hydrogen Atom

Lecture 3 - Hydrogen atom: Rotational and Dynamical Symmetry of the $1/r$ Potential

Lecture 4 - Hydrogen atom: Dynamical Symmetry of the $1/r$ Potential

Lecture 5 - Degeneracy of the Hydrogen Atom: $SO(4)$

Lecture 6 - Wavefunctions of the Hydrogen Atom

Lecture 7 - Angular Momentum in Quantum Mechanics

Lecture 8 - Angular Momentum in Quantum Mechanics: half-odd-integer and integer quantum numbers: $SU(2)$ & $SO(3)$

Lecture 9 - Angular Momentum in Quantum Mechanics: Addition Theorem for Spherical Harmonics - Coupling of Angular Momenta

Lecture 10 - Angular Momentum in Quantum Mechanics Dimensionality of the Direct-Product (Composite) Vector Space CGC recursion relations

Lecture 11 - Angular Momentum in Quantum Mechanics CGC matrix, Wigner D Rotation Matrix, Irreducible Tensor Operators

Lecture 12 - Angular Momentum in Quantum Mechanics - more on ITO, and the Wigner-Eckart Theorem

Lecture 13 - Angular Momentum in Quantum Mechanics Wigner-Eckart Theorem - 2

Lecture 14 - Relativistic Quantum Mechanics of the Hydrogen Atom - 1

Lecture 15 - Relativistic Quantum Mechanics of the Hydrogen Atom - 2

Lecture 16 - Relativistic Quantum Mechanics of the Hydrogen Atom - PAULI Equation - Foldy - Wouthysen Transformations - 1

Lecture 17 - Relativistic Quantum Mechanics of the Hydrogen Atom - Foldy - Wouthysen Transformations - 2

Lecture 18 - Relativistic Quantum Mechanics of the Hydrogen Atom - Foldy - Wouthysen Transformations - 3

Lecture 19 - Relativistic Quantum Mechanics of the Hydrogen Atom - Spherical Symmetry of the Coulomb Potential

Lecture 20 - Hartree-Fock Self-Consistent Field formalism - 1

Lecture 21 - Hartree-Fock Self-Consistent Field formalism - 2

Lecture 22 - Hartree-Fock Self-Consistent Field formalism - 3

Lecture 23 - Hartree-Fock Self-Consistent Field formalism - 4

Lecture 24 - Hartree-Fock Self-Consistent Field formalism - 5

Lecture 25 - Perturbative treatment of relativistic effectsâ€| Schrodinger's and Dirac QM

Lecture 26 - Perturbative treatment of relativistic effectsâ€| Schrodinger's and Dirac QM

Lecture 27 - Probing the atom - Collisions and Spectroscopy - boundary conditions - 1

Lecture 28 - Atomic Probes - Collisions and Spectroscopy - boundary conditions - 2

Lecture 29 - Atomic Probes - Collisions and Spectroscopy - Scattering phase shifts and boundary conditions

Lecture 30 - Atomic Probes - Time reversal symmetry - applications in atomic collisions and photoionization processes

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[Lecture 31 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 1](#)

[Lecture 32 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 2](#)

[Lecture 33 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 3](#)

[Lecture 34 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 4](#)

[Lecture 35 - Atomic Photoionization cross sections, angular distributions of photoelectrons Cooper Zare Formula](#)

[Lecture 36 - Stark- Zeeman Spectroscopy - Stark effect](#)

[Lecture 37 - Stark- Zeeman Spectroscopy - Stark effect on \$n=2\$ excited state of the H atom Zeeman effect](#)

[Lecture 38 - Stark- Zeeman Spectroscopy - Normal, Anomalous Zeeman effect; Paschen- Back effect](#)

[Lecture 39 - Stark- Zeeman Spectroscopy - Anomalous Zeeman effect](#)

[Lecture 40 - Zeeman effect Fine structure, Hyperfine structure - Elemental, rudimentary introduction to Laser Cooling, BEC, Atomic Clock / Attosecond metrology](#)

Lecture 1 - What is Classical Field Theory?

Lecture 2 - Symmetries and Invariances - I

Lecture 3 - Symmetries and Invariances - II

Lecture 4 - Group Theory in Physics - I

Lecture 5 - Group Theory in Physics - II

Lecture 6 - Finite Groups - I

Lecture 7 - Finite Groups - II

Lecture 8 - Basics of CFT - I

Lecture 9 - Basics of CFT - II

Lecture 10 - Basics of CFT - III

Lecture 11 - Green Functions - I

Lecture 12 - Green Functions - II

Lecture 13 - Noether's Theorem - I

Lecture 14 - Noether's Theorem - II

Lecture 15 - Kink Soliton

Lecture 16 - Hidden Symmetry

Lecture 17 - Local Symmetries

Lecture 18 - The Abelian Higgs model

Lecture 19 - Lie Algebras - I

Lecture 20 - Lie Algebras - II

Lecture 21 - Magnetic Vortices - I

Lecture 22 - Magnetic Vortices - II

Lecture 23 - Non-abelian gauge theories - I

Lecture 24 - Non-abelian gauge theories - II

Lecture 25 - Irreps of Lie algebras - I

Lecture 26 - Irreps of Lie algebras - II

Lecture 27 - The Standard Model - I

Lecture 28 - The Standard Model - II

Lecture 29 - Irreps of the Lorentz/Poincare algebras

Lecture 30 - The Dirac monopole

Lecture 31 - The 't Hooft-Polyakov monopole

[Lecture 32 - Revisiting Derrick's Theorem](#)

[Lecture 33 - The Julia-Zee dyon](#)

[Lecture 34 - Instantons - I](#)

[Lecture 35 - Instantons - II](#)

[Lecture 36 - Instantons - III](#)

[Lecture 37 - Instantons - IV](#)

[Lecture 38 - Dualities](#)

[Lecture 39 - Geometrization of Field Theory](#)

NPTEL : Topics in Nonlinear Dynamics (Physics)

Co-ordinators : Prof. V. Balakrishnan

Lecture 1 - Overview

Lecture 2 - Critical points of a dynamical system

Lecture 3 - Two-dimensional flows

Lecture 4 - Stable and unstable manifolds

Lecture 5 - Hamiltonian dynamics - Part I

Lecture 6 - Hamiltonian dynamics - Part II

Lecture 7 - Hamiltonian dynamics - Part III

Lecture 8 - Hamiltonian dynamics - Part IV

Lecture 9 - Hamiltonian dynamics - Part V

Lecture 10 - Elementary bifurcations

Lecture 11 - Limit cycles

Lecture 12 - Poincaré index

Lecture 13 - Illustrative examples

Lecture 14 - Quiz 1. Questions and answers

Lecture 15 - Bead on a rotating hoop

Lecture 16 - Types of dynamical behaviour

Lecture 17 - Discrete time dynamics - Part I

Lecture 18 - Discrete time dynamics - Part II

Lecture 19 - Discrete time dynamics - Part III

Lecture 20 - Discrete time dynamics - Part IV

Lecture 21 - Coarse-grained dynamics in phase space - Part I

Lecture 22 - Coarse-grained dynamics in phase space - Part II & Stochastic dynamics - Part I

Lecture 23 - Stochastic dynamics - Part II

Lecture 24 - Stochastic dynamics - Part III

Lecture 25 - Coarse-grained dynamics in phase space - Part IV & Stochastic dynamics - Part IV

Lecture 26 - Discrete time dynamics - Part V

Lecture 27 - Quiz 2. Questions and answers

Lecture 28 - Stochastic dynamics - Part V

Lecture 29 - Stochastic dynamics - Part VI

Lecture 1 - Principles of Condensed Matter Physics

Lecture 2 - Symmetry in Perfect Solids

Lecture 3 - Symmetry in Perfect Solids (Continued...)

Lecture 4 - Symmetry in Perfect Solids - Worked Examples

Lecture 5 - Diffraction Methods For Crystal Structures

Lecture 6 - Diffraction Methods For Crystal Structures (Continued...)

Lecture 7 - Diffraction Methods For Crystal Structures - Worked Examples

Lecture 8 - Physical Properties of Crystals

Lecture 9 - Physical Properties of Crystals (Continued...)

Lecture 10 - Physical Properties of Crystals - Worked Examples

Lecture 11 - Cohesion in Solids

Lecture 12 - Cohesion in Solids - Worked Examples

Lecture 13 - The Free Electron Theory of Metals

Lecture 14 - The Free Electron Theory of Metals - Worked Examples

Lecture 15 - The Free Electron Theory of Metals - Electrical Conductivity

Lecture 16 - The Free Electron Theory of Metals - Electrical Conductivity - Worked Examples

Lecture 17 - Thermal Conductivity of Metals

Lecture 18 - Thermal Conductivity of Metals - Worked Examples

Lecture 19 - The Concept of Phonons

Lecture 20 - Debye Theory of Specific Heat, Lattice Vibrations

Lecture 21 - Debye Theory of Specific Heat, Lattice Vibrations - Worked Examples

Lecture 22 - Lattice Vibrations (Continued) Phonon thermal conductivity

Lecture 23 - Lattice Vibrations (Continued) Phonon Thermal Conductivity - Worked Examples

Lecture 24 - Anharmonicity and Thermal Expansion

Lecture 25 - Dielectric (Insulating) Solids

Lecture 26 - Dispersion and Absorption of Electromagnetic Waves in Dielectric Media, Ferro-and Antiferroelectrics

Lecture 27 - Optical Properties of Metals; Ionic Polarization in Alkali Halides; Piezoelectricity

Lecture 28 - Dielectric Solids - Worked Examples

Lecture 29 - Dia - and Paramagnetism

Lecture 30 - Paramagnetism of Transition Metal and Rare Earth Ions

Lecture 31 - Quenching of Orbital Angular Momentum; Ferromagnetism

- Lecture 32 - Exchange Interactions, Magnetic Order, Neutron Diffraction
- Lecture 33 - Hysteresis and Magnetic Domains; Spin Waves and Magnons
- Lecture 34 - Magnetic Resonance
- Lecture 35 - Magnetism and Magnetic Resonance - Worked Examples
- Lecture 36 - Magnetism - Worked Examples (Continued...)
- Lecture 37 - Pauli Paramagnetism and Landau Diamagnetism
- Lecture 38 - Band Magnetism; Itinerant Electrons; Stoner Model
- Lecture 39 - Superconductivity - Perfect Electrical Conductivity and Perfect Diamagnetism
- Lecture 40 - Type I and Type II Superconductors
- Lecture 41 - Ginsburg - Landau Theory, Flux Quantization
- Lecture 42 - Cooper Pairs
- Lecture 43 - Microscopic (BCS) Theory of Superconductivity
- Lecture 44 - BCS Theory (Continued...): Josephson Tunneling: Quantum Interference
- Lecture 45 - Josephson Effect (Continued...); High Temperature Superconductors
- Lecture 46 - Superconductors - Worked Examples
- Lecture 47 - Energy Bands in Solids
- Lecture 48 - Electron Dynamics in a Periodic Solid
- Lecture 49 - Semiconductors
- Lecture 50 - Semiconductors (Continued...)
- Lecture 51 - Semiconductors - Worked Examples
- Lecture 52 - Defects in Solids - Point Defects
- Lecture 53 - Point Defects in Solids - Worked Examples
- Lecture 54 - Defects in Solids - Line and Surface Defects
- Lecture 55 - Dislocations in Solids - Worked Examples
- Lecture 56 - Quantum Fluids and Quantum Solids
- Lecture 57 - Quantum Liquids and Quantum Solids - Worked Examples
- Lecture 58 - Epilogue

Lecture 1 - Introduction

Lecture 2 - Introduction to Classical Field Theory

Lecture 3 - Quantization of Real Scalar Field - I

Lecture 4 - Quantization of Real Scalar Field - II

Lecture 5 - Quantization of Real Scalar Field - III

Lecture 6 - Quantization of Real Scalar Field - IV

Lecture 7 - Quantization of Complex Scalar Field

Lecture 8 - Interacting Field Theory - I

Lecture 9 - Interacting Field Theory - II

Lecture 10 - Interacting Field Theory - III

Lecture 11 - Interacting Field Theory - IV

Lecture 12 - Interacting Field Theory - V

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Lecture 14 - Interacting Field Theory - VII

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Lecture 16 - Quantization of Electromagnetic Field - II

Lecture 17 - Fermion Quantization - I

Lecture 18 - Fermion Quantization - II

Lecture 19 - Fermion Quantization - III

Lecture 20 - Fermion Quantization - IV

Lecture 21 - Fermion Quantization - V

Lecture 22 - Fermion Quantization - VI

Lecture 23 - The S-Matrix Expansion in QED - I

Lecture 24 - The S-Matrix Expansion in QED - II

Lecture 25 - Feynman Rules in QED - I

Lecture 26 - Feynman Rules in QED - II

Lecture 27 - Compton Scattering - I

Lecture 28 - Compton Scattering - II

Lecture 29 - Compton Scattering - III

Lecture 30 - Moller Scattering - I

Lecture 31 - Moller Scattering - II

[Lecture 32 - Vertex Correction - I](#)

[Lecture 33 - Vertex Correction - II](#)

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[Lecture 35 - Vertex Correction - IV](#)

[Lecture 36 - Electron Selfenergy](#)

[Lecture 37 - Photon Selfenergy - I](#)

[Lecture 38 - Photon Selfenergy - II](#)

- Lecture 1 - Quantum Mechanics " An Introduction
- Lecture 2 - Linear Vector Spaces - I
- Lecture 3 - Linear Vector Spaces - II: The two-level atom
- Lecture 4 - Linear Vector Spaces - III: The three-level atom
- Lecture 5 - Postulates of Quantum Mechanics - I
- Lecture 6 - Postulates of Quantum Mechanics - II
- Lecture 7 - The Uncertainty Principle
- Lecture 8 - The Linear Harmonic Oscillator
- Lecture 9 - Introducing Quantum Optics
- Lecture 10 - An Interesting Quantum Superposition: The Coherent State
- Lecture 11 - The Displacement and Squeezing Operators
- Lecture 12 - Exercises in Finite Dimensional Linear Vector Spaces
- Lecture 13 - Exercises on Angular Momentum Operators and their algebra
- Lecture 14 - Exercises on Quantum Expectation Values
- Lecture 15 - Composite Systems
- Lecture 16 - The Quantum Beam Splitter
- Lecture 17 - Addition of Angular Momenta - I
- Lecture 18 - Addition of Angular Momenta - II
- Lecture 19 - Addition of Angular Momenta - III
- Lecture 20 - Infinite Dimensional Linear Vector Spaces
- Lecture 21 - Square-Integrable Functions
- Lecture 22 - Ingredients of Wave Mechanics
- Lecture 23 - The Schrodinger equation
- Lecture 24 - Wave Mechanics of the Simple Harmonic Oscillator
- Lecture 25 - One-Dimensional Square Well Potential: The Bound State Problem
- Lecture 26 - The Square Well and the Square Potential Barrier
- Lecture 27 - The Particle in a one-dimensional Box
- Lecture 28 - A Charged Particle in a Uniform Magnetic Field
- Lecture 29 - The Wavefunction: Its Single-valuedness and its Phase
- Lecture 30 - The Central Potential
- Lecture 31 - The Spherical Harmonics

[Lecture 32 - Central Potential: The Radial Equation](#)

[Lecture 33 - Illustrative Exercises - I](#)

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[Lecture 35 - Ehrenfest's Theorem](#)

[Lecture 36 - Perturbation Theory - I](#)

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[Lecture 38 - Perturbation Theory - III](#)

[Lecture 39 - Perturbation Theory - IV](#)

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[Lecture 41 - The Jaynes-Cummings model](#)

Lecture 1 - Course Overview

Lecture 2 - Equations of Motion (i)

Lecture 3 - Equations of Motion (ii)

Lecture 4 - Equations of Motion (iii)

Lecture 5 - Equations of Motion (iv)

Lecture 6 - Equations of Motion (v)

Lecture 7 - Oscillators, Resonances, Waves (i)

Lecture 8 - Oscillators, Resonances, Waves (ii)

Lecture 9 - Oscillators, Resonances, Waves (iii)

Lecture 10 - Oscillators, Resonances, Waves (iv)

Lecture 11 - Polar Coordinates (i)

Lecture 12 - Polar Coordinates (ii)

Lecture 13 - Dynamical Symmetry in the Kepler Problem (i)

Lecture 14 - Dynamical Symmetry in the Kepler Problem (ii)

Lecture 15 - Real Effects of Pseudo-Forces (i)

Lecture 16 - Real Effects of Pseudo-Forces (ii)

Lecture 17 - Real Effects of Pseudo-Forces (iii)

Lecture 18 - Real Effects of Pseudo-Forces (iv)

Lecture 19 - Special Theory of Relativity (i)

Lecture 20 - Special Theory of Relativity (ii)

Lecture 21 - Special Theory of Relativity (iii)

Lecture 22 - Special Theory of Relativity (iv)

Lecture 23 - Potentials Gradients Fields (i)

Lecture 24 - Potentials Gradients Fields (ii)

Lecture 25 - Potentials Gradients Fields (iii)

Lecture 26 - Gauss Law Eq of continuity (i)

Lecture 27 - Gauss Law Eq of continuity (ii)

Lecture 28 - Gauss Law Eq of continuity (iii)

Lecture 29 - Fluid Flow Bernoulli Principle (i)

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Lecture 31 - Classical Electrodynamics (i)

[Lecture 32 - Classical Electrodynamics \(ii\)](#)

[Lecture 33 - Classical Electrodynamics \(iii\)](#)

[Lecture 34 - Classical Electrodynamics \(iv\)](#)

[Lecture 35 - Chaotic Dynamical Systems \(i\)](#)

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[Lecture 37 - Chaotic Dynamical Systems \(iii\)](#)

[Lecture 38 - Chaotic Dynamical Systems \(iv\)](#)

[Lecture 39 - Chaotic Dynamical Systems \(v\)](#)

[Lecture 40 - The Scope and Limitations of Classical Mechanics](#)

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Lecture 2 - Quantum Theory of collisions

Lecture 3 - Quantum Theory of collisions: optical Theorem

Lecture 4 - Quantum Theory of collisions: Optical Theorem (Continued...)

Lecture 5 - Quantum Theory of collisions: Differential scattering cross section

Lecture 6 - Quantum Theory of collisions: Differential scattering cross section, Partial wave analysis

Lecture 7 - Quantum Theory of collisions: Optical Theorem – Unitarity of the Scattering Operator

Lecture 8 - Quantum Theory of collisions: Reciprocity Theorem, Phase shift analysis

Lecture 9 - Quantum Theory of collisions: More on Phase shift analysis

Lecture 10 - Quantum Theory of collisions: resonant condition in the l th partial wave.

Lecture 11 - Quantum Theory of collisions: Levinson's theorem

Lecture 12 - Quantum Theory of collisions: Levinson's theorem (Continued...)

Lecture 13 - Many body theory, electron correlations

Lecture 14 - Second Quantization Creation, Destruction and Number operators

Lecture 15 - Many-particle Hamiltonian & Schrodinger Equation in 2nd Quantization

Lecture 16 - Many-electron problem in quantum mechanics

Lecture 17 - Hartree-Fock Self-Consistent-Field

Lecture 18 - Exchange, Statistical, Fermi-Dirac correlations

Lecture 19 - Limitations of the Hartree-Fock Self-Consistent-Field formalism

Lecture 20 - Many-Body formalism, II Quantization

Lecture 21 - Density fluctuations in an electron gas

Lecture 22 - Bohm-Pines approach to Random Phase Approximation

Lecture 23 - Bohm-Pines approach to Random Phase Approximation (Continued...)

Lecture 24 - Bohm-Pines approach to Random Phase Approximation (Continued...)

Lecture 25 - Schrodinger, Heisenberg and Dirac "pictures" of QM

Lecture 26 - Dyson's chronological operator

Lecture 27 - Gell-Mann-Low Theorem

Lecture 28 - Reyleigh-Schrodinger perturbation methods and adiabatic switching

Lecture 29 - Feynman Diagrams

Lecture 30 - I Order Feynman Diagrams

Lecture 31 - II and higher order Feynman Diagrams

- [Lecture 32 - Linear response of electron correlations](#)
- [Lecture 33 - Lippman Schwinger equation of potential scattering](#)
- [Lecture 34 - Born Approximation](#)
- [Lecture 35 - Coulomb scattering](#)
- [Lecture 36 - Scattering of partial waves](#)
- [Lecture 37 - Scattering at high energy](#)
- [Lecture 38 - Resonances in Quantum Collisions](#)
- [Lecture 39 - Breit-Wigner Resonances](#)
- [Lecture 40 - Fano parameterization of Breit-Wigner formula](#)
- [Lecture 41 - Discrete state embedded in the continuum](#)
- [Lecture 42 - Resonance life times](#)
- [Lecture 43 - Wigner-Eisenbud formalism of time-delay in scattering](#)
- [Lecture 44 - Photoionization and Photoelectron Angular Distributions](#)
- [Lecture 45 - Ionization and Excitation of Atoms by Fast Charged Particles](#)
- [Lecture 46 - Photo-absorption by Free and Confined Atoms and Ions: Recent Developments](#)

- Lecture 1 - Analytic functions of a complex variable - Part I
- Lecture 2 - Analytic functions of a complex variable - Part II
- Lecture 3 - Calculus of residues - Part I
- Lecture 4 - Calculus of residues - Part II
- Lecture 5 - Calculus of residues - Part III
- Lecture 6 - Calculus of residues - Part IV
- Lecture 7 - Linear response; dispersion relations - Part I
- Lecture 8 - Linear response; dispersion relations - Part II
- Lecture 9 - Analytic continuation and the gamma function - Part I
- Lecture 10 - Analytic continuation and the gamma function - Part II
- Lecture 11 - Möbius transformations - Part I
- Lecture 12 - Möbius transformations - Part II
- Lecture 13 - Möbius transformations - Part III
- Lecture 14 - Multivalued functions; integral representations - Part I
- Lecture 15 - Multivalued functions; integral representations - Part II
- Lecture 16 - Multivalued functions; integral representations - Part III
- Lecture 17 - Multivalued functions; integral representations - Part IV
- Lecture 18 - Laplace transforms - Part I
- Lecture 19 - Laplace transforms - Part II
- Lecture 20 - Fourier transforms - Part I
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- Lecture 22 - Fourier transforms - Part III
- Lecture 23 - Fundamental Green function for \hat{p}^2 - Part I
- Lecture 24 - Fundamental Green function for \hat{p}^2 - Part II
- Lecture 25 - The diffusion equation - Part I
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- Lecture 27 - The diffusion equation - Part III
- Lecture 28 - The diffusion equation - Part IV
- Lecture 29 - Green function for $(\hat{p}^2 + k^2)$; nonrelativistic scattering - Part I
- Lecture 30 - Green function for $(\hat{p}^2 + k^2)$; nonrelativistic scattering - Part II
- Lecture 31 - Green function for $(\hat{p}^2 + k^2)$; nonrelativistic scattering - Part III

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- Lecture 1 - Energy Sources
- Lecture 2 - Nuclear Power Production Cycle
- Lecture 3 - Basic Physics of Nuclear Fission
- Lecture 4 - Basic Physics of Nuclear Fission (Continued...)
- Lecture 5 - Nuclear Reactors
- Lecture 6 - Reactors Generation
- Lecture 7 - Radiation Sources and Protection
- Lecture 8 - Biological Effects of Radiation
- Lecture 9 - Safety Principles
- Lecture 10 - Safety Principles (Continued...)
- Lecture 11 - Safety Approach
- Lecture 12 - Risk and Probabilistic safety analysis (PSA)
- Lecture 13 - History of Events in Nuclear Power Plants and Radiation facilities
- Lecture 14 - Other Events
- Lecture 15 - Validation and Dynamic Analysis
- Lecture 16 - Validation and Dynamic Analysis (Continued...)
- Lecture 17 - Quality Assurance
- Lecture 18 - Siting of Nuclear Plants
- Lecture 19 - Siting of Nuclear Plants (Continued...)
- Lecture 20 - Engineered Safety Systems
- Lecture 21 - Engineered Safety Systems (Continued...)
- Lecture 22 - Assessment of Radiological Consequences of Incidents
- Lecture 23 - Safety Regulation in India
- Lecture 24 - Safety Regulation in India (Continued...)
- Lecture 25 - Safety Regulation in India (Continued...)
- Lecture 26 - Safety Practices in Indian NPPs
- Lecture 27 - Safety Practices in Indian NPPs (Continued...)
- Lecture 28 - Safety Practices in Indian NPPs (Continued...)
- Lecture 29 - Passive Safety
- Lecture 30 - Passive Safety (Continued...)

- Lecture 1 - Discrete probability distributions - Part 1
- Lecture 2 - Discrete probability distributions - Part 2
- Lecture 3 - Continuous random variables
- Lecture 4 - Central Limit Theorem
- Lecture 5 - Stable distributions
- Lecture 6 - Stochastic processes
- Lecture 7 - Markov processes - Part 1
- Lecture 8 - Markov processes - Part 2
- Lecture 9 - Markov processes - Part 3
- Lecture 10 - Birth-and-death processes
- Lecture 11 - Continuous Markov processes
- Lecture 12 - Langevin dynamics - Part 1
- Lecture 13 - Langevin dynamics - Part 2
- Lecture 14 - Langevin dynamics - Part 3
- Lecture 15 - Langevin dynamics - Part 4
- Lecture 16 - Itô and Fokker-Planck equations for diffusion processes
- Lecture 17 - Level-crossing statistics of a continuous random process
- Lecture 18 - Diffusion of a charged particle in a magnetic field
- Lecture 19 - Power spectrum of noise
- Lecture 20 - Elements of linear response theory
- Lecture 21 - Random pulse sequences
- Lecture 22 - Dichotomous diffusion
- Lecture 23 - First passage time (Part 1)
- Lecture 24 - First passage time (Part 2)
- Lecture 25 - First passage and recurrence in Markov chains
- Lecture 26 - Recurrent and transient random walks
- Lecture 27 - Non-Markovian random walks
- Lecture 28 - Statistical aspects of deterministic dynamics (Part 1)
- Lecture 29 - Statistical aspects of deterministic dynamics (Part 2)

- Lecture 1 - The Nature of Physical Laws
- Lecture 2 - Fundamental Constants and Dimensional Analysis
- Lecture 3 - Dimensional analysis and scaling
- Lecture 4 - sketching Elementary Functions
- Lecture 5 - The fundamental forces of nature
- Lecture 6 - Scalars, Vectors and All That
- Lecture 7 - Plane Polar Coordinates
- Lecture 8 - Vectors In a Plane, Scalars and Pseudoscalars
- Lecture 9 - Kinematics In a Plane
- Lecture 10 - Vectors in 3-Dimensional Space
- Lecture 11 - Vectors in 3-Dimensional space (Continued...)
- Lecture 12 - The Finite Rotation Formula, Polar Coordinates in 3-dimensions
- Lecture 13 - Cylindrical and Spherical polar coordinates
- Lecture 14 - Motion in a circle - Acceleration
- Lecture 15 - Newtons laws of motion
- Lecture 16 - Conservation Laws and Newtons Equations
- Lecture 17 - Conservation of Angular Momentum
- Lecture 18 - Two-Body Scattering
- Lecture 19 - Two-Body Collision Kinematics
- Lecture 20 - Conservative Forces - The Concept of a Potential
- Lecture 21 - Central Potential and Central Force
- Lecture 22 - The 2-Body Central Force Problem
- Lecture 23 - Keplers Laws of Planetary Motion
- Lecture 24 - Non-Inertial Forces (Pseudo-forces)
- Lecture 25 - More on the Kepler problem; Satellite motion
- Lecture 26 - Linear Elasticity of Solids
- Lecture 27 - Simple Harmonic Motion
- Lecture 28 - Some Physical Examples of Simple Harmonic Motion
- Lecture 29 - More on Simple Harmonic Motion
- Lecture 30 - Damped Simple Harmonic Motion
- Lecture 31 - Wave Motion - Travelling and Standing Waves

[Lecture 32 - Wave Motion - Wave Equation, General Solution](#)

[Lecture 33 - Fluid Dynamics - Hydrostatic Equilibrium](#)

[Lecture 34 - Fluid Dynamics - Equation of Continuity](#)

[Lecture 35 - Fluid Flow - Bernoullis Principle](#)

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[Lecture 38 - The Classical Ideal Gas](#)

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[Lecture 41 - Van der Waals Equation](#)

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Lecture 3 - The Langevin model (Part 2)

Lecture 4 - The Langevin model (Part 3)

Lecture 5 - The Langevin model (Part 4)

Lecture 6 - Linear response theory (Part 1)

Lecture 7 - Linear response theory (Part 2)

Lecture 8 - Linear response (Part 3)

Lecture 9 - Linear response(Part 4)

Lecture 10 - Linear response (Part 5)

Lecture 11 - Linear response (Part 6)

Lecture 12 - Linear response theory (Part 7)

Lecture 13 - Quiz 1 - Questions and answers

Lecture 14 - Linear response theory (Part 8)

Lecture 15 - Linear response theory (Part 9)

Lecture 16 - The dynamic mobility

Lecture 17 - Fokker-Planck equations (Part 1)

Lecture 18 - Fokker-Planck equations (Part 2)

Lecture 19 - Fokker-Planck equations (Part 3)

Lecture 20 - The generalized Langevin equation (Part 1)

Lecture 21 - The generalized Langevin equation (Part 2)

Lecture 22 - Diffusion in a magnetic field

Lecture 23 - The Boltzmann equation for a dilute gas (Part 1)

Lecture 24 - The Boltzmann equation for a dilute gas (Part 2)

Lecture 25 - The Boltzmann equation for a dilute gas (Part 3)

Lecture 26 - The Boltzmann equation for a dilute gas (Part 4)

Lecture 27 - The Boltzmann equation for a dilute gas (Part 5)

Lecture 28 - Quiz 2 - Questions and answers

Lecture 29 - Critical phenomena (Part 1)

Lecture 30 - Critical phenomena (Part 2)

Lecture 31 - Critical phenomena (Part 3)

[Lecture 32 - Critical phenomena \(Part 4\)](#)

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[Lecture 36 - The Wiener process \(standard Brownian motion\)](#)

Lecture 1 - Discrete Probability

Lecture 2 - Continuous Probability

Lecture 3 - Characteristic Function

Lecture 4 - Gaussian Distribution

Lecture 5 - Binomial Distribution

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Lecture 7 - Central Limit Theorem

Lecture 8 - Many Random Variables

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Lecture 11 - Transformation of Random Variables

Lecture 12 - Tutorial

Lecture 13 - Mathematical Preliminaries - 1

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Lecture 15 - Two Level System (Microcanonical Ensemble)

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Lecture 19 - Two Level System (Canonical Ensemble)

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Lecture 21 - Gibbs Canonical Ensemble

Lecture 22 - Classical Ideal Gas (Gibbs Canonical Ensemble)

Lecture 23 - N Spins in a Uniform Magnetic Field

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Lecture 26 - N Non - Interacting Spins in Constant Magnetic Field

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Lecture 29 - Quantum to Classical Correspondance

Lecture 30 - Vibrations of Solid (Low Temperature)

Lecture 31 - Vibrations of Solid (Continuation)

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Lecture 17 - Monte Carlo Simulation Introduction - Part 2

Lecture 18 - Implementing the Ising model on computer

Lecture 19 - Periodic Boundary conditions and the Metropolis scheme

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- Lecture 50 - Quarter and Half Wave Plates
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- Lecture 52 - Plane Wave Propagation in Anisotropic Media - I
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- Lecture 54 - Antireflecting Coating
- Lecture 55 - Basic Concepts of Holography - I
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- Lecture 2 - Scalars, vectors and tensors - most general definition
- Lecture 3 - Elementary vector algebra - I (unit vector, dot product)
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- Lecture 5 - Review of Newton's laws of motion - tools for analysis
- Lecture 6 - Newton's laws of motion - third and second law
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- Lecture 8 - Solving mechanics problems - how to draw free body diagram correctly
- Lecture 9 - Mechanical equilibrium (statics) using force and torque balance
- Lecture 10 - Mechanical equilibrium (statics) using force and torque balance - more examples
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- Lecture 14 - Mechanical equilibrium of truss (framework) - nature of internal forces
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- Lecture 16 - Mechanical equilibrium of truss - uniqueness of solution, beam with distributed load
- Lecture 17 - Mechanical equilibrium of truss - more on beam with distributed load
- Lecture 18 - Mechanical equilibrium - more examples, principle of virtual work, constrained motion
- Lecture 19 - Mechanical equilibrium: constraints, degrees of freedom, work done by constrained force
- Lecture 20 - d'Alembert - Lagrange principle of virtual work - statement and examples
- Lecture 21 - Equivalence of principles of force, torque balance and virtual work, stability analysis
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- Lecture 23 - Friction between solids - Amonton-Coulomb laws, common misconceptions
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- Lecture 25 - Friction between solid and fluid - drag force
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- Lecture 27 - Work-energy theorem in one dimension, importance of conservation laws
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- Lecture 29 - Momentum balance principle, critical review: projectile motion in real-life
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- Lecture 31 - More on rocket motion - comparing effect of thrust in deep space and at lift off

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Lecture 35 - Centre of mass of composite objects

Lecture 36 - Concepts necessary for translation and rotation of rigid bodies - moment of inertia

Lecture 37 - More on moment of inertia - 3D objects, composite objects, engineering applications

Lecture 38 - Symmetry of mass distribution - product of inertia

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- Lecture 8 - More Aspects of Debye Shielding
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- Lecture 10 - Plasma as a Gas and Distribution of Velocities
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- Lecture 17 - Motion in Perpendicular Electric and Magnetic fields - I
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- Lecture 36 - MHD Approximation - II
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- Lecture 39 - Plasma as a fluid: Fluid Drift - I
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- Lecture 45 - Ion Acoustic Wave - I
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- Lecture 48 - Invalidity of Plasma Approximation - I
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- Lecture 61 - Surface Modification of Metallic Components by Plasma Nitriding - I
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NPTEL : ACM Summer School on Algorithmic and Theoretical Aspects of Machine Learning (Special Lecture Series)

Co-ordinators : Meenakshi D'Souza

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DIGIMAT - The No.1 Autonomous Learning Platform for Creative Learning

NPTEL : ACM India Summer School on IoT and Embedded Systems (Special Lecture Series)

Co-ordinators : Prof. Meenakshi DSouza

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NPTEL : Theory of Yarn Structures (Textile Engineering)

Co-ordinators : Prof. Bohuslav Neckar

Lecture 1 - Fibers and Yarns : Terms, Definitions and Relations

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Lecture 12 - Modelling of Internal Yarn Geometry

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Lecture 15 - Relations Among Yarn Count T, Twist Z, Packing Density, And Diameter D (Continued...)

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Lecture 17 - Bundle Theory of Yarn Unevenness

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Lecture 20 - Yarn Strength as a Stochastic Process (Continued...)

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- Lecture 5 - Psychology and Comfort
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- Lecture 7 - Psychology and Comfort (Continued...)
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- Lecture 9 - Neurophysiological Processes in Clothing Comfort
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- Lecture 29 - Moisture Transmission and Clothing Comfort
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[Lecture 33 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

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- Lecture 2 - Opening Principle and Opening Devices
- Lecture 3 - Cleaning Principle
- Lecture 4 - Machines and their Layout
- Lecture 5 - Bale Opening Machines
- Lecture 6 - Machines in Blow Room - Part II
- Lecture 7 - Opening Cleaning Machines - Part II
- Lecture 8 - Mixing/Blending
- Lecture 9 - Transportation of Tuft
- Lecture 10 - Lap formation and Material Flow Regulation
- Lecture 11 - Process Performance
- Lecture 12 - Introduction
- Lecture 13 - Card Feed Zone
- Lecture 14 - Carding Zone
- Lecture 15 - Analysis of flat action
- Lecture 16 - Sliver Formation
- Lecture 17 - Package Formation
- Lecture 18 - Card Clothing
- Lecture 19 - Card Setting, Draft, Production
- Lecture 20 - Fibre Configuration and Neps in Card sliver
- Lecture 21 - Carding Process
- Lecture 22 - Numerical Problems and Solution
- Lecture 23 - Introduction and Drafting principle
- Lecture 24 - Design Features and operating principle of drawframe
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- Lecture 29 - Significance of Process Parameters
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- Lecture 11 - Evaluation of Fibre Length (Continued...)
- Lecture 12 - Evaluation of Fibre Fineness
- Lecture 13 - Evaluation of Fibre Fineness - 1
- Lecture 14 - Evaluation of Cotton Fibre Maturity
- Lecture 15 - Evaluation of Cotton Fibre Properties: (HVI and AFIS)
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- Lecture 2 - Testing of Low Stress mechanical Properties of Textile Fabrics (Continued...)
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- Lecture 10 - Testing of Fibre Reinforced Composite Materials
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- Lecture 12 - Testing of Fibre Reinforced Composite Materials (Continued...)
- Lecture 13 - Testing of Fibre Reinforced Composite Materials (Continued...)
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- Lecture 17 - Testing of Fibre Fabrics (Continued...)
- Lecture 18 - Testing of Geotextiles
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- Lecture 20 - Testing of Geotextiles (Continued...)
- Lecture 21 - Testing of Ballistics Protective Clothing
- Lecture 22 - Testing of UV Radiation Protective Textiles
- Lecture 23 - Testing of Compression Bandages
- Lecture 24 - Testing of Electromagnetic Shielding Textiles

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- Lecture 2 - The Building Block of Yarns (Continued...)
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- Lecture 6 - Relations Among Yarn Count, Twist, and Diameter
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- Lecture 10 - Helical Model of Fibers in Yarns (Continued...)
- Lecture 11 - Helical Model of Fibers in Yarns (Continued...)
- Lecture 12 - Mass Irregularity of Yarns
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Lecture 3 - Dyes and pigments

Lecture 4 - Thickeners

Lecture 5 - Measurement of viscosity

Lecture 6 - Discharge and resist printing

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Lecture 8 - Sublimation Transfer Printing : Paper Printing

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Lecture 10 - Free path length and mechanism of transfer

Lecture 11 - Transfer Printing Machines and Other Transfer Methods

Lecture 12 - Introduction to Digital Textile Printing

Lecture 13 - Revision and Doubt Clarification Session - 1

Lecture 14 - Digital Textile Printing: Inkjet Technologies

Lecture 15 - Inkjet Technologies: drop-on-demand

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Lecture 17 - Inkjet Technologies: Machines

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Lecture 21 - Water-based inks (Continued...)

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Lecture 2 - General principles involved in the manufacture of textured yarns

Lecture 3 - General principles involved in the manufacture of textured yarns (Continued...)

Lecture 4 - Bulked yarns

Lecture 5 - Mechanisms of setting and texturing

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Lecture 8 - Influence of material and process parameters

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Lecture 10 - Influence of process parameters (Continued...)

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Lecture 12 - Influence of process parameters (Continued...)

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Lecture 14 - Simultaneous draw texturing with POY

Lecture 15 - Draw Texturing (Continued...)

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Lecture 21 - Air-Jet Texturing

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Lecture 26 - Air-Texturing Jets

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- Lecture 17 - Soil Repellency and Soil Release
- Lecture 18 - Soil Release Finishing
- Lecture 19 - Fire Retardant Finishing
- Lecture 20 - Chemistry of Flame Retardants
- Lecture 21 - More Flame retardants and evaluation of fire retardancy
- Lecture 22 - Antimicrobial Finishing
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- Lecture 7 - Timing Diagram
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- Lecture 11 - Parameters Influencing Combing Performance
- Lecture 12 - Analysis of Drive
- Lecture 13 - Calculation of Process Performance Parameters
- Lecture 14 - Introduction, Working Principle and Creel
- Lecture 15 - DRAFTING Unit - Part 1
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- Lecture 17 - Flyer Twisting
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- Lecture 20 - Building Motion and Drive Analysis
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- Lecture 2 - Knitting Glossary
- Lecture 3 - Loop Formation in Weft Knitting
- Lecture 4 - Lab Demo 1: Analysis of a Weft Knit Fabric
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- Lecture 8 - Single Bed Weft Knitting-Flat and Circular M/C
- Lecture 9 - Lab Demo 2: Single Flat Bed Machine
- Lecture 10 - Lab Demo 3: Single Bed Circular Machine
- Lecture 11 - Single Bed Weft Knitting Fabric Curling
- Lecture 12 - Weft Knitting Double Flat Beds
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- Lecture 14 - Weft Knitting V-Bed Machine
- Lecture 15 - Analysis of a Double Jersey Fabric
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- Lecture 17 - Weft Knit Stitches - Loop, Tuck and Float
- Lecture 18 - Lab Demo 6 (Part 1) Knitting Notations
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- Lecture 20 - Fabric Analysis - Influence of Loop Length
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- Lecture 23 - Fabric Analysis - Shrinkage (Relaxation)
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- Lecture 25 - Knitting Calculation - Yarn Selection
- Lecture 26 - Knitting Calculation - Production (Circular)
- Lecture 27 - Knitting Calculation - Production (Flat)
- Lecture 28 - Knitting Calculation - Fabric Calculations
- Lecture 29 - Knitting Calculation - Geometrical Modeling
- Lecture 30 - Knitting Calculation - Fabric Spirality in Single Jersey (Tubular)
- Lecture 31 - Advancement in Knitting Technology

- Lecture 32 - Knitting Designs Possibilities
- Lecture 33 - Knitting Designs Possibilities - 1
- Lecture 34 - Design Software
- Lecture 35 - Weft Knitting- Revision
- Lecture 36 - Introduction to Warp Knitting
- Lecture 37 - Warp Knitting Technology- Loop Formation
- Lecture 38 - Swinging and Shogging Motions (Overlap and Underlap)
- Lecture 39 - Warp Knit - Structural Identification
- Lecture 40 - Warp Knit Fabric Notation - Lapping Diagram and Lapping Plan
- Lecture 41 - Warp Knit Structure - Design Principles
- Lecture 42 - Single Bar Warp Knit Constructions
- Lecture 43 - Double Bar Warp Knit Constructions
- Lecture 44 - Lapping Plan Execution - Pattern Disc and Pattern Drum
- Lecture 45 - Chain Links Arrangement - Single and Double Bar Constructions
- Lecture 46 - Warp Knits : Structure - Property Relationship
- Lecture 47 - Warp Knits : Multi-bar Structures and Double Bed Designs
- Lecture 48 - Weft and Warp Knitting - Summary
- Lecture 49 - Technical Applications of Knitting
- Lecture 50 - Technical Applications of Knitting (Continued...)

- Lecture 1 - Introduction to Technical Textiles
- Lecture 2 - Introduction to Technical Textiles (Continued...)
- Lecture 3 - Textile Reinforced Composites
- Lecture 4 - Textile Reinforced Composites (Continued...)
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- Lecture 6 - Textile Reinforced Composites (Continued...)
- Lecture 7 - Textile Reinforced Composites (Continued...)
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- Lecture 10 - Textile Reinforced Composites (Continued...)
- Lecture 11 - Textile Reinforced Composites (Continued...)
- Lecture 12 - Textile Reinforced Composites (Continued...)
- Lecture 13 - Filter Fabrics
- Lecture 14 - Filter Fabrics (Continued...)
- Lecture 15 - Filter Fabrics (Continued...)
- Lecture 16 - Geotextiles
- Lecture 17 - Geotextiles (Continued...)
- Lecture 18 - Geotextiles (Continued...)
- Lecture 19 - Geotextiles (Continued...)
- Lecture 20 - Extreme Cold Protective Clothing
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- Lecture 22 - Extreme Heat Protective Clothing
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- Lecture 24 - Sports Textiles
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- Lecture 26 - Sports Textiles (Continued...)
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- Lecture 29 - Ultraviolet Protective Textiles (Continued...)
- Lecture 30 - Ballistic Protective Textiles
- Lecture 31 - Compression Bandage

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[Lecture 33 - Compression Bandage \(Continued...\)](#)

[Lecture 34 - Automotive Textiles](#)

[Lecture 35 - Textiles in Hygiene](#)

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[Lecture 37 - Additional Lectuer on Geotextiles \(Continued...\)](#)

[Lecture 38 - Additional Lectuer on Composites](#)

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- Lecture 1 - New Spinning Technology
- Lecture 2 - Sliver Feed Arrangement
- Lecture 3 - Principle of Yarn Formation
- Lecture 4 - Twist Equation
- Lecture 5 - Rotor: Construction, Geometry and Drive
- Lecture 6 - Package Formation
- Lecture 7 - Significance of Fibre and Process Parameters
- Lecture 8 - Rotor Selection
- Lecture 9 - Spinning Tension
- Lecture 10 - Production and Energy Consumption Calculation
- Lecture 11 - Rotor Yarn: Structure, Properties and Application
- Lecture 12 - Air Jet Spinning: Introduction
- Lecture 13 - High Draft System
- Lecture 14 - Yarn Formation Mechanism
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- Lecture 17 - Friction Spinning: Dref-2
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- Lecture 23 - Wrap Spinning (Continued...)
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NPTEL : Natural Dyes (Textile Engineering)

Co-ordinators : Dr. Padma S Vankar

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