

NPTEL : Convective Heat and Mass Transfer (Mechanical Engineering)

Co-ordinators : Prof. A.W. Date

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Co-ordinators : Prof. M.D. Atrey

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NPTEL : Heat and Mass Transfer (Mechanical Engineering)

Co-ordinators : Prof. S.P. Sukhatme, Prof. U.N. Gaitonde

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NPTEL : Project and Production Management (Mechanical Engineering)

Co-ordinators : Prof. Arun Kanda

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Lecture 12 - Case Study on a Railway Air Conditioning System

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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

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[Lecture 50 - Thermodynamics of Reacting systems: Introduction to reacting systems and combustion](#)

[Lecture 51 - Thermodynamics of Reacting systems: Flames, Stoichiometry](#)

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[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

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- 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

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Lecture 2 - Examples of visualization - 1

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Lecture 4 - Visualization and drawing

Lecture 5 - Sketch to engineering drawing

Lecture 6 - Types of projections

Lecture 7 - Multiview projections

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Lecture 25 - Example Section View

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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

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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 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

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Lecture 20 - Analysis of viscoelastic beams

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Lecture 22 - Dynamic mechanical thermal analysis (DMTA)

Lecture 23 - Time temperature superposition principle (TTSP)

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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

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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

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Lecture 14 - Thin film coatings and their tribological properties

Lecture 15 - Nanotribology

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Lecture 17 - Wear testing techniques and standards

Lecture 18 - Measurement and analysis of wear debris

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Lecture 21 - Data Collection and Preprocessing

Lecture 22 - Feature Extraction and Selection

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Lecture 24 - Regression and Classification Algorithms for Tribological Modeling

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Lecture 29 - Data-Driven Models for Tribofilm Formation

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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

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Lecture 8 - Derivation of Equation of motion of nonlinear continuous system - 1

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Lecture 10 - Ordering of nonlinear Equation of motion

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Lecture 13 - Lindstedt Poincaré technique

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Lecture 20 - Modified Lindstedt Poincaré technique

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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

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Lecture 14 - Torsional Vibrations: Simple Rotor Systems

Lecture 15 - Three Disc Rotor System

Lecture 16 - Transfer Matrix Approach - Part I

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Lecture 19 - Geared and Branched Systems

Lecture 20 - Continuous System and Finite Element Method

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Lecture 22 - Finite Element Analysis

Lecture 23 - Finite Element Analysis - Part III

Lecture 24 - Influence Coefficient Method

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Lecture 10 - Application of Friction - Part 1

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Lecture 13 - Centroids Center of Mass

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Lecture 15 - Product of Inertia, Rotation of Axis and Principle Moments of Inertia

Lecture 16 - Principle Mass Moments of Inertia

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Lecture 18 - Virtual Work of Ideal System

Lecture 19 - Principle of Virtual Work

Lecture 20 - Systems with Friction

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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

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Lecture 31 - Plane Kinetics of Rigid Bodies

[Lecture 32 - Kinetics of a Body](#)

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[Lecture 38 - Vibration of Rigid Bodies - Part 1](#)

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[Lecture 40 - Some Problems of Vibration](#)

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](#)

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[Lecture 37 - Vibration Testing Equipments: Signal Measurements](#)

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[Lecture 39 - Field Balancing of Rotors](#)

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[Lecture 1 - Introduction to advanced machining processes](#)

[Lecture 2 - Ultrasonic machining - Part I](#)

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[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

Lecture 16 - Mechanics of sheet metal forming - 2

Lecture 17 - Heat transfer and thermomechanical processing

Lecture 18 - Fusion welding processes - 1

Lecture 19 - Fusion welding processes - 2

Lecture 20 - Physics of welding and metal transfer

Lecture 21 - Heat source model in fusion welding

Lecture 22 - Heat transfer and material flow

Lecture 23 - Solidification in welding - 1

Lecture 24 - Solidification in welding - 2

Lecture 25 - Solid state welding - 1

Lecture 26 - Solid state welding - 2

Lecture 27 - Hybrid welding, residual stress and distortion

Lecture 28 - Cooling and solidification at different casting processes

Lecture 29 - Powder metallurgy

Lecture 30 - Principle of surface and coating technologies

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Lecture 21 - Fundamentals of Gas turbine systems

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Lecture 26 - Hydro-Power System - Part II

Lecture 27 - Wind Energy - Part I

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Lecture 31 - Geothermal Energy

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- 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
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- 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

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Lecture 12 - Casting and welding - 1

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Lecture 2 - A Focus on Lubrication and Cooling Systems

Lecture 3 - Engine Classifications and Nomenclature

Lecture 4 - Analysis of Basic Cycles

Lecture 5 - Description of Engine Components

Lecture 6 - Design and Constructional Features of Engine Hardware

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Lecture 10 - Description of Energy Transfer Mechanism

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Lecture 12 - Components Involved and Numerical Problems: Energy Transfer

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Lecture 14 - Description of Electronic Control Unit (ECU) and types of control system: Open-loop and Close loop

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Lecture 16 - Control system layout and types of sensors: Coolant temperature sensor and Crankshaft position sensor

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Lecture 20 - Introduction to electronic devices and circuits

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Lecture 23 - Functional layout of Electronic Control Unit (ECU)

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Lecture 27 - Modes for fuel control, Integrated engine control system

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Lecture 29 - Measurement of fuel flow rate, air flow rate and needle lift in a CI engine

Lecture 30 - Measurement of indicated work, Numerical problem

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Lecture 5 - Weld Induced Thermal History (2D-3D Heat Flow and Cooling Rate)

Lecture 6 - Weld Induced Thermal History (2D-3D Heat Flow and Cooling Rate)

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Lecture 17 - Design of Welds Subjected to Combined Stresses

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Lecture 22 - Fundamental of Creep on Welded Joints

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Lecture 24 - Basics of Fatigue Analysis

Lecture 25 - Basics of Fatigue Life Prediction

Lecture 26 - Basics of Fatigue Life Prediction

Lecture 27 - Some Problems on Fatigue Life Prediction of Welded Joints

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NPTEL : NOC:Industrial Engineering and Operations Research (Mechanical Engineering)

Co-ordinators : Prof. Uday Shanker Dixit

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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

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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](#)

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[Lecture 36 - Absorption coefficient, and irregular rooms](#)

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Lecture 19 - Constrained Optimization: Optimality Criteria

Lecture 20 - Constrained Optimization: Further Issues

Lecture 21 - Interpolation

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NPTEL : Finite Element Method (Mechanical Engineering)

Co-ordinators : Prof. C.S. Upadhyay

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NPTEL : Kinematics of Machines (Mechanical Engineering)

Co-ordinators : Prof. Ashok K Mallik

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Co-ordinators : Prof. A. Dasgupta

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NPTEL : Manufacturing Processes II (Mechanical Engineering)

Co-ordinators : Prof. S. Paul, Prof. A.B. Chattopadhyay, Prof. A.K. Chattopadhyay

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NPTEL : Refrigeration and Air Conditioning (Mechanical Engineering)

Co-ordinators : Prof. M. Ramgopal, Prof. R.C. Arora

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Lecture 3 - Applications of RTAC

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NPTEL : Fluid Mechanics (Mechanical Engineering)

Co-ordinators : Prof. S.K. Som

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Lecture 2 - Introduction (Continued...) - binary logic and logic gates

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Lecture 5 - Tutorial involving simple calculations on different aspects of CNC controls

Lecture 6 - Questions, MCQ Discussions on Motors, Encoders, Decoders and Programming Practice

Lecture 7 - Stepper motors, Permanent magnet DC motors

Lecture 8 - Binary circuits and decoders

Lecture 9 - Tachogenerator, printed circuit motors, Encoders

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Lecture 20 - Questions and Discussions on Curved Surface Machining

**NPTEL : NOC:Non Traditional Abrasive Machining Processes - Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining
(Mechanical Engineering)**

Co-ordinators : Prof. Asimava Roy Choudhury

Lecture 1 - Non-traditional abrasive machining : Ultrasonic, Abrasive jet and abrasive water jet machining

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Lecture 4 - Ultrasonic Machining - Free Impacts and Problem Solving

Lecture 5 - Ultrasonic Machining - Problems and MCQs

Lecture 6 - USM - Horn Design

Lecture 7 - USM - Horn Design (Continued...)

Lecture 8 - Ultrasonic Machining - Feed Mechanism, Head design and other aspects

Lecture 9 - Ultrasonic Machining - Effects of Various Inputs on the Output

Lecture 10 - Ultrasonic Machining - Numerical and MCQs

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
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Co-ordinators : Prof. K. Ramamurthi

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NPTEL : Advanced Finite Elements Analysis (Mechanical Engineering)

Co-ordinators : Dr. R. Krishnakumar

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NPTEL : Introduction to Finite Element Method (Mechanical Engineering)

Co-ordinators : Dr. R. Krishnakumar

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[Lecture 20 - Pressure Measurement \(Continued...\)](#)

[Lecture 21 - Pressure Measurement \(Continued...\)](#)

[Lecture 22 - Pressure Measurement \(Continued...\)](#)

[Lecture 23 - Pressure Measurement \(Continued...\)](#)

[Lecture 24 - Transient Response of Pressure Transducers](#)

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[Lecture 26 - Measurement of High Vacuum](#)

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[Lecture 28 - Hot Wire Anemometry and Laser Doppler Velocimetry](#)

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[Lecture 33 - Measurement of Volume and Mass Flow Rate of Fluid](#)

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[Lecture 37 - Measurement of Thermal Conductivity](#)

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[Lecture 40 - Measurement of Viscosity \(Continued...\)](#)

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[Lecture 47 - Vibration and Acceleration Measurement](#)

[Lecture 48 - Laser Doppler Accelerometer,Speed,Torque](#)

[Lecture 49 - General Issues in Mechanical Measurement](#)

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NPTEL : Principles of Mechanical Measurements (Mechanical Engineering)

Co-ordinators : Prof. R. Raman

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[Lecture 26 - Principles Of Mechanical Measurements](#)

NPTEL : Spray Theory and Applications (Mechanical Engineering)

Co-ordinators : Prof. Mahesh Panchagnula, Dr. Paul E. Sojka

Lecture 1 - Introduction to sprays and their applications

Lecture 2 - Spatial versus Temporal Sampling

Lecture 3 - Spatial Vs Temporal Sampling example problem

Lecture 4 - Steady vs unsteady spray

Lecture 5 - Statistical measures on spray

Lecture 6 - Discussion on pdf and moments

Lecture 7 - Size velocity correlation

Lecture 8 - Discussion on Interfacial tension

Lecture 9 - Introduction to Atomizers and their design - 1

Lecture 10 - Introduction to Atomizers and their design - 2

Lecture 11 - Simple measurement techniques

Lecture 12 - Selection of atomizers

Lecture 13 - Spray measurement characteristics

Lecture 14 - Spray measurements techniques

Lecture 15 - Non-intrusive spray measurements techniques

Lecture 16 - Non-intrusive spray measurements techniques

Lecture 17 - Linear stability analysis – Introduction

Lecture 18 - Linear stability analysis- Kelvin-Helmholtz instability - 1

Lecture 19 - Linear stability analysis- Kelvin-Helmholtz instability - 2

Lecture 20 - Linear stability analysis- Kelvin-Helmholtz instability - 3

Lecture 21 - Linear stability analysis procedure

Lecture 22 - Linear stability analysis - Cylindrical jet instability - 1

Lecture 23 - Linear stability analysis - Cylindrical jet instability - 2

Lecture 24 - Linear stability analysis - Planar Liquid Sheet instability - 1

Lecture 25 - Linear stability analysis - Planar Liquid Sheet instability - 2

Lecture 26 - Design of pressure swirl atomizer - 1

Lecture 27 - Design of pressure swirl atomizer - 2

Lecture 28 - Design of pressure swirl atomizer - 3

Lecture 29 - Design of pressure swirl atomizer - 4

Lecture 30 - Secondary atomization-Dimensionless parameters

Lecture 31 - Secondary atomization-Modes of breakup - 1

[Lecture 32 - Secondary atomization-Modes of breakup - 2](#)

[Lecture 33 - Multiphase modelling](#)

[Lecture 34 - Multiphase modelling](#)

[Lecture 35 - Multiphase flow modelling basics](#)

[Lecture 36 - Multiphase modelling “ Selection of model - 1](#)

[Lecture 37 - Multiphase modelling “ Selection of model - 2](#)

[Lecture 38 - Multiphase modelling - Governing equations](#)

[Lecture 39 - Droplet evaporation](#)

[Lecture 40 - Droplet combustion](#)

[Lecture 41 - Spray combustion](#)

NPTEL : Conduction And Radiation (Mechanical Engineering)

Co-ordinators : Prof. C. Balaji

Lecture 1 - Importance of Thermal Radiation

Lecture 2 - Blackbody definition

Lecture 3 - Solid angle, spectral radiation intensity

Lecture 4 - Radiation pressure and radiation energy density

Lecture 5 - Relationship between ϵ_λ and ϵ_T and Candidate blackbody distribution functions

Lecture 6 - Candidate blackbody distribution functions (Continued...)

Lecture 7 - Planck's blackbody radiation distribution function

Lecture 8 - Planck's distribution and Wien's displacement law

Lecture 9 - Universal blackbody function

Lecture 10 - Emissivity

Lecture 11 - Emissivity (Continued...)

Lecture 12 - Emissivity (Continued...)

Lecture 13 - Kirchoff law, Absorptivity

Lecture 14 - Kirchoff law, Absorptivity (Continued...)

Lecture 15 - Problems on emissivity, absorptivity

Lecture 16 - Reflectivity

Lecture 17 - Transmissivity

Lecture 18 - Problems on reflectivity and transmissivity

Lecture 19 - Radiation heat transfer between surfaces

Lecture 20 - View factor

Lecture 21 - View factor (Continued...)

Lecture 22 - View factor (Continued...)

Lecture 23 - Enclosure analysis

Lecture 24 - Enclosure analysis (Continued...)

Lecture 25 - Enclosure analysis - Gray surface

Lecture 26 - Enclosure analysis - Non gray surfaces

Lecture 27 - Radiation in participating media

Lecture 28 - Solution to the RTE

Lecture 29 - Concept of mean beam length

Lecture 30 - Enclosure analysis in the presence of absorbing / emitting gas

Lecture 31 - Emissivities and absorptivities of Gas mixtures

[Lecture 32 - Conduction - Introduction](#)

[Lecture 33 - Conduction - Energy equation](#)

[Lecture 34 - Conduction - 1D, steady state](#)

[Lecture 35 - Conduction - 1D, heat generation](#)

[Lecture 36 - Fin heat transfer - I](#)

[Lecture 37 - Fin heat transfer - II](#)

[Lecture 38 - Conduction - Cylindrical and Spherical geometries](#)

[Lecture 39 - Transient conduction](#)

[Lecture 40 - Transient conduction \(Continued...\)](#)

[Lecture 41 - Two dimensional steady state conduction](#)

[Lecture 42 - Analytical solution for Laplace equation](#)

[Lecture 43 - Numerical methods in conduction](#)

[Lecture 44 - Numerical methods in conduction \(Continued...\)](#)

[Lecture 45 - Conduction with change of phase](#)

[Lecture 46 - Conduction with change of phase \(Continued...\)](#)

[Lecture 1 - Introduction](#)

[Lecture 2 - Introduction / Fundamental Ideas](#)

[Lecture 3 - Fundamental Ideas](#)

[Lecture 4 - Fundamental Ideas](#)

[Lecture 5 - Fundamental Ideas / Normal Shock Waves](#)

[Lecture 6 - Normal Shock Waves](#)

[Lecture 7 - Normal Shock Waves / Rayleigh Flow](#)

[Lecture 8 - Rayleigh Flow](#)

[Lecture 9 - Rayleigh Flow](#)

[Lecture 10 - Rayleigh Flow / Fanno Flow](#)

[Lecture 11 - Fanno Flow](#)

[Lecture 12 - Fanno Flow](#)

[Lecture 13 - Fanno Flow / Quasi One Dimensional Flows](#)

[Lecture 14 - Quasi One Dimensional Flows](#)

[Lecture 15 - Quasi One Dimensional Flows](#)

[Lecture 16 - Quasi One Dimensional Flows](#)

[Lecture 17 - Quasi One Dimensional Flows](#)

[Lecture 18 - Quasi One Dimensional Flows](#)

[Lecture 19 - Quasi One Dimensional Flows](#)

[Lecture 20 - Oblique Shock Waves](#)

[Lecture 21 - Oblique Shock Waves](#)

[Lecture 22 - Oblique Shock Waves](#)

[Lecture 23 - Oblique Shock Waves / Prandtl Meyer Waves](#)

[Lecture 24 - Prandtl Meyer Waves](#)

[Lecture 25 - Prandtl Meyer Waves](#)

[Lecture 26 - Propulsion - an Introduction](#)

[Lecture 27 - Components of the Gas Turbine Engine](#)

[Lecture 28 - Components of the Gas Turbine Engine](#)

[Lecture 29 - Components of the Gas Turbine Engine](#)

[Lecture 30 - Components of the Gas Turbine Engine](#)

[Lecture 31 - Components of the Gas Turbine Engine / Thermodynamic Analysis of the Engine](#)

[Lecture 32 - Thermodynamic Analysis of the Engine](#)

[Lecture 33 - Thermodynamic Analysis of the Engine](#)

[Lecture 34 - Calculations for Thrust and Fuel Consumption](#)

[Lecture 35 - Calculations for Thrust and Fuel Consumption](#)

[Lecture 36 - Calculations for Thrust and Fuel Consumption / Emerging Trends](#)

[Lecture 37 - Emerging Trends / Ramjets](#)

[Lecture 38 - Ramjets](#)

[Lecture 39 - Ramjets / Scramjets](#)

[Lecture 40 - Scramjets](#)

[Lecture 1 - Introduction and Scaling](#)

[Lecture 2 - Scaling](#)

[Lecture 3 - Micro-scale fluid mechanics](#)

[Lecture 4 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 5 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 6 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 7 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 8 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 9 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 10 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 11 - Capillary Flows](#)

[Lecture 12 - Capillary Flows \(Continued...\)](#)

[Lecture 13 - Capillary Flows and Electrokinetics](#)

[Lecture 14 - Electrokinetics](#)

[Lecture 15 - Electrokinetics \(Continued...\)](#)

[Lecture 16 - Electrokinetics \(Continued...\)](#)

[Lecture 17 - Electrokinetics \(Continued...\)](#)

[Lecture 18 - Electrokinetics \(Continued...\)](#)

[Lecture 19 - Electrokinetics \(Continued...\)](#)

[Lecture 20 - Electrokinetics and Magnetophoresis](#)

[Lecture 21 - Microfabrication Techniques](#)

[Lecture 22 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 23 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 24 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 25 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 26 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 27 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 28 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 29 - Micropump](#)

[Lecture 30 - Micropump \(Continued...\)](#)

[Lecture 31 - Microvalve](#)

[Lecture 32 - Microvalve \(Continued...\)](#)

[Lecture 33 - Microvalve \(Continued...\)](#)

[Lecture 34 - Micro Flow Sensor and Micro mixers](#)

[Lecture 35 - Micro mixers](#)

[Lecture 36 - Micro mixers \(Continued...\)](#)

[Lecture 37 - Micro droplets](#)

[Lecture 38 - Micro reactors \(Continued...\)](#)

[Lecture 39 - Micro needles and Microparticle separation](#)

[Lecture 40 - Few applications of microfluidics](#)

[Lecture 41 - Lab Demo](#)

NPTEL : Convective Heat Transfer (Mechanical Engineering)

Co-ordinators : Dr. Arvind Pattamatta, Prof. Ajit K. Kolar

- Lecture 1 - Introduction to convective heat transfer - Part 1
- Lecture 2 - Introduction to convective heat transfer - Part 2
- Lecture 3 - Continuity Equation
- Lecture 4 - Momentum and Energy Equations
- Lecture 5 - Energy Equation
- Lecture 6 - Reynolds Transport Theorem
- Lecture 7 - Entropy Generation and streamfunction-vorticity formulation
- Lecture 8 - Couette flow - Part 1
- Lecture 9 - Couette flow - Part 2
- Lecture 10 - Couette flow - Part 3
- Lecture 11 - Boundary layer approximation
- Lecture 12 - Laminar External flow past flat plate (Blasius Similarity Solution)
- Lecture 13 - Numerical solution to the Blasius equation and similarity solution to heat transfer
- Lecture 14 - Pohlhausen similarity solution and flows including pressure gradient (Falkner-Skan)
- Lecture 15 - Falkner skan solutions for heat transfer
- Lecture 16 - Similarity solution for flow and heat transfer with transpiration at walls
- Lecture 17 - Thermal boundary layer in high speed flows
- Lecture 18 - Approximate(Integral) methods for laminar external flow and heat transfer
- Lecture 19 - Integral method for laminar external thermal boundary layer over isothermal surface
- Lecture 20 - Integral method for flows with pressure gradient (von Karman-Pohlhausen method)
- Lecture 21 - Integral method with pressure gradient: heat transfer
- Lecture 22 - Heat transfer across a circular cylinder: Walz approximation
- Lecture 23 - Duhamel's method for varying surface temperature
- Lecture 24 - Laminar External heat transfer with non uniform surface temperature
- Lecture 25 - Laminar internal forced convection - fundamentals
- Lecture 26 - Hydrodynamically and thermally fully developed internal laminar flows
- Lecture 27 - Fully developed laminar internal flow and heat transfer
- Lecture 28 - Shooting method for fully developed heat transfer and thermal entry length problem
- Lecture 29 - Thermal entry length problem with plug velocity profile: Graetz problem
- Lecture 30 - Extended Graetz problem for parabolic velocity profile
- Lecture 31 - Extended Graetz problem

[Lecture 32 - Extended Graetz problem with wall flux boundary condition](#)

[Lecture 33 - Approximate method for laminar internal flows](#)

[Lecture 34 - Integral method for thermal entry length problem](#)

[Lecture 35 - Introduction to Natural Convection Heat Transfer](#)

[Lecture 36 - Similarity Solution in Natural Convection for Vertical isothermal Plate - Part 1](#)

[Lecture 37 - Similarity Solution in Natural Convection for Vertical isothermal Plate - Part 2](#)

[Lecture 38 - Similarity Solution in Natural Convection for Vertical isoflux Plate](#)

[Lecture 39 - Approximate Method in Natural Convection Heat Transfer](#)

[Lecture 40 - Natural Convection in Other Configurations](#)

[Lecture 41 - Turbulent Convective Heat Transfer : RANS Equations - Part 1](#)

[Lecture 42 - Turbulent Convective Heat Transfer : RANS Equations - Part 2](#)

[Lecture 43 - Analogies in Turbulent Convective Heat Transfer - Part 1](#)

[Lecture 44 - Analogies in Turbulent Convective Heat Transfer - Part 2](#)

Lecture 1 - Loud Bang and Disruption

Lecture 2 - Blast Wave in an Explosion: Predictions from Dimensional Considerations

Lecture 3 - Typical Examples of Explosions and Classification

Lecture 4 - Shock Hugoniot and Rayleigh Line

Lecture 5 - Properties behind a Constant Velocity Shock

Lecture 6 - Blast waves: Concentration of Mass at the Front, Snow Plow Approximation, Energy conservation in a Blast wave

Lecture 7 - Blast waves: Decay of a strong Blast wave, Explosion Length, Sach's Scaling, Over pressure, Cranz Hopkinson Scaling law of Overpressure

Lecture 8 - Blast Waves: Overpressure and Impulse in the Near and Far Field, Examples, Introduction to Impulse

Lecture 9 - Blast Waves: Non-dimensional Impulse, Cranz -Hopkinson Scaling, Missiles, Fragments and Shrapnel, Craters, Examples

Lecture 10 - Blast Waves: Interaction with Objects, Reflection and Transmission of Blast Waves, Impedance

Lecture 11 - Blast Waves: Amplification of Reflected Blast Waves; Role of Impedance, Spalling, Damage to Organs containing Air, Mushroom Cloud in an Explosion, Examples

Lecture 12 - Blast Waves: Damage from Blast Waves, Examples, Multiple Spikes in an Impulse, Iso-damage Curve on an Overpressure-Impulse Diagram, Complex Structures

Lecture 13 - Energy Release in a Chemical Reaction: Moles, Internal Chemical Energy, Standard Heats of Formation

Lecture 14 - Energy Release: Stoichiometry, Equivalence Ratio and Heat Release in Fuel Rich and Oxidizer Rich Compounds

Lecture 15 - Energy Release: Examples of Energy Release Calculations, Higher and Lower Calorific Values, Internal Energy of Formation

Lecture 16 - Rate of Energy Release: Concentration, Activation Energy, Energy Release Profile

Lecture 17 - Thermal Theory of Explosion

Lecture 18 - Thermal Theory

Lecture 19 - Role of Chain Carriers in an Explosion

Lecture 20 - Combustion - I

Lecture 21 - Combustion - II

Lecture 22 - Case Histories of Explosions involving Volatile Liquids

Lecture 23 - Detonation

Lecture 24 - Structure of Detonations

Lecture 25 - Realizable States in a Detonation

Lecture 26 - One Dimensional Model of Detonation

Lecture 27 - Case Histories of Explosions involving Detonation or Quasi-Detonation

Lecture 28 - Explosions in Confined and Unconfined Geometries

Lecture 29 - Dust Explosions - I

[Lecture 30 - Dust Explosions - II](#)

[Lecture 31 - Physical Explosions](#)

[Lecture 32 - Rupture of Cryogenic Storage Vessels and Pressure Vessels](#)

[Lecture 33 - Condensed Phased Explosives Based on Hydrocarbons](#)

[Lecture 34 - Condensed Phase Explosives and their Properties](#)

[Lecture 35 - TNT Equivalence and Yield of an Explosion](#)

[Lecture 36 - Atmospheric Dispersion](#)

[Lecture 37 - Modeling Atmospheric Dispersion](#)

[Lecture 38 - Explosions Involving Atmospheric Dispersion](#)

[Lecture 39 - Quantification of Damages in an Explosion](#)

[Lecture 40 - Risk Analysis for an Explosion](#)

- Lecture 1 - Introduction to Metrology
- Lecture 2 - Metrology terminologies
- Lecture 3 - Measurement errors
- Lecture 4 - Linear measuring instruments – 1 (Angle plate, steel rule, spring calipers)
- Lecture 5 - Linear measuring instruments – 2 (Combination set, Vernier calipers)
- Lecture 6 - Linear measuring instruments – 3 (Height gauge, Micrometers – 1)
- Lecture 7 - Linear measuring instruments – 4 (Micrometers – 2, Bore gauge)
- Lecture 8 - Linear measuring instruments – 5 (Dial indicators, thickness gauges, depth gauges)
- Lecture 9 - Manufacturing tolerances and fits
- Lecture 10 - Terminologies of limits fits and tolerances
- Lecture 11 - Numerical problems on fit and tolerances
- Lecture 12 - Selection of fits, Geometrical tolerances
- Lecture 13 - Positional tolerances
- Lecture 14 - Limit gauging - 1
- Lecture 15 - Limit gauging - 2
- Lecture 16 - Design of limit gauges
- Lecture 17 - Measurement of straightness, flatness and squareness
- Lecture 18 - Perpendicularity measurement
- Lecture 19 - Basics of surface roughness
- Lecture 20 - Surface finish parameters
- Lecture 21 - Stylus type surface finish measuring instruments
- Lecture 22 - Non-contact type surface finish measuring instruments
- Lecture 23 - Screw thread production and terminology
- Lecture 24 - Measurement of screw thread elements
- Lecture 25 - Introduction to gears
- Lecture 26 - Measurement of gear elements
- Lecture 27 - Angle measurement - 1
- Lecture 28 - Angle measurement - 2
- Lecture 29 - Radius measurement, Contact angle measurement
- Lecture 30 - Basics of interferometry
- Lecture 31 - Interferometers

[Lecture 32 - Introduction to comparators, Mechanical comparators](#)

[Lecture 33 - Electrical and electronic comparators, Optical comparators](#)

[Lecture 34 - Pneumatic comparators](#)

[Lecture 35 - Geometrical tests on lathe](#)

[Lecture 36 - Geometrical tests on pillar type drilling machine](#)

[Lecture 37 - Universal measuring machine \(UMM\) and Coordinate measuring machine \(CMM\)](#)

[Lecture 38 - CMM probes and CMM software](#)

[Lecture 39 - Feature measurement using CMM, Laser vision](#)

[Lecture 40 - In-process gauging and control](#)

[Lecture 41 - Stage position metrology](#)

[Lecture 42 - Micro and Nano stages, Nano technology instrumentation](#)

[Lecture 43 - Optical system design](#)

[Lecture 44 - Complex opto- mechanical assemblies, Metrology testing and certification services](#)

Lecture 1 - Introduction to the course

Lecture 2 - Newton's laws

Lecture 3 - Equilibrium

Lecture 4 - Example 1 - Statics

Lecture 5 - Example 2 - Rigid Body Systems

Lecture 6 - Example 3 - Rigid Body Systems

Lecture 7 - Structural Systems with rigid bodies

Lecture 8 - Types of 1-D Structural Elements

Lecture 9 - Axial members

Lecture 10 - Analysis of the truss system

Lecture 11 - Stability of Structural systems

Lecture 12 - Beams - Example 1

Lecture 13 - Beams - BMD and SFD

Lecture 14 - Beams - Loading, Shear and Bending Moment Relations

Lecture 15 - Static Friction

Lecture 16 - Friction - Solving Problems

Lecture 17 - Particle Kinematics - 1

Lecture 18 - Particle Kinematics - 2 (Example)

Lecture 19 - Particle Kinematics - Curvilinear Coordinates

Lecture 20 - Rigid Body Kinematics

Lecture 21 - Rotational Motion (Example 1)

Lecture 22 - Rotational Motion (Example 2)

Lecture 23 - Dynamics (Introduction)

Lecture 24 - Dynamics - Example 1

Lecture 25 - Dynamics - Example 2

Lecture 26 - Dynamics - Example 3

Lecture 27 - Dynamics - Example 4

Lecture 28 - Center of Percussion - Example

Lecture 29 - Impulse / Momentum - Example 1

Lecture 30 - Impulse / Momentum - Example 2

Lecture 31 - Impulse / Momentum - Example 3

[Lecture 32 - Impulse / Momentum - Example 4](#)

[Lecture 33 - Work Energy Methods - Example 1](#)

[Lecture 34 - Work Energy Methods - Example 2](#)

[Lecture 35 - Work Energy Methods - Example 3](#)

[Week 1 - Module-1](#)

[Week 1 - Module-2](#)

[Week 1 - Module-3](#)

[Week 1 - Module-4](#)

[Week 1 - Module-5](#)

[Week 2 - Module-1](#)

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[Week 2 - Module-4](#)

[Week 2 - Module-5](#)

[Week 3 - Module-1](#)

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[Week 3 - Module-3](#)

[Week 3 - Module-4](#)

[Week 3 - Module-5](#)

[Week 4 - Module-1](#)

[Week 4 - Module-2](#)

[Week 4 - Module-3](#)

[Week 4 - Module-4](#)

[Week 4 - Module-5](#)

[Week 5 - Module-1](#)

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[Week 5 - Module-3](#)

[Week 5 - Module-4](#)

[Week 5 - Module-5](#)

[Week 5 - Module-6](#)

[Week 6 - Module-1](#)

[Week 6 - Module-2 - Part 1](#)

[Week 6 - Module-2 - Part 2](#)

[Week 6 - Module-3](#)

[Week 6 - Module-4](#)

[Week 6 - Module-5](#)

[Week 7 - Module-1](#)

[Week 7 - Module-2](#)

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[Week 8 - Module-1](#)

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[Week 8 - Module-3](#)

[Week 8 - Module-4](#)

[Week 8 - Module-5](#)

[Week 8 - Module-6](#)

[Conclusion](#)

Lecture 1 - Review of fundamentals of fluid mechanics - I

Lecture 2 - Review of fundamentals of fluid mechanics - II

Lecture 3 - Concept of a Boundary Layer (BL) - I

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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](#)

NPTEL : Theory of Mechanism (Mechanical Engineering)

Co-ordinators : Prof. Sujatha Srinivasan

- 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 Centroids
- 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 Crystal 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](#)

[Lecture 41 - Laminar Diffusion Flames - Part 1 - Theory of gas jets](#)

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Co-ordinators : Prof. Babu Viswanathan

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Co-ordinators : Prof. C.Balaji, Prof.S. Balaji

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Co-ordinators : Prof. Aditya G. Nair

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Co-ordinators : Dr. D. B. Karunakar

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NPTEL : Vibration control (Mechanical Engineering)

Co-ordinators : Dr. S. P. Harsha

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NPTEL : Strength of Materials (Mechanical Engineering)

Co-ordinators : Dr. S.P. Harsha

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- 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)
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- Lecture 9 - Compounding frequency of Interest: Nominal and Effective interest rates
- Lecture 10 - Problem solving on frequency compounding of interest and gradient series factors
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- 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
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- Lecture 28 - Breakeven analysis, Effect of fixed and variable cost on BEP.
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- Lecture 4 - Material and Manufacturing Processes
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