NPTEL Video Course - Physics - Electromagnetic Theory (Prof. D.K. Ghosh)

Subject Co-ordinator - Prof. D.K. Ghosh

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Scalar field and its Gradient
Lecture 2 - Line and Surface Integrals
Lecture 3 - Divergence and Curl of Vector Fields
Lecture 4 - Conservative Field, Stoke's Theorem
Lecture 5 - Laplacian
Lecture 6 - Electric Field Potential
Lecture 7 - Gauss's Law, Potential
Lecture 8 - Electric Field and Potential
Lecture 9 - Potential and Potential Energy - I
Lecture 10 - Potential and Potential Energy - II
Lecture 11 - Potential and Potential Energy - III
Lecture 12 - Coefficients of Potential and Capacitance
Lecture 13 - Poission and Laplace Equation
Lecture 14 - Solutions of Laplace Equation - I
Lecture 15 - Solutions of Laplace Equation - II
Lecture 16 - Solutions of Laplace Equation - III
Lecture 17 - Special Techniques - I
Lecture 18 - Special Techniques - II
Lecture 19 - Special Techniques - III
Lecture 20 - Dielectrics - I
Lecture 21 - Dielectrics - II
Lecture 22 - Dielectrics - III
Lecture 23 - Equation of Continuity
Lecture 24 - a) Force between current loops b) Magnetic Vector Potential
Lecture 25 - Magnetic Vector Potential
Lecture 26 - Boundary Conditions
Lecture 27 - Magnetized Material
Lecture 28 - Magentostatics (Continued...), Time Varying Field (Introduction)
Lecture 29 - Faraday's Law and Inductance

Lecture 30 - Maxwell's Equations
Lecture 31 - Maxwell's Equations and Conservation Laws
Lecture 32 - Conservation Laws
Lecture 33 - a) Angular Momentum Conservation b) Electromagnetic Waves
Lecture 34 - Electromagnetic Waves
Lecture 35 - Propagation of Electromagnetic Waves in a metal
Lecture 36 - Waveguides - I
Lecture 37 - Waveguides - II
Lecture 38 - Resonating Cavity
Lecture 39 - Radiation - I
Lecture 40 - Radiation - II

NPTEL Video Course - Physics - Special Theory of Relativity

Subject Co-ordinator - Prof. Shiva Prasad

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Problem with Classical Physics
Lecture 2 - Michelson-Morley Experiment
Lecture 3 - Postulates of Special Theory of Relativity and Galilean Transformation
Lecture 4 - Look out for a New Transformation
Lecture 5 - Lorentz Transformation
Lecture 6 - Length Contraction and Time Dilation
Lecture 7 - Examples of Length Contraction and Time Dilation
Lecture 8 - Velocity Transformation and Examples
Lecture 9 - A Three Event Problem
Lecture 10 - A Problem involving Light and Concept of Casuality
Lecture 11 - Problems involving Casuality and Need to Redefine Momentum
Lecture 12 - Minikowski Space and Four Vectors
Lecture 13 - Proper Time a Four Scalar
Lecture 14 - Velocity Four Vector
Lecture 15 - Momentum Energy Four Vector
Lecture 16 - Relook at Collision Problems
Lecture 17 - Zero Rest Mass Particle and Photon
Lecture 18 - Doppler Effect in Light
Lecture 19 - Example in C-Frame
Lecture 20 - Force in Relativity
Lecture 21 - Force Four-Vector
Lecture 22 - Electric & Magnetic Field Transformation
Lecture 23 - Example of EM Field Transformation
Lecture 24 - Current Density Four Vector and Maxwell Equation

NPTEL Video Course - Physics - NOC:Quantum Information and Computing

Subject Co-ordinator - Prof.Dipan Ghosh

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Why Quantum Computing?
Lecture 2 - Postulates of Quantum Mechanics - I
Lecture 3 - Postulates of Quantum Mechanics - II
Lecture 4 - Qubit - The smallest unit
Lecture 5 - Qubit - Bloch sphere representation
Lecture 6 - Multiple Qubit States and Quantum Gates
Lecture 7 - Quantum Gates
Lecture 8 - Quantum Circuts
Lecture 9 - No-Cloning Theorem and Quantum Teleportation
Lecture 10 - Super Dense Coding
Lecture 11 - Density Matrix - I
Lecture 12 - Density Matrix - II
Lecture 13 - Bloch Sphere and Density Matrix
Lecture 14 - Measurement Postulates - I
Lecture 15 - Measurement Postulates - II
Lecture 16 - Simple Algorithms-Deutsch Algorithm
Lecture 17 - Deutsch-Josza and Bernstein - Vazirani Algorithms
Lecture 18 - Simon Problem
Lecture 19 - Grover's Search Algorithm - I
Lecture 20 - Grover's Search Algorithm - II
Lecture 21 - Grover's Search Algorithm - III
Lecture 22 - Grover's Search Algorithm - IV
Lecture 23 - Quantum Fourier Transform
Lecture 24 - Period Finding and QFT
Lecture 25 - Implementing QFT
Lecture 26 - Implementing QFT-3 qubits (and more)
Lecture 27 - Shor's Factorization Algorithm
Lecture 28 - Shor's Factorization Algorithm-Implementation
Lecture 29 - Shor's Algorithm-Continued Fraction

Lecture 30 - Quantum Error Correction - I
Lecture 31 - Quantum Error Correction - II Three Qubit Code
Lecture 32 - Quantum Error Correction - III Shor's 9 Qubit Code - I
Lecture 33 - Quantum Error Correction - IV Shor's 9 Qubit Code - II
Lecture 34 - Classical Information Theory
Lecture 35 - Shannon Entropy
Lecture 36 - Shannon's Noiseless Coding Theorem
Lecture 37 - Ven Neumann Entropy
Lecture 38 - EPR and Bell's Inequalities - I
Lecture 39 - EPR and Bell's Inequalities - II
Lecture 40 - EPR and Bell's Inequalities - III
Lecture 41 - Cryptography-RSA Algorithm - I
Lecture 42 - Cryptography-RSA Algorithm - II
Lecture 43 - Quantum Cryptography - I
Lecture 44 - Quantum Cryptography - II
Lecture 45 - Experimental Aspects of Quantum Computing - I
Lecture 46 - Experimental Aspects of Quantum Computing - II

NPTEL Video Course - Physics - NOC:Theory of Groups for Physics Applications

Subject Co-ordinator - Prof. Urjit A. Yajnik

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Algebraic Preliminaries
Lecture 3 - Basic Group Concepts and Low Order Groups - I
Lecture 4 - Basic Group Concepts and Low Order Groups - II
Lecture 5 - Lagrange's Theorem and Cayley's Theorem - I
Lecture 6 - Lagrange's Theorem and Cayley's Theorem - II
Lecture 7 - Factor Group Conjugacy Classes - I
Lecture 8 - Factor Group Conjugacy Classes - II
Lecture 9 - Cycle Structures and Molecular Notation - I
Lecture 10 - Cycle Structures and Molecular Notation - II
Lecture 11 - Cycle Structures and Classification - I
Lecture 12 - Cycle Structures and Classification - II
Lecture 13 - Point Group Notation and Factor Group - I
Lecture 14 - Point Group Notation and Factor Group - II
Lecture 15 - Representation Theory - I
Lecture 16 - Representation Theory - II
Lecture 17 - Representation Theory - III
Lecture 18 - Representation Theory - IV
Lecture 19 - Schur's Lemma and Orthogonality Theorem - I
Lecture 20 - Schur's Lemma and Orthogonality Theorem - II
Lecture 21 - Orthogonality For Characters - I
Lecture 22 - Orthogonality For Characters - II
Lecture 23 - Character Tables and Molecular Applications - I
Lecture 24 - Character Tables and Molecular Applications - II
Lecture 25 - Preliminaries About The Continuum - I
Lecture 26 - Preliminaries About The Continuum - II
Lecture 27 - Classical Groups - I
Lecture 28 - Classical Groups - II
Lecture 29 - Classical Groups-Topology - I

Lecture 30 - Classical Groups-Topology - II
Lecture 31 - SO(3) And Matrix Exponent - I
Lecture 32 - SO(3) And Matrix Exponent - II
Lecture 33 - Generators, Discussion Of Lie's Theorems - I
Lecture 34 - Generators, Discussion Of Lie's Theorems - II
Lecture 35 - Group Algebras; SO(3)-SU(2) Correspondence - I
Lecture 36 - Group Algebras; SO(3)-SU(2) Correspondence - II
Lecture 37 - SO(3), SU(2) Representations - I
Lecture 38 - SO(3), SU(2) Representations - II
Lecture 39 - Representation On Function Spaces - I
Lecture 40 - Representation On Function Spaces - II
Lecture 41 - Lorentz Boosts, SO(3,1) Algebra - I
Lecture 42 - Lorentz Boosts, SO(3,1) Algebra - II
Lecture 43 - Representation Of Lorentz Group And Clifford Algebra - I
Lecture 44 - Representation Of Lorentz Group And Clifford Algebra - II
Lecture 45 - SU(3) And Lie's Classification - I
Lecture 46 - SU(3) And Lie's Classification - II
Lecture 47 - Fundamental Symmetries Of Physics - I
Lecture 48 - Fundamental Symmetries Of Physics - II

NPTEL Video Course - Physics - NOC:Quantum Mechanics-I

Subject Co-ordinator - Prof. Ramadevi

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Quantum Mechanics - I
Lecture 2 - Introduction to Quantum Mechanics - II
Lecture 3 - Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator - I
Lecture 4 - Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator - II
Lecture 5 - Tutorial 1 - Part I
Lecture 6 - Tutorial 1 - Part II
Lecture 7 - Bound States - I
Lecture 8 - Bound States - II
Lecture 9 - Conditions and Solutions for one Dimensional Bound States - I
Lecture 10 - Conditions and Solutions for one Dimensional Bound States - II
Lecture 11 - Tutorial 2
Lecture 12 - Linear Vector Space (LVS) - I
Lecture 13 - Linear Vector Space (LVS) - II
Lecture 14 - Linear Vector Space (LVS) - III
Lecture 15 - Basis for Operators and States in LVS - I
Lecture 16 - Basis for Operators and States in LVS - II
Lecture 17 - Tutorial 3 - Part I
Lecture 18 - Tutorial 3 - Part II
Lecture 19 - Function Spaces - I
Lecture 20 - Function Spaces - II
Lecture 21 - Postulates of Quantum Mechanics - I
Lecture 22 - Postulates of Quantum Mechanics - II
Lecture 23 - Tutorial 4 - Part I
Lecture 24 - Tutorial 4 - Part II
Lecture 25 - Classical vs Quantum Mechanics - I
Lecture 26 - Classical vs Quantum Mechanics - II
Lecture 27 - Compatible vs Incompatible Observable - I
Lecture 28 - Compatible vs Incompatible Observable - II
Lecture 29 - Tutorial 5 - Part I

Lecture 30 - Tutorial 5 - Part II
Lecture 31 - Tutorial 5 - Part III
Lecture 32 - Schrodinger and Heisenberg Pictures - I
Lecture 33 - Schrodinger and Heisenberg Pictures - II
Lecture 34 - Solutions to other Coupled Potential Energies - I
Lecture 35 - Solutions to other Coupled Potential Energies - II
Lecture 36 - Tutorial 6 - Part I
Lecture 37 - Tutorial 6 - Part II
Lecture 38 - Hydrogen Atom and Wave Functions, Angular Momentum Operators, Identical Particles - I
Lecture 39 - Hydrogen Atom and Wave Functions, Angular Momentum Operators, Identical Particles - II
Lecture 40 - Identical Particles and Quantum Computer - I
Lecture 41 - Identical Particles and Quantum Computer - II
Lecture 42 - Tutorial 7 - Part I
Lecture 43 - Tutorial 7 - Part II
Lecture 44 - Harmonic Oscillator - I
Lecture 45 - Harmonic Oscillator - II
Lecture 46 - Ladder Operators - I
Lecture 47 - Ladder Operators - II
Lecture 48 - Tutorial 8 - Part I
Lecture 49 - Tutorial 8 - Part II
Lecture 50 - Stern-Gerlach Experiment - I
Lecture 51 - Stern-Gerlach Experiment - II
Lecture 52 - Oscillator Algebra
Lecture 53 - Tutorial 9 - Part I
Lecture 54 - Tutorial 9 - Part II
Lecture 55 - Angular Momentum - I
Lecture 56 - Angular Momentum - II
Lecture 57 - Rotations Groups - I
Lecture 58 - Rotations Groups - II
Lecture 59 - Tutorial 10 - Part I
Lecture 60 - Tutorial 10 - Part II
Lecture 61 - Addition of Angular Momentum - I
Lecture 62 - Addition of Angular Momentum - II
Lecture 63 - Clebsch-Gordan Coe cients - I
Lecture 64 - Clebsch-Gordan Coe cients - II
Lecture 65 - Tutorial 11 - Part I
Lecture 66 - Tutorial 11 - Part II
Lecture 67 - Clebsch-Gordan Coe cients - III
Lecture 68 - Tensor Operators and Wigner-Eckart Theorem - I

Lecture 69 - Tensor Operators and Wigner-Eckart Theorem - II
Lecture 70 - Tensor Operators and Wigner-Eckart Theorem - III
Lecture 71 - Tutorial 12

NPTEL Video Course - Physics - NOC:Path Integral and Functional Methods in Quantum Field Theory

Subject Co-ordinator - Prof. Urjit A. Yajnik

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Quantum Theory Fundamental Quantisation - I
Lecture 2 - Quantum Theory Fundamental Quantisation - II
Lecture 3 - Path Integral Formulation - I
Lecture 4 - Path Integral Formulation - II
Lecture 5 - Path Integral Formulation - III
Lecture 6 - Path Integral Formulation - IV
Lecture 7 - Correlation Functions - I
Lecture 8 - Correlation Functions - II
Lecture 9 - Generating Functional, Forced Harmonic Oscillator - I
Lecture 10 - Generating Functional, Forced Harmonic Oscillator - II
Lecture 11 - Generating Function in Field Theory - I
Lecture 12 - Generating Function in Field Theory - II
Lecture 13 - Effective Potential - I
Lecture 14 - Effective Potential - II
Lecture 15 - Effective Potential - III
Lecture 16 - Effective Potential - IV
Lecture 17 - Asymptotic Theory - I
Lecture 18 - Asymptotic Theory - II
Lecture 19 - Asymptotic Condition Kallen-Lehmann representation - I
Lecture 20 - Asymptotic Condition Kallen-Lehmann representation - II
Lecture 21 - Gauge Invariance - Minimal Coupling
Lecture 22 - Gauge Invariance - Geometric Picture
Lecture 23 - Gauge Invariance - Abelian Case
Lecture 24 - Gauge Invariance - Non-abelian case
Lecture 25 - Yang Mills Theory - Coupling to Matter
Lecture 26 - Yang Mills Theory - Physical Content
Lecture 27 - Yang Mills Theory Constraint Dynamics - I
Lecture 28 - Yang Mills Theory Constraint Dynamics - II
Lecture 29 - Gauge Fixing and Faddeev Popov Ghosts - I

Lecture 30 - Gauge Fixing and Faddeev Popov Ghosts - II
Lecture 31 - Topological Vacuum of Yang Mills Theories - I
Lecture 32 - Topological Vacuum of Yang Mills Theories - II

NPTEL Video Course - Physics - NOC:Physics of Biological Systems

Subject Co-ordinator - Prof. Mithun Mitra

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - DNA packing and structure
Lecture 3 - Shape and function
Lecture 4 - Numbers and sizes
Lecture 5 - Spatial scales and System variation
Lecture 6 - Timescales in Biology
Lecture 7 - Random walks and Passive diffusion
Lecture 8 - Random walks to model Biology
Lecture 9 - Derivation of FRAP equations
Lecture 10 - Drift-diffusion equations
Lecture 11 - Solutions of the drift-diffusion equations
Lecture 12 - The cell signaling problem
Lecture 13 - Cell Signalling and Capture Probability of absorbing sphere
Lecture 14 - Capture probability of reflecting sphere
Lecture 15 - Mean capture time
Lecture 16 - Introduction to fluids, viscosity and reynolds number
Lecture 17 - Introduction to the navier stokes equation
Lecture 18 - Understanding reynolds number
Lecture 19 - Life at low reynolds number
Lecture 20 - Various phenomena at low reynolds number
Lecture 21 - Bacterial flagellar motion
Lecture 22 - Rotating flagellum
Lecture 23 - Energy and equilibrium
Lecture 24 - Binding problems
Lecture 25 - Transcription and translation
Lecture 26 - Internal states of macromolecules
Lecture 27 - Protein modification problem
Lecture 28 - Haemoglobin-Oxygen binding problem
Lecture 29 - Freely jointed polymer model

Lecture 30 - Entropic springs and persistence length
Lecture 31 - Freely rotating chain model and radius of gyration
Lecture 32 - The hierarchical chromatin packing model
Lecture 33 - FISH and DNA looping
Lecture 34 - Nucleosomes as barriers, Hi-C, and contact probabilities
Lecture 35 - Deriving the full force extension curve
Lecture 36 - Random walk models for proteins
Lecture 37 - Hydrophobic polar protein model
Lecture 38 - Diffusion in crowded environments
Lecture 39 - Depletion interactions
Lecture 40 - Examples and implications of depletion interactions
Lecture 41 - Introduction to Biological dynamics
Lecture 42 - Introduction to rate equations
Lecture 43 - Separation of timescales in enzyme kinetics
Lecture 44 - Structure and treadmilling of actins and microtubules
Lecture 45 - Average length of polymers in equilibrium
Lecture 46 - Growth rate of polymers
Lecture 47 - Dynamic treadmilling in microtubules
Lecture 48 - Introduction to molecular motors
Lecture 49 - Force generation by molecular motors
Lecture 50 - Models of motor motion
Lecture 51 - molecular motors
Lecture 52 - Free energies of motor for stepping
Lecture 53 - Two state models
Lecture 54 - cooperative transport of cargo
Lecture 55 - Cytoskeleton as a motor
Lecture 56 - translocation ratchet
Lecture 57 - Spatial pattern in biology
Lecture 58 - Some common spatial patterns in biology
Lecture 59 - reaction diffusion and spatial pattern
Lecture 60 - Pattern formation in reaction diffusion system with stability
Lecture 61 - Condition for destablization in pattern formation
Lecture 62 - Schnakenberg kinetics

NPTEL Video Course - Physics - NOC:Group Theory Methods in Physics

Subject Co-ordinator - Prof. Ramadevi

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - I
Lecture 2 - Introduction - II
Lecture 3 - Normal subgroup, Coset, Conjugate group
Lecture 4 - Factor group, Homomorphism, Isomorphism
Lecture 5 - Factor group, Homomorphism, Isomorphism
Lecture 6 - Conjugacy Classes
Lecture 7 - Permutation Groups
Lecture 8 - Cycle Structure
Lecture 9 - Cycle Structure (Continued...)
Lecture 10 - Young Diagram and Molecular Symmetry
Lecture 11 - Point Groups
Lecture 12 - Symmetries of Molecules, Schoenflies Notation
Lecture 13 - Symmetries of Molecules, Stereographic Projection
Lecture 14 - Examples of Molecular Symmetries and Proof of Cayley Theorem
Lecture 15 - Matrix Representation of Groups - I
Lecture 16 - Matrix Representation of Groups - II
Lecture 17 - Reducible and Irreducible Representation - I
Lecture 18 - Reducible and Irreducible Representation - II
Lecture 19 - Great Orthogonality Theorem and Character Table - I
Lecture 20 - Great Orthogonality Theorem and Character Table - II
Lecture 21 - Mulliken Notation, Character Table and Basis
Lecture 22 - Tensor Product of Representation
Lecture 23 - Tensor Product and Projection Operator - I
Lecture 24 - Tensor Product and Projection Operator - II
Lecture 25 - Tensor Product and Projection Operator with an example
Lecture 26 - Binary Basis and Observables
Lecture 27 - Selection Rules
Lecture 28 - Selection Rules and Molecular Vibrations
Lecture 29 - Molecular vibration normal modes

Lecture 30 - Molecular vibration normal modes
Lecture 31 - Molecular vibration modes using projection operator
Lecture 32 - Vibrational representation of character
Lecture 33 - Infrared Spectra and Raman Spectra
Lecture 34 - Introduction to continuous group
Lecture 35 - Generators of translational and rotational transformation
Lecture 36 - Generators of Lorentz transformation
Lecture 37 - Introduction to O(3) and SO(3) group
Lecture 38 - SO(n) and Lorentz group
Lecture 39 - Generalised orthogonal group and Lie algebra
Lecture 40 - Subalgebra of Lie algebra
Lecture 41 - gl(2,C) and sl(2,C) group
Lecture 42 - U(n) and SU(n) group
Lecture 43 - Symplectic group
Lecture 44 - SU(2) and SU(3) groups
Lecture 45 - Rank, weight and weight vector
Lecture 46 - Weight vector, root vector, comparison between SU(2) and SU(3) algebra
Lecture 47 - Root diagram, simple roots, adjoint representation
Lecture 48 - SU(2) sub-algebra, Dynkin diagrams
Lecture 49 - Fundamental weights, Young diagrams, dimension of irreducible representation
Lecture 50 - Young diagrams and tensor products
Lecture 51 - Tensor product, Wigner - Eckart theorem
Lecture 52 - Tensor product of irreducible representation 1
Lecture 53 - Tensor product of irreducible representation 2
Lecture 54 - Clebsch - Gordan coefficients
Lecture 55 - 1) Quadrupole moment tensor (Wigner-Eckart theorem) 2) Decimet Baryon wavefunction
Lecture 56 - Higher dimensional multiplets in the quark model
Lecture 57 - Symmetry breaking in continuous groups
Lecture 58 - Dynamical symmetry in hydrogen atom
Lecture 59 - Hydrogen atom energy spectrum and degeneracy using Runge-Lenz vector

NPTEL Video Course - Physics - NOC:Neutron Scattering for Condensed Matter Studies

Subject Co-ordinator - Prof. Saibal Basu

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Neutrons as Probe of Condensed Matter
Lecture 2 - Sources for thermal neutrons used in neutron scattering
Lecture 3
Lecture 4 - Calculating Neutron Scattering cross-section
Lecture 5
Lecture 6 - Scattering theory and introducing dynamics in the formalism
Lecture 7 - Scattering theory and introducing dynamics in the formalism
Lecture 8 - Scattering theory and introducing dynamics in the formalism
Lecture 9 - Scattering law's correlation with double-Fourier transform of real space correlation function
Lecture 10 - Scattering law's correlation with double-Fourier transform of real space correlation function
Lecture 11 - Correlation function to resolution and accessible(Q,Ã•â °). Introducing experimental facilities
Lecture 12 - Correlation function to resolution and accessible(Q,Ã•â °). Introducing experimental facilities
Lecture 13 - Correlation function to resolution and accessible(Q,Ã•â °). Introducing experimental facilities
Lecture 14 - Correlation function to resolution and accessible(Q,Ã•â °). Introducing experimental facilities
Lecture 15 - Introducing resolution and components of neutron scattering facilities.
Lecture 16 - Introducing resolution and components of neutron scattering facilities.
Lecture 17 - Continue with neutron scattering set up and its components like collimators, filters, detectors
Lecture 18 - Continue with neutron scattering set up and its components like collimators, filters, detectors
Lecture 19 - Describe the operation of various kinds of neutron detectors
Lecture 20 - Describe the operation of various kinds of neutron detectors
Lecture 21 - Introducing neutron choppers, velocity selectors and polarizers, some important components of be
Lecture 22 - Introducing neutron choppers, velocity selectors and polarizers, some important components of be
Lecture 23 - Neutron polarizers and spin-flippers
Lecture 24 - Neutron polarizers and spin-flippers
Lecture 25 - Diffraction at various length scales at a reactor and at a spallation neutron source
Lecture 26 - Diffraction at various length scales at a reactor and at a spallation neutron source
Lecture 27 - Application of neutron crystallography
Lecture 28 - Application of neutron crystallography
Lecture 29 - Magnetism in solids

Lecture 30 - Magnetism in solids
Lecture 31 - Magnetic interaction in solids and magnetic neutron diffarction
Lecture 32 - Magnetic interaction in solids and magnetic neutron diffarction
Lecture 33 - Magnetic interaction in solids and magnetic neutron diffarction
Lecture 34 - Magnetic neutron diffraction
Lecture 35 - Magnetic neutron diffraction
Lecture 36 - Neutron diffraction from liquid and amorphous systems
Lecture 37 - Neutron diffraction from liquid and amorphous systems
Lecture 38 - Small Angle Neutron Scattering (SANS) for mesoscopic structure
Lecture 39 - Small Angle Neutron Scattering (SANS) for mesoscopic structure
Lecture 40 - Small Angle Neutron Scattering (SANS) for mesoscopic structure
Lecture 41 - Small Angle Neutron Scattering (SANS) for mesoscopic structure
Lecture 42 - SANS for soft condensed matter
Lecture 43 - SANS for soft condensed matter
Lecture 44 - SANS for polymers, biological systems, nanoparticle aggregates, rocks, Superconducting vortex la
Lecture 45 - SANS for polymers, biological systems, nanoparticle aggregates, rocks, Superconducting vortex la
Lecture 46 - Neutron reflectometry for thin films
Lecture 47 - Neutron reflectometry for thin films
Lecture 48 - Neutron reflectometry for thin films
Lecture 49 - Details formalism to evaluate specular neutron reflectivity and comparison with x-ray reflectome
Lecture 50 - Details formalism to evaluate specular neutron reflectivity and comparison with x-ray reflectome
Lecture 51 - Neutron reflectometry data analysis and reflectometers at various sources
Lecture 52 - Neutron reflectometry data analysis and reflectometers at various sources
Lecture 53 - Neutron reflectometry data analysis and reflectometers at various sources
Lecture 54 - Examples of PNR with and without spin analysis and introduction to off-specular reflectometry
Lecture 55 - Examples of PNR with and without spin analysis and introduction to off-specular reflectometry
Lecture 56 - Examples of PNR with and without spin analysis and introduction to off-specular reflectometry
Lecture 57 - Off-specular neutron reflectometry and introduction to inelastic neutron scattering
Lecture 58 - Off-specular neutron reflectometry and introduction to inelastic neutron scattering
Lecture 59 - Off-specular neutron reflectometry and introduction to inelastic neutron scattering
Lecture 60 - Phonon measurements with neutrons
Lecture 61 - Phonon measurements with neutrons
Lecture 62 - Phonon measurements; single crystals
Lecture 63
Lecture 64 - Phonon: Density of States measurements
Lecture 65 - Stochastic dynamics with neutrons
Lecture 66 - Stochastic motion and various types of diffusion
Lecture 67 - Stochastic motion and various types of diffusion
Lecture 68 - Spin echo spectrometer, Summary of the course

Lecture 69 - Spin echo spectrometer, Summary of the course

NPTEL Video Course - Physics - NOC:Accelerator Physics

Subject Co-ordinator - Prof. Rajni Pande, Prof. Amalendu Sharma, Prof. Pitamber Singh

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Why accelerators
Lecture 2 - Accelerator as a microscope
Lecture 3 - Charging and Discharging of capacitors
Lecture 4 - Charging and Discharging of capacitors (Continued...)
Lecture 5 - Introduction to DC accelerators
Lecture 6 - Cockcroft Walton Accelerator (1929)
Lecture 7 - Van-de-Graaff accelerator and Tandem and Pelletron accelerators
Lecture 8 - Van-de-Graaff accelerator and Tandem and Pelletron accelerators
Lecture 9 - Voltage measurement and stabilisation
Lecture 10 - Voltage measurement and stabilisation
Lecture 11 - Beam energy calibration/measurement
Lecture 12 - Beam energy calibration/measurement
Lecture 13 - Beam focussing using electrostatic and magnetic lenses and beam optics
Lecture 14 - Beam focussing using electrostatic and magnetic lenses and beam optics
Lecture 15 - Beam focussing using electrostatic and magnetic lenses and beam optics
Lecture 16 - Ion Sources
Lecture 17 - Ion Sources
Lecture 18 - Introduction and Basic concepts of linear accelerators
Lecture 19 - Introduction and Basic concepts of linear accelerators
Lecture 20 - RF Acceleration - 1
Lecture 21 - RF Acceleration - 1
Lecture 22 - RF Acceleration - 2
Lecture 23 - RF Acceleration - 2
Lecture 24 - RF Acceleration - 3 - Waveguides and cavities
Lecture 25 - RF Acceleration - 3 - Waveguides and cavities
Lecture 26 - Accelerating structures - Pillbox cavity and DTL
Lecture 27 - Accelerating structures - Pillbox cavity and DTL
Lecture 28 - Accelerating structures - Travelling wave linacs and periodic accelerating structures
Lecture 29 - Accelerating structures - Travelling wave linacs and periodic accelerating structures

Lecture 30 - Superconducting cavities
Lecture 31 - Superconducting cavities
Lecture 32 - Transverse Dynamics - 1
Lecture 33 - Transverse Dynamics - 1
Lecture 34 - Transverse Dynamics - 2
Lecture 35 - Transverse Dynamics - 2
Lecture 36 - Transverse Dynamics - 3
Lecture 37 - Transverse Dynamics - 3
Lecture 38 - Longitudinal Dynamics - 1
Lecture 39 - Longitudinal Dynamics - 1
Lecture 40 - Longitudinal Dynamics - 2
Lecture 41 - Longitudinal Dynamics - 2
Lecture 42 - Radio Frequency Quadrupole
Lecture 43 - Radio Frequency Quadrupole
Lecture 44 - Cyclic accelerators: Some basic principles
Lecture 45 - Cyclic accelerators: Some basic principles
Lecture 46 - About the cyclotron
Lecture 47 - About the cyclotron
Lecture 48 - Microtron
Lecture 49 - Equation of motion, Focusing
Lecture 50 - Equation of motion, Focusing
Lecture 51 - Strong focusing, Edge focusing, AG principle
Lecture 52 - Strong focusing, Edge focusing, AG principle
Lecture 53 - Matrix methods
Lecture 54 - Matrix methods
Lecture 55 - Hill's equation and parameterization - 1
Lecture 56 - Hill's equation and parameterization - 1
Lecture 57 - Hill's equation and parameterization - 2
Lecture 58 - Hill's equation and parameterization - 2
Lecture 59 - Hill's equation and parameterization - 3
Lecture 60 - Hill's equation and parameterization - 3
Lecture 61
Lecture 62
Lecture 63
Lecture 64
Lecture 65
Lecture 66
Lecture 67 - Proton synchrotron for spallation source
Lecture 68 - Proton synchrotron for spallation source

Lecture 69 - Colliders
Lecture 70 - Colliders
Lecture 71 - Laser Plasma accelerators and Accelerator Driven Systems (ADS)
Lecture 72 - Laser Plasma accelerators and Accelerator Driven Systems (ADS)

NPTEL Video Course - Physics - NOC:An Introduction to Lasers and Laser Systems

Subject Co-ordinator - Prof. Dhruba J. Biswas, Prof. J. Padma Nilaya

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Lasers at a Glance
Lecture 2 - Light Amplifier and the Concept of Cavity
Lecture 3 - Laser: An Integration of a Population Inverted Medium and a Cavity
Lecture 4 - The Invention of Lasers by Maiman
Lecture 5 - Population Inversion vis-Ã -vis Boltzmann Distribution
Lecture 6 - Different Methods of Pumping to Effect Population Inversion
Lecture 7 - Population Inversion vis-Ã -vis No. of Participating Energy Levels in the process of Lasing
Lecture 8 - Behaviour of Light
Lecture 9 - Behaviour of Light (Continued...)
Lecture 10 - Youngs Doble Slit Experiment and Interference of Light
Lecture 11 - Interference of Light and Fabrication of Laser Windows and Mirrors
Lecture 12 - Fabrication of Laser Windows and Mirrors (Continued...)
Lecture 13 - Diffraction of Light
Lecture 14 - Scattering of Light
Lecture 15 - Light Scattering (Continued...) and Polarisation of Light
Lecture 16 - Polarisation of Light (Continued...) and Brewster Angle of Incidence
Lecture 17 - Continuous and Pulsed Operation of Lasers
Lecture 18 - The Maximum Achievable Power from a Pulsed Laser
Lecture 19 - Continuous and Pulsed Pumping of Lasers
Lecture 20 - Continuous and Pulsed Pumping of Lasers (Continued...)
Lecture 21 - Optical Pumping : Coupling of Pump Laser Beam into the Cavity
Lecture 22 - Electrical Pumping
Lecture 23 - Different Kinds of Lasers
Lecture 24 - Atomic Gas Lasers: He-Ne Laser
Lecture 25 - He-Ne Laser (Continued...)
Lecture 26 - Emission Features of He-Ne Laser
Lecture 27 - Ion Lasers: Argon Ion Laser
Lecture 28 - Argon Ion Lasers: Emission Feature
Lecture 29 - Liquid Lasers: Dye Laser

Lecture 30 - Dye Lasers: Working Principle and Emission Features
Lecture 31 - Solid State Lasers: Nd-YAG Laser
Lecture 32 - Pumping of Nd-YAG Lasers
Lecture 33 - Diode Pumped Solid State Lasers and Continuously Tunable Solid State Lasers
Lecture 34 - Excimer Lasers: Importance
Lecture 35 - Excimer Lasers: Working Principle, Rare Gas Halide Lasers
Lecture 36 - Introduction to CO2 lasers and molecular spectroscopy
Lecture 37 - Molecular Spectroscopy: Ro-vibrational Transitions
Lecture 38 - Modes of molecular vibration, Vibrational modes and 4 level lasing scheme in a CO2 laser
Lecture 39 - Mechanism of lasing in a CO2 laser
Lecture 40 - Low pressure, CW Operation of a CO2 laser
Lecture 41 - Limitations of CW-CO2 Lasers and remedy
Lecture 42 - Pulsed Operation of CO2 Lasers; TEA CO2 Lasers and their Temporal Emission Profile
Lecture 43 - TEA CO2 Lasers: Operation, Gain Broadening and Emission Features
Lecture 44 - Gain Broadening and Emission Features (Continued...)
Lecture 45 - Discrete and Continuously Tunable Operation of a CO2 laser
Lecture 46 - Chemical Lasers: Underlying Physics
Lecture 47 - Principle of Operation of HF, DF Chemical Oxygen Iodine Lasers
Lecture 48 - Gas Dynamic Lasers: Principle of Operation
Lecture 49 - Operation of Gas Dynamic CO2 Lasers
Lecture 50 - Fiber Lasers: Its Advantages over Conventional Solid State Lasers
Lecture 51 - Fiber Laser (Continued...)
Lecture 52 - The Acceptance Angle, Pumping of Fiber Lasers and their Operation
Lecture 53 - Scaling up of Output Power of Fiber Laser and Operation of Fiber Amplifiers
Lecture 54 - Semiconductor Lasers: An Introduction and Basics of Semiconductor Physics
Lecture 55 - Metals, Insulators and Semiconductors, Concept of Holes
Lecture 56 - Concept of Holes (Continued...), Intrinsic and Extrinsic Semiconductors
Lecture 57 - n-type and p-type semiconductors, Semiconductor Diodes, Light Emitting Diodes (LED)
Lecture 58 - Diode Laser from the LED
Lecture 59 - Homojunction and Hetrojunction Diode Lasers
Lecture 60 - Edge Emitting Diode Lasers, Surface Emitting Diode Lasers, Diode Bars and Arrays

NPTEL Video Course - Physics - NOC:The Science of Light Amplification: An Extensive Laser course

Subject Co-ordinator - Prof. Paramita Deb

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Lasers and the Electromagnetic Spectrum
Lecture 2 - Stimulated Emission and Spontaneous Emission and Properties of Laser
Lecture 3 - Population Inversion in a Laser medium
Lecture 4 - Laser Oscillations and the Optical Resonator
Lecture 5 - Line Broadening Mechanism - 1
Lecture 6 - Line Broadening Mechanism - 2
Lecture 7 - Laser Resonators - 1
Lecture 8 - Laser Resonators - 2
Lecture 9 - Gas laser examples
Lecture 10 - Gas lasers and Solid State Lasers
Lecture 11 - Solid State Lasers
Lecture 12 - Pulsed Lasers and Optical shutters
Lecture 13 - Modes and Mode Locking
Lecture 14 - The technique of Mode Locking
Lecture 15 - Time Bandwidth product and Ultra short pulse
Lecture 16 - Non-linear phenomenon in optics
Lecture 17 - Self-focusing and Self-phase-modulation
Lecture 18 - Second Harmonic Generation (SHG)
Lecture 19 - Phase matching and SHG
Lecture 20 - Anisotropic medium and SHG
Lecture 21 - Birefringent Crystals and Phase Matching
Lecture 22 - Semiconductor Basics
Lecture 23 - Photon Absorption and Emission in Semiconductors
Lecture 24 - p-n Junction and the Semiconductor Laser
Lecture 25 - Types of Semiconductor Laser
Lecture 26 - Nuclear Fusion
Lecture 27 - Inertial Confinement Fusion
Lecture 28 - Master Oscillator and Power Amplifier Chain
Lecture 29 - Amplifier Chain

Lecture 30 - Chirped Pulse Amplification - 1
Lecture 31 - Chirped Pulse Amplification - 2
Lecture 32 - Ultra-Short-Pulse Oscillator
Lecture 33 - Ultra-Short-Pulse Amplification - 1
Lecture 34 - Ultra-Short-Pulse Amplification - 2
Lecture 35 - Stretching and Compressing a Pulse
Lecture 36 - Stretching and Compressing a Pulse
Lecture 37 - The Auto-Correlation Technique for Temporal Pulse Measurement
Lecture 38 - Frequency Resolved Optical Gating for Temporal Pulse measurement
Lecture 39 - Light Detection And Ranging (LIDAR)
Lecture 40 - Remote Sensing
Lecture 41 - Optical Tweezers
Lecture 42 - Lasers in Spectroscopy
Lecture 43 - Dye Laser
Lecture 44 - Tuning a laser with a grating
Lecture 45 - Details of a grating
Lecture 46 - Multi-Photon Processes
Lecture 47 - Laser Enrichment Method
Lecture 48 - Laser Raman Spectroscopy
Lecture 49 - Polarization Of Electromagnetic Waves
Lecture 50 - Polarizer and Analyzer
Lecture 51 - Interference of Electromagnetic waves - 1
Lecture 52 - Interference Of Electromagnetic waves - 2
Lecture 53 - Interference Patterns - 1
Lecture 54 - Interference Patterns - 2
Lecture 55 - Interference Patterns - 3
Lecture 56 - Fabry - Perot Cavity
Lecture 57 - Holography - 1
Lecture 58 - Holography - 2
Lecture 59 - Holography - 3
Lecture 60 - Holography - 4

NPTEL Video Course - Physics - NOC:Theory and Applications in Thermal and Cold Plasma

Subject Co-ordinator - Prof. Srikumar Ghorui

Co-ordinating Institute - IIT-Bombay - HBNI

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Fundamentals of Thermal and Cold Plasma
Lecture 3 - Theory and Applications in Thermal and Cold Plasma
Lecture 4 - Theory and Applications in Thermal and Cold Plasma
Lecture 5 - Saha Ionization Equation and That Follows
Lecture 6 - Tutorial-1: Theory and Applications in Thermal and Cold Plasma
Lecture 7 - Plasma Screening
Lecture 8 - Propagation of EM Waves in Plasma
Lecture 9 - Further Details on The Basics of EM Waves in Plasma
Lecture 10 - Collisions in Plasma: Plasma Temperature and Equilibria
Lecture 11 - Tutorial-2: Plasma Physics Fundamentals
Lecture 12 - Large Angle and Small Angle Scattering in Plasma
Lecture 13 - Small Angle Scattering in Plasma
Lecture 14 - Ambipolar Diffusion in Plasma
Lecture 15 - Description of Plasma Kinetics: Orbit Theory, Kinetic Theory and Fluid Model
Lecture 16 - Tutorial-3: Understanding Ionization, Gas Behavior, and Maxwell-Boltzmann Distribution
Lecture 17 - Description of Plasma Kinetics: Orbit Theory
Lecture 18 - Description of Plasma Kinetics: Orbit Theory-Plasma Confinement
Lecture 19 - Description of Plasma Kinetics: Plasma Kinetic Theory
Lecture 20 - Description of Plasma Kinetics: Electrostatic Waves in Plasma
Lecture 21 - Review of Key Concepts: Week 1-3 - Part A
Lecture 22 - Review of Key Concepts: Week 1-3 - Part B
Lecture 23 - Tutorial-4: Gas Ionization and Breakdown Mechanisms
Lecture 24 - Description of Plasma Kinetics: Langmuir Wave
Lecture 25 - Plasma Fluid Model
Lecture 26 - Some More Insights on High Frequency Electrostatic Waves in Plasma
Lecture 27 - Further Insights into Dispersion Relation
Lecture 28 - Tutorial-5: Plasma Kinetics, Thermodynamics and Excitation in Plasma
Lecture 29 - First Order Moment of Plasma Kinetic Equation

Lecture 30 - Generalized Ohms Law
Lecture 31 - Expression for Generalized Ohms Law and Reduction to Ordinary Ohmâ s Law
Lecture 32 - Energy Conservation Equation
Lecture 33 - Tutorial-6: Plasma Devices, Characteristics and Plasma Parameters
Lecture 34 - Energy Conservation Equation: Solution technique
Lecture 35 - Navier Stokes Equation in Plasma
Lecture 36 - Numerical Solution of Fluid Equations: Thermodynamic and transport properties, an example
Lecture 37 - Finding Solution of Fluid Equations in a Plasma Torch: example of N2-O2 plasma
Lecture 38 - Tutorial-7: Thermodynamic and Transport Properties in Plasma
Lecture 39 - Review of Key Concepts: Week 4-6 - Part A
Lecture 40 - Review of Key Concepts: Week 4-6 - Part B
Lecture 41 - Actual Solutions of Fluid Equations in a Plasma Torch
Lecture 42 - Understanding the Solution of Fluid Equations in a Plasma Torch
Lecture 43 - Understanding the Solution Results and Designing a Plasma Torch
Lecture 44 - Designing Plasma Torches with Desired Electrothermal Efficiency and Jet Characteristics
Lecture 45 - Tutorial-8: RF and Cold Plasma Devices
Lecture 46 - Features of Plasma Jets in Practice
Lecture 47 - Plasma Production
Lecture 48 - Paschen Break Down Criteria
Lecture 49 - AC Breakdown
Lecture 50 - Tutorial-9: Plasma Thermodynamics and Radiation equilibrium
Lecture 51 - Review of Key Concepts: Week 7-9 - Part A
Lecture 52 - Review of Key Concepts: Week 7-9 - Part B
Lecture 53 - Plasma Sources
Lecture 54 - Typical Configuration of Arc Devices and Special Features
Lecture 55 - Plasma Power Supplies: Steady and Unsteady Operating Points, RF Thermal Plasma Sources
Lecture 56 - RF plasma-Thermal Plasma Sources
Lecture 57 - Non-Thermal Plasma Sources: Atmospheric pressure plasma jets (APPJ)
Lecture 58 - Tutorial-10: Advanced Plasma Diagnostics
Lecture 59 - Non-Thermal Plasma Sources: ECR Plasma and Plasma Sheath
Lecture 60 - Plasma Sheath-mathematical modelling
Lecture 61 - Plasma Diagnostics
Lecture 62 - Boltzmann Plot Technique
Lecture 63 - Plasma Diagnosis: Finding number density
Lecture 64 - Tutorial-11: Plasma Technology for Renewable Energy and Environment
Lecture 65 - Plasma Diagnosis: Langmuir Probe Principles
Lecture 66 - Plasma Application
Lecture 67 - Plasma Application: Waste Management Capacity, Efficacy and Empowerment, thermal plasma for mate
Lecture 68 - Atmospheric Pressure Plasma Spray (APS), Plasma Metallurgy and Novel Materials

Lecture 69 - Plasma Medicine and Plasma in Agriculture
Lecture 70 - Tutorial-12: Plasma Technology for Industrial Applications: Options, Efficacy and Benefits
Lecture 71 - Review of Key Concepts: Week 10-12 - Part A
Lecture 72 - Review of Key Concepts: Week 10-12 - Part B

NPTEL Video Course - Physics - Electronics

Subject Co-ordinator - Prof. D.C. Dube

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - p-n diode
Lecture 2 - p-n Junction/Diode (Continued...)
Lecture 3 - p-n diode (Continued...)
Lecture 4 - Diode Application
Lecture 5 - Transistors
Lecture 6 - Reverse - bias (Continued...)
Lecture 7 - Transistors (Continued...)
Lecture 8 - Transistors (Continued...)
Lecture 9 - Biasing a transistor unit 2 (Continued...)
Lecture 10 - Biasing of transistor
Lecture 11 - H and R Parameters and their use in small amplifiers
Lecture 12 - Small signal amplifiers analysis using H - Parameters
Lecture 13 - Small signal amplifiers analysis using R - Parameters
Lecture 14 - R - analysis (Continued...)
Lecture 15 - Common Collector(CC) amplifier (Continued...)
Lecture 16 - Feedback in amplifiers, Feedback Configurations and multi stage amplifiers
Lecture 17 - Reduction in non-linear distortion
Lecture 18 - Input/Output impedances in negative feedback amplifiers (Continued...)
Lecture 19 - RC Coupled Amplifiers
Lecture 20 - RC Coupled Amplifiers (Continued...)
Lecture 21 - RC Coupled Amplifiers (Continued...)
Lecture 22 - FETs ans MOSFET
Lecture 23 - FETs ans MOSFET (Continued...)
Lecture 24 - Depletion - MOSFET
Lecture 25 - Drain and transfer characteristic of E - MOSFET
Lecture 26 - Self Bias (Continued...) Design Procedure
Lecture 27 - FET/MOSFET Amplifiers and their Analysis
Lecture 28 - CMOS Inverter
Lecture 29 - CMOS Inverter (Continued...)

Lecture 30 - Power Amplifier
Lecture 31 - Power Amplifier (Continued...)
Lecture 32 - Power Amplifier (Continued...)
Lecture 33 - Power Amplifier (Continued...)
Lecture 34 - Differential and Operational Amplifier
Lecture 35 - Differential and Operational Amplifier (Continued...) dc and ac analysis
Lecture 36 - Differential and Operational Amplifier dc and ac analysis (Continued...)
Lecture 37 - Operational Amplifiers
Lecture 38 - Operational amplifiers in open loop (Continued...)
Lecture 39 - Summing Amplifiers
Lecture 40 - Frequency response of an intigration
Lecture 41 - Filters
Lecture 42 - Specification of OP Amplifiers

NPTEL Video Course - Physics - Plasma Physics: Fundamentals and Applications

Subject Co-ordinator - Prof. Vijayshri, Prof. V.K. Tripathi

Co-ordinating Institute - IIT - Delhi | IGNOU - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Plasmas
Lecture 2 - Plasma Response to fields
Lecture 3 - DC Conductivity and Negative Differential Conductivity
Lecture 4 - RF Conductivity of Plasma
Lecture 5 - RF Conductivity of Plasma (Continued...)
Lecture 6 - Hall Effect, Cowling Effect and Cyclotron Resonance Heating
Lecture 7 - Electromagnetic Wave Propagation in Plasma
Lecture 8 - Electromagnetic Wave Propagation in Plasma (Continued...)
Lecture 9 - Electromagnetic Wave Propagation Inhomogeneous Plasma
Lecture 10 - Electrostatic Waves in Plasmas
Lecture 11 - Energy Flow with an Electrostatic Wave
Lecture 12 - Two Stream Instability
Lecture 13 - Relativistic electron Beam- Plasma Interaction
Lecture 14 - Cerenkov Free Electron Laser
Lecture 15 - Free Electron Laser
Lecture 16 - Free Electron Laser
Lecture 17 - Free Electron Laser
Lecture 18 - Weibel Instability
Lecture 19 - Rayleigh Taylor Instability
Lecture 20 - Single Particle Motion in Static Magnetic and Electric Fields
Lecture 21 - Plasma Physics Grad B and Curvature Drifts
Lecture 22 - Adiabatic Invariance of Magnetic Moment and Mirror confinement
Lecture 23 - Mirror machine
Lecture 24 - Thermonuclear fusion
Lecture 25 - Tokamak
Lecture 26 - Tokamak operation
Lecture 27 - Auxiliary heating and current drive in tokamak
Lecture 28 - Electromagnetic waves propagation in magnetise plasma
Lecture 29 - Longitudinal electromagnetic wave propagation cutoffs, resonances and faraday rotation

Lecture 30 - Electromagnetic propagation at oblique angles to magnetic field in a plasma
Lecture 31 - Low frequency EM waves magnetized plasma
Lecture 32 - Electrostatic waves in magnetized plasma
Lecture 33 - Ion acoustic, ion cyclotron and magneto sonic waves in magnetized plasma
Lecture 34 - VIasov theory of plasma waves
Lecture 35 - Landau damping and growth of waves
Lecture 36 - Landau damping and growth of waves (Continued...)
Lecture 37 - Anomalous resistivity in a plasma
Lecture 38 - Diffusion in plasma
Lecture 39 - Diffusion in magnetized plasma
Lecture 40 - Surface plasma wave
Lecture 41 - Laser interaction with plasmas embedded with clusters
Lecture 42 - Current trends and epilogue

NPTEL Video Course - Physics - Quantum Electronics

Subject Co-ordinator - Prof. K. Thyagarajan

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Anisotropic Media
Lecture 3 - Anisotropic Media (Continued...)
Lecture 4 - Anisotropic Media (Continued...)
Lecture 5 - Nonlinear optical effects and nonlinear polarization
Lecture 6 - Non - Linear Optics (Continued...)
Lecture 7 - Non - Linear Optics (Continued...)
Lecture 8 - Non - Linear Optics (Continued...)
Lecture 9 - Non - Linear Optics (Continued...)
Lecture 10 - Non - Linear Optics - Quasi Phase Matching
Lecture 11 - Non - Linear Optics
Lecture 12 - Non Linear Optics (Continued...)
Lecture 13 - Non Linear Optics (Continued...)
Lecture 14 - Non Linear Optics (Continued...)
Lecture 15 - Non Linear Optics (Continued...)
Lecture 16 - Non Linear Optics (Continued...)
Lecture 17 - Non Linear Optics (Continued...)
Lecture 18 - Non Linear Optics (Continued...)
Lecture 19 - Non Linear Optics (Continued...)
Lecture 20 - Third Order Non - Linear Effects
Lecture 21 - Third Order Non - Linear Effects (Continued...)
Lecture 22 - Third Order Non - Linear Effects (Continued...)
Lecture 23 - Third Order Non - Linear Effects (Continued...)
Lecture 24 - Review of Quantum Mechanics
Lecture 25 - Review of Quantum Mechanics (Continued...)
Lecture 26 - Review of Quantum Mechanics (Continued...)
Lecture 27 - Quantization of EM Field
Lecture 28 - Quantization of EM Field (Continued...)
Lecture 29 - Quantization of EM Field (Continued...)

Lecture 30 - Quantum States of EM Field
Lecture 31 - Quantum States of EM Field (Continued...)
Lecture 32 - Quantization of EM Field (Continued...)
Lecture 33 - Quantization of EM Field (Continued...)
Lecture 34 - Quantization of EM Field (Continued...)
Lecture 35 - Quantization of EM Field (Continued...)
Lecture 36 - Quantization of EM Field (Continued...)
Lecture 37 - Beam Splitter
Lecture 38 - Beam Splitter (Continued...)
Lecture 39 - Beam Splitter and Balanced Homodyning
Lecture 40 - Balanced Homodyning
Lecture 41 - Quantum Picture of Parametric Down Conversion
Lecture 42 - Questions

NPTEL Video Course - Physics - Quantum Mechanics and Applications

Subject Co-ordinator - Prof. Ajoy Ghatak

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Basic Quantum Mechanics I
Lecture 2 - Basic Quantum Mechanics II
Lecture 3 - Dirac Delta Function & Fourier Transforms
Lecture 4 - The Free Particle
Lecture 5 - Physical Interpretation of The Wave Function
Lecture 6 - Expectation Values & The Uncertainty Principle
Lecture 7 - The Free Particle (Continued...)
Lecture 8 - Interference Experiment & The Particle in a Box Problem
Lecture 9 - On Eigen Values and Eigen Functions of the 1 Dimensional Schrodinger Equation
Lecture 10 - Linear Harmonic Oscillator
Lecture 11 - Linear Harmonic Oscillator (Continued...1)
Lecture 12 - Linear Harmonic Oscillator (Continued...2)
Lecture 13 - Linear Harmonic Oscillator (Continued...3)
Lecture 14 - Tunneling through a Barrier
Lecture 15 - The 1-Dimensional Potential Wall & Particle in a Box
Lecture 16 - Particle in a Box and Density of States
Lecture 17 - The Angular Momentum Problem
Lecture 18 - The Angular Momentum Problem (Continued...)
Lecture 19 - The Hydrogen Atom Problem
Lecture 20 - The Two Body Problem
Lecture 21 - TheTwo Body Problem
Lecture 22 - Two Body Problem
Lecture 23 - 3d Oscillator & Dirac's Bra and Ket Algebra
Lecture 24 - Diracâ s Bra and Ket Algebra
Lecture 25 - Diracâ s Bra and Ket Algebra
Lecture 26 - The Linear Harmonic Oscillator using Bra and Ket Algebra (Continued...)
Lecture 27 - The Linear Harmonic Oscillator
Lecture 28 - Coherent State and Relationship with the Classical Oscillator
Lecture 29 - Angular Momentum Problem using Operator Algebra

Lecture 30 - Angular Momentum Problem (Continued...)
Lecture 31 - Pauli Spin Matrices and The Stern Gerlach Experiment
Lecture 32 - The Larmor Precession and NMR Spherical Harmonics using Operator Algebra
Lecture 33 - Addition of Angular Momentum
Lecture 34 - Clebsch Gordon Coefficients
Lecture 35 - The JWKB Approximation
Lecture 36 - The JWKB Approximation
Lecture 37 - The JWKB Approximation
Lecture 38 - The JWKB Approximation
Lecture 39 - The JWKB Approximation
Lecture 40 - Time Independent Perturbation Theory
Lecture 41 - Time Independent Perturbation Theory (Continued...1)
Lecture 42 - Time Independent Perturbation Theory (Continued...2)

NPTEL Video Course - Physics - Semiconductor Optoelectronics

Subject Co-ordinator - Prof. M.R. Shenoy

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Context and Scope of the Course
Lecture 2 - Energy Bands in Solids
Lecture 3 - E-K Diagram
Lecture 4 - The Density of States
Lecture 5 - The Density of States (Continued...)
Lecture 6 - The Density of states in a Quantum well Structure
Lecture 7 - Occupation Probability and Carrier Concentration
Lecture 8 - Carrier Concentration and Fermi Level
Lecture 9 - Quasi Fermi Levels
Lecture 10 - Semiconductor Materials
Lecture 11 - Semiconductor Hetrostructures-Lattice-Matched Layers
Lecture 12 - Strained -Layer Epitaxy and Quantum Well Structures
Lecture 13 - Bandgap Engineering
Lecture 14 - Hetrostructure p-n junctions
Lecture 15 - Schottky Junction and Ohmic Contacts
Lecture 16 - Fabrication of Heterostructure Devices
Lecture 17 - Interaction od Photons with Electrons and Holes in a Semiconductor
Lecture 18 - Optical Joint Density of States
Lecture 19 - Rates of Emission and Absorption
Lecture 20 - Amplication by Stimulated Emission
Lecture 21 - The Semiconductor (Laser) Amplifier
Lecture 22 - Absorption Spectrum of Semiconductor
Lecture 23 - Gain and Absorption Spectrum of Quantum Well Structures
Lecture 24 - Electro-absorption Modulator
Lecture 25 - Electro-absorption Modulator - II Device Configuration
Lecture 26 - Mid-Term Revision Question and Discussion
Lecture 27 - Part - III Semiconductor Light Sources
Lecture 28 - Light Emitting Diode-I Device Structure and Parameters
Lecture 29 - Light Emitting Diode-II Device Chracteristics

Lecture 30 - Light Emitting Diode-III Output Characteristics
Lecture 31 - Light Emitting Diode-IV Modulation Bandwidth
Lecture 32 - Light Emitting Diode-V materials and Applications
Lecture 33 - Laser Basics
Lecture 34 - Semiconductor Laser-I Device Structure
Lecture 35 - Semiconductor Laser-II Output Characteristics
Lecture 36 - Semiconductor Laser-III Single Frequency Lasers
Lecture 37 - Vertical Cavity Surface Emitting Laser (VCSEL)
Lecture 38 - Quantum Well Laser
Lecture 39 - Practical Laser Diodes and Handling
Lecture 40 - General Characteristics of Photodetectors
Lecture 41 - Responsivity and Impulse Response
Lecture 42 - Photoconductors
Lecture 43 - Semiconductor Photo-Diodes
Lecture 44 - Semiconductor Photo-Diodes-II
Lecture 45 - Other Photodectors
Lecture 46 - Photonic Integrated Circuits

NPTEL Video Course - Physics - NOC:Semiconductor Optoelectronics

Subject Co-ordinator - Prof. M. R. Shenoy

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Context, Scope and Contents of the Course
Lecture 2 - Energy Bands in Solids
Lecture 3 - E-k Diagram - The Band Structure
Lecture 4 - The Density of States
Lecture 5 - The Density of States Ï•(k), Ï•(E)
Lecture 6 - Density of States in a Quantum Well Structure
Lecture 7 - Occupation Probability and Carrier Concentration
Lecture 8 - Carrier Concentration and Fermi Level
Lecture 9 - Quasi Fermi Levels
Lecture 10 - Semiconductor Materials
Lecture 11 - Semiconductor Heterostructures-Lattice-Matched Layers
Lecture 12 - Strained-Layer Epitaxy and Quantum Well Structures
Lecture 13 - Bandgap Engineering
Lecture 14 - Heterostructure p-n junctions
Lecture 15 - Schottky Junctions and Ohmic Contacts
Lecture 16 - Fabrication of Heterostructure Devices
Lecture 17 - Interaction of Photons with Electrons and Holes in a Semiconductor
Lecture 18 - Optical Joint Density of States, and Probabilities of Emission and Absorption
Lecture 19 - Rates of Emission and Absorption
Lecture 20 - Amplification by Stimulated Emission
Lecture 21 - The Semiconductor (Laser) Amplifier
Lecture 22 - Absorption Spectrum of Semiconductors
Lecture 23 - Gain and Absorption Spectrum of Quantum Well Structures
Lecture 24 - Electro-absorption Modulator-I Principle of Operation
Lecture 25 - Electro-absorption Modulator-II Device Configuration
Lecture 26 - Injuction Electroluminescence
Lecture 27 - Light emitting diode-1 Device structure and parameters
Lecture 28 - Light emitting diode-II Device Characteristics
Lecture 29 - Light emitting diode-III Output Characteristics

Lecture 30 - Light emitting diode-IV Modulation Bandwidth
Lecture 31 - Light emitting diode-V Material and Applications
Lecture 32 - Laser Basics
Lecture 33 - Semiconductor Laser-I Device Structure
Lecture 34 - Semiconductor Laser-II Output Characteristics
Lecture 35 - Semiconductor Laser-III Single Frequency Lasers
Lecture 36 - Vertical cavity Surface Emitting Laser (VCSEL)
Lecture 37 - Quantum Well Laser
Lecture 38 - Practical Laser Diodes and Handling
Lecture 39 - General Characteristics of Photodetectors
Lecture 40 - Responsivity and Impulse Response
Lecture 41 - Photoconductors
Lecture 42 - Semiconductor Photo-Diodes-I
Lecture 43 - Semiconductor Photo-Diodes-II
Lecture 44 - Other Photodetectors
Lecture 45 - Photonic Integrated Circuits

NPTEL Video Course - Physics - NOC:Introduction to LASER

Subject Co-ordinator - Unknown

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - General Introduction, Scope and Contents
Lecture 2 - Interaction of Radiation with Matter
Lecture 3 - The Einstein Coefficients
Lecture 4 - Atomic Lineshape Function, g(Î½)
Lecture 5 - Amplification by Stimulated Emission
Lecture 6 - Line Broadening Mechanisms - 1
Lecture 7 - Line Broadening Mechanisms - 2
Lecture 8 - Laser Rate Equations: 2-Level System
Lecture 9 - Laser Rate Equations: 3-Level System
Lecture 10 - Laser Rate Equations: 4-Level System
Lecture 11 - Laser Amplifiers
Lecture 12 - Er-Doped Fiber Amplifier
Lecture 13 - Resonance Frequencies
Lecture 14 - Spectral Response of an Optical Resonator
Lecture 15 - Resonator Loss and Cavity Lifetime
Lecture 16 - Spherical Mirror Resonators
Lecture 17 - Resonator Stability Condition
Lecture 18 - Ray Paths in Spherical Mirror Resonators
Lecture 19 - Tranverse Modes of a Spherical Mirror Resonator
Lecture 20 - Gaussian Mode of the Spherical Mirror Resonator
Lecture 21 - Longitudinal Modes of a Spherical Mirror Resonator
Lecture 22 - Laser Oscillations and The Threshold Condition
Lecture 23 - Spectral Hole Burning
Lecture 24 - Variation of Laser Power around Threshold
Lecture 25 - Optimum Output Coupling
Lecture 26 - Laser Output Characteristics
Lecture 27 - Laser Beam Properties
Lecture 28 - Ultimate Linewidth of a Laser
Lecture 29 - Pulsed Lasers

Lecture 30 - Q-Switching
Lecture 31 - Mode Locking
Lecture 32 - Methods of Mode Locking
Lecture 33 - Some Common Lasers
Lecture 34 - Fiber Lasers
Lecture 35 - Semiconductor Lasers
Lecture 36 - Lasers and Laser Amplifiers in Optical Fiber Communication
Lecture 37 - Lasers in Nonlinear Optics
Lecture 38 - Laser Safety

NPTEL Video Course - Physics - NOC:Energy Materials and Devices

Subject Co-ordinator - Prof. Santanu Ghosh

Co-ordinating Institute - IIT Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Solar energy conversion and silicon solar cell
Lecture 2 - Solar energy conversion and silicon solar cell (Continued...)
Lecture 3 - Tutorial session on solar energy conversion and silicon solar cell
Lecture 4 - Wide band gap semiconductor based thin film solar cell: CdTe-CdS
Lecture 5 - Wide band gap semiconductor based thin film solar cell: Tutorial session
Lecture 6 - Dye sensitized solar cell
Lecture 7 - Quantum dot sensitized solar cell and Perovskite solar cell
Lecture 8 - DSCC and QDSSC: Tutorial session
Lecture 9 - Tandem Solar Cell
Lecture 10 - Tandem Solar Cell: Tutorial session
Lecture 11 - Thermoelectric Energy and materials
Lecture 12 - Thermoelectric Energy and materials (Continued...)
Lecture 13 - TEG Materials and devices
Lecture 14 - TEG Materials and devices (Continued...)
Lecture 15 - Tutorial session of Thermoelectric generator materials and devices
Lecture 16 - Thermionic emission fundamentals
Lecture 17 - Thermionic energy and materials
Lecture 18 - Tutorial of Thermionic energy and Materials
Lecture 19 - Materials for energy storage and devices: Battery and Capacitor
Lecture 20 - Materials for energy storage and devices: Supercapacitor
Lecture 21 - Materials for energy storage and devices: Lithium ion battery
Lecture 22 - Materials for energy storage and devices: Lithium ion battery (Continued...)
Lecture 23 - Materials for energy storage and devices: Tutorial-I
Lecture 24 - Materials for energy storage and devices: Fuel cell
Lecture 25 - Materials for energy storage and devices: Fuel cell (Continued...)
Lecture 26 - Materials for energy storage and devices: Fuel Cell (Tutorial)
Lecture 27 - Hydrogen production by PEC water splitting
Lecture 28 - PEC water splitting (Continued...)
Lecture 29 - PEC water splitting: Materials and Applications

Lecture 30 - PEC water splitting: Materials and Applications (Continued...)
Lecture 31 - 5PEC water splitting tutorial
Lecture 32 - Conclusion of the Lecture Series Energy Materials and Devices

NPTEL Video Course - Physics - NOC:Nuclear and Particle Physics

Subject Co-ordinator - Dr. P. Poulose

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Nuclear Properties
Lecture 3 - Properties of Nuclear Force
Lecture 4 - Deuteron
Lecture 5 - Nucleons Scattering
Lecture 6 - Nuclear Models - I
Lecture 7 - Nuclear Models - II
Lecture 8 - Radioactive Decay - General Properties
Lecture 9 - Nuclear Alpha Decay
Lecture 10 - Nuclear Beta decay
Lecture 11 - Beta-decay details
Lecture 12 - Gamma decay
Lecture 13 - Nuclear Scattering - Preliminaries
Lecture 14 - Types of Reactions
Lecture 15 - Particle Accelerators - I
Lecture 16 - Particle Accelerators - II
Lecture 17 - Detectors
Lecture 18 - Elementary Particles - Introduction and Overview
Lecture 19 - Quark Model - I
Lecture 20 - Quark Model - II
Lecture 21 - Quark Model - III
Lecture 22 - Structure of the Hadron - Nucleus
Lecture 23 - Structure of the Hadron - Proton
Lecture 24 - Deep Inelastic Scattering
Lecture 25 - Relativistic Kinematics
Lecture 26 - Klein-Gordon Equation
Lecture 27 - Interaction of charged scalar with EM field
Lecture 28 - Relativistic Electrodynamics
Lecture 29 - Quantum Electrodynamics

Lecture 30 - Interaction between charged scalars
Lecture 31 - Dirac Equation - 1
Lecture 32 - Dirac Equation - 2
Lecture 33 - Interacting charged fermions - 1
Lecture 34 - Interacting charged fermions - 2
Lecture 35 - Interacting charged fermions - 3
Lecture 36 - Scattering Cross Section Revisited - 1
Lecture 37 - Scattering Cross Section Revisited - 2
Lecture 38 - Weak Interactions - 1
Lecture 39 - Weak Interactions - 2
Lecture 40 - Lagrangian Framework
Lecture 41 - Gauge Symmetry - U(1)
Lecture 42 - Electroweak Theory - 1
Lecture 43 - Electroweak Theory - 2
Lecture 44 - SSB and the Higgs Mechanism

NPTEL Video Course - Physics - NOC:Advanced Condensed Matter Physics

Subject Co-ordinator - Dr. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Propagators - I
Lecture 2 - Propagators - II
Lecture 3 - Second quantization - I
Lecture 4 - Second quantization - II
Lecture 5 - Second quantized Hamiltonian
Lecture 6 - Tight Binding Hamiltonian, Hubbard model
Lecture 7 - Magnetism
Lecture 8 - Singlet and Triplet State
Lecture 9 - Antiferromagnetism in Hubbard model
Lecture 10 - Green's function and representations in quantum mechanics
Lecture 11 - S matrix and free electron Green's function
Lecture 12 - Wick's theorem and normal ordering
Lecture 13 - Green's function and Feynman diagrams
Lecture 14 - Feynman diagram
Lecture 15 - phonon Green' function and Hartree Fock approaximation
Lecture 16 - Finite temperature Green's function and Matsubara frequencies
Lecture 17 - Dyson's equation and disorder in electronic systems
Lecture 18 - Introduction to electrodynamics, Meissner effect
Lecture 19 - London penetration depth, Type I and II superconductors
Lecture 20 - Cooper's problem, BCS gap equation
Lecture 21 - BCS theory, Transition temperature
Lecture 22 - Ginzburg Landau Theory, Coherence length and penetration depth
Lecture 23 - Quantum Hall Effect
Lecture 24 - Spin Hall effect, 2D topological insulator
Lecture 25 - Bose-Einstein condensation

NPTEL Video Course - Physics - NOC:Advanced Quantum Mechanics with Applications

Subject Co-ordinator - Dr. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, Postulates of Quantum Mechanics
Lecture 2 - Stern Gerlach Experiment, Spin Quantization, Young's Double Slit Experiment
Lecture 3 - The Mathematical Formalism of Quantum Mechanics, Uncertainty Principle
Lecture 4 - The Density Matrix Formalism, Expectation values of Operators
Lecture 5 - Qunatum Harmonic Oscillator, Creation and annihilation Operators
Lecture 6 - Coherent States and their Properties
Lecture 7 - Applications of Coherent States, squeezed states
Lecture 8 - Symmetries and Conservational Principles in Quantum Mechanics
Lecture 9 - Rotation Operator and Invariance of Angular Momentum, Parity
Lecture 10 - Spherically Symmetric System and Applications to quantum dots
Lecture 11 - Spin Angular Momentum, Addition of Angular Momentum, Clebsch gordan coefficients
Lecture 12 - Magnetic Hamiltonian, Heisenberg Model
Lecture 13 - Nuclear Magnetic Resonance (NMR)
Lecture 14 - Applications of NMR, time evolution of Magnetic Moments
Lecture 15 - Introduction to Quantum Computing
Lecture 16 - Qubits,EPR Paradox
Lecture 17 - Quantum Entanglement (QE)
Lecture 18 - Teleportation, Quantum Teleportation for one spin
Lecture 19 - Entangled state for two spins
Lecture 20 - Quantum Gates, Walsh Hadamard Transportation, No cloning theorem
Lecture 21 - Perturbation Theory
Lecture 22 - Stark Effect
Lecture 23 - Stark Effect
Lecture 24 - Variational method, Variation of constants, Upper bound on ground state energy
Lecture 25 - Application of Variational method,Hydrogen,Helium atom,Comparison with perturbation theory
Lecture 26 - WKB Approximation, Bohr Sommerfeld quantization condition
Lecture 27 - Summary of Approximation methods, Time dependent Perturbation Theory
Lecture 28 - Time dependent Perturbation Theory, Fermi's Golden rule, Einstein's A and B coefficients
Lecture 29 - Scattering Theory

Lecture 30 - Linear Response Theory
Lecture 31 - Quantum Dynamics
Lecture 32 - Examples
Lecture 33 - Interaction of Radiation with matter, Landau levels

NPTEL Video Course - Physics - NOC:A Brief Course on Superconductivity

Subject Co-ordinator - Dr. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Historical introduction of superconductivity
Lecture 2 - Meissner effect, Electrodynamics of Superconductors, coherence length and penetration depth
Lecture 3 - Electron Pairing, Basics of BCS Theory
Lecture 4 - BCS ground state, variational calculation, expression for Tc
Lecture 5 - Order parameter, Free energy functional, Ginzburg-Landau (GL) Theory, GL equations
Lecture 6 - London Equations, Flux quantization
Lecture 7 - Thermodynamic properties of superconductors, specific heat
Lecture 8 - Experimental determination of Superconducting properties
Lecture 9 - Unconventional Superconductivity, Uemura plot, High-Tc superconductivity, d-wave pairing, ARPES
Lecture 10 - Singlet and triplet states of two s =1/2, magnetic Hamiltonian
Lecture 11 - t-J model, discrete symmetry groups, example square lattice
Lecture 12 - Cuprate Superconductors, electron vs hole doped superconductors
Lecture 13 - Non-Fermi Liquid Theory, Adiabatic continuity
Lecture 14 - Quasiparticle lifetime, breakdown of Fermi Liquid Theory in cuprate superconductors
Lecture 15 - Josephson junctions, Josephson equations
Lecture 16 - Numerical Differentiation
Lecture 17 - Richardson's extrapolation

NPTEL Video Course - Physics - NOC:Introduction to Statistical Mechanics

Subject Co-ordinator - Prof.Girish S. Setlur

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Prerequisites and Introduction
Lecture 2 - Combinatorics and Entropy
Lecture 3 - Method of steepest descent
Lecture 4 - Bose and Fermi gases
Lecture 5 - Maxwell Boltzmann distribution
Lecture 6 - Thermodynamic potentials
Lecture 7 - Legendre transformation
Lecture 8 - Specific heats of quantum gases
Lecture 9 - Low and high temperature equations of state
Lecture 10 - Chandrasekhar Limit
Lecture 11 - Radiation thermodynamics
Lecture 12 - Thermodyamics of black holes
Lecture 13 - Van der Waals fluid
Lecture 14 - Landau Diamagnetism
Lecture 15 - Relations between ensembles and Pauli paramagnetism
Lecture 16 - Ferromagnetism
Lecture 17 - Correlations and Mean Field
Lecture 18 - Theories of Specific Heat of Solids
Lecture 19 - Tutorial - I
Lecture 20 - Tutorial - II
Lecture 21 - Tutorial - III
Lecture 22 - Tutorial - IV
Lecture 23 - Tutorial - V
Lecture 24 - RG method Ising model
Lecture 25 - Introduction to Second Quantisation
Lecture 26 - Quantum Theory of EM Field - I
Lecture 27 - Quantum Theory of EM Field - II
Lecture 28 - Creation and Annihilation in Fock Space - I
Lecture 29 - Creation and Annihilation in Fock Space - II

Lecture 30 - Green functions in many particle systems
Lecture 31 - Second quantised hamiltonians
Lecture 32 - Current algebra

NPTEL Video Course - Physics - NOC:Numerical Methods and Simulation Techniques for Scientists and Engineers

Subject Co-ordinator - Dr. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Error analysis and estimates, significant digits, convergence
Lecture 2 - Roots of Non-linear equations, Bisection method
Lecture 3 - Newton Raphson method, Secant method
Lecture 4 - Newton Raphson Method
Lecture 5 - Newton Raphson Method (example), Curve fitting and interpolation of data
Lecture 6 - Newtonâ s interpolation formula, statistical interpolation of data
Lecture 7 - Linear and Polynomial regression
Lecture 8 - Numerical differentiation
Lecture 9 - Numerical differentiation, Error analysis
Lecture 10 - Numerical integration, Trapezoidal rule
Lecture 11 - Simpsonâ s 1/3rd rule
Lecture 12 - Simpsonâ s 1/3rd rule, Gaussian integration
Lecture 13 - Ordinary Differential equations
Lecture 14 - Solution of differential equation, Taylor series and Euler method
Lecture 15 - Heunâ s method
Lecture 16 - Runge Kutta method
Lecture 17 - Examples of differential equation
Lecture 18 - Introduction to Monte Carlo technique
Lecture 19 - Details of the Monte Carlo method
Lecture 20 - Importance sampling
Lecture 21 - Applications
Lecture 22 - Introduction to Molecular Dynamics
Lecture 23 - Verlet algorithm
Lecture 24 - Applications of Molecular dynamics

NPTEL Video Course - Physics - NOC:Theoretical Mechanics

Subject Co-ordinator - Dr. Charudatt Y. Kadolkar

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, Constraints
Lecture 2 - Generalized Coordinates, Configuration Space
Lecture 3 - Principle of Virtual Work
Lecture 4 - D'Alembert's Principle
Lecture 5 - Lagrange's Equations
Lecture 6 - Hamilton's Principle
Lecture 7 - Variational Calculus, Lagrange's Equations
Lecture 8 - Conservation Laws and Symmetries
Lecture 9 - Velocity Dependent Potentials, Non-holonomic Constraints
Lecture 10 - An Example
Lecture 11 - Phase Space
Lecture 12 - Legendre Transforms
Lecture 13 - Hamilton's Equations
Lecture 14 - Conservation Laws, Routh's procedure
Lecture 15 - An Example
Lecture 16 - Canonical Transformations
Lecture 17 - Symplectic Condition
Lecture 18 - Canonical Invariants, Harmonic Oscillator
Lecture 19 - Poisson Bracket Formulation
Lecture 20 - Infinitesimal Canonical Transformations
Lecture 21 - Symmetry Groups of Mechanical Systems
Lecture 22 - Hamilton Jacobi Theory
Lecture 23 - Action-Angle Variables
Lecture 24 - Separation of Variables and Examples
Lecture 25 - Continuous Systems and Fields
Lecture 26 - The Stress-Energy Tensor
Lecture 27 - Hamiltonian Formulation

NPTEL Video Course - Physics - NOC:Solar Energy Engineering and Technology

Subject Co-ordinator - Prof. Pankaj Kalita

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Energy Scenarios
Lecture 2 - Overview of solar energy conversion devices and applications
Lecture 3 - Physics of propagation of solar radiation from the sun to the earth
Lecture 4 - Solar radiation and sunshine measuring instruments
Lecture 5 - Geometry, angles and measurement - I
Lecture 6 - Geometry, angles and measurement - II
Lecture 7 - Estimation of radiation under different climatic conditions
Lecture 8 - Estimation of radiation in horizontal and inclined surface
Lecture 9 - Fundamentals of PV cells
Lecture 10 - Semiconductor physics
Lecture 11 - Performance characterization of PV cells
Lecture 12 - Photovoltaic modules and arrays
Lecture 13 - Components of standalone PV system
Lecture 14 - Design of standalone PV system
Lecture 15 - Functioning and components of PV system
Lecture 16 - Design of a grid connected PV system
Lecture 17 - Performance analysis of a grid connected PV system
Lecture 18 - Basics of thermal collectors
Lecture 19 - Basics of heat transfer
Lecture 20 - Solar collector losses and loss estimation
Lecture 21 - Analysis of flat plate collector
Lecture 22 - Influence of various parameters on the performance of LFPC
Lecture 23 - Testing and application of LFPC
Lecture 24 - Basics and performance analysis of solar air heaters
Lecture 25 - Testing and application of solar air heaters
Lecture 26 - Fundamentals of concentrating collectors
Lecture 27 - Concentrating collector technologies and working principle
Lecture 28 - Tutorial
Lecture 29 - Sensible heat, latent heat and thermochemical energy storage

Lecture 30 - Solar pond
Lecture 31 - Tutorial
Lecture 32 - Emerging technologies
Lecture 33 - Solar energy applications in cooking, desalination, refrigeration and electricity generation
Lecture 34 - Tutorial

NPTEL Video Course - Physics - NOC:Quantum Technology and Quantum Phenomena in Macroscopic Systems

Subject Co-ordinator - Prof. Amarendra Kumar Sarma

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Basic Quantum Mechanics
Lecture 2 - Problem Solving Session - 1
Lecture 3 - Two-level System - I
Lecture 4 - Bloch Sphere: Supplementary Lecture - I
Lecture 5 - Two-level Systems - II
Lecture 6 - Two-level Systems - III
Lecture 7 - Dressed States;Introduction to Density Matrix
Lecture 8 - Problem Solving Session - 2
Lecture 9 - Density-matrix formalism
Lecture 10 - Quantum Harmonic Oscillators
Lecture 11 - Quantization of Electromagnetic Radiation
Lecture 12 - Quantization of Standing EM Waves;Quantum States of Radiation Fields - I
Lecture 13 - Problem Solving Session - 3
Lecture 14 - Quantum States of Radiation Fields-II: Squeezed States
Lecture 15 - Problem Solving Session - 4
Lecture 16 - Introduction and Basics of Superconductivity
Lecture 17 - Cooper Pair Box as TLS;Introduction to Transmission Line
Lecture 18 - Quantization of Transmission Line - I
Lecture 19 - Quantization of Transmission Line - II
Lecture 20 - The Jaynes Cummings Model - I
Lecture 21 - Problem Solving Session - 5
Lecture 22 - The Jaynes Cummings Model - II
Lecture 23 - Josephson Junctions - I
Lecture 24 - Josephson Junctions - II
Lecture 25 - Problem Solving Session - 6
Lecture 26 - Transmon;Introduction to Dissipation in Quantum Systems
Lecture 27 - Quantum Master Equation
Lecture 28 - Pure dephasing and Dissipative Bloch Equations
Lecture 29 - Derivation of Fermi-Golden Rule

Lecture 30 - Introduction to Cavity Optomechanics;Fabry-Perot Cavity
Lecture 31 - Cavity Optomechanics: Basic Physics - I
Lecture 32 - Problem Solving Session - 7
Lecture 33 - Cavity Optomechanics: Basic Physics - II
Lecture 34 - Classical Regime - I
Lecture 35 - Classical Regime - II; Classical Langevin Equation
Lecture 36 - Problem Solving Session - 8
Lecture 37 - Langevin Equation
Lecture 38 - Quantum Langevin Noise
Lecture 39 - Problem Solving Session - 9
Lecture 40 - Input-Output Relation
Lecture 41 - Cavity Quantum Optomechanics
Lecture 42 - Linearized Cavity Optomechanics; Ground state cooling
Lecture 43 - Normal-Mode Splitting
Lecture 44 - Quantum Optomechanics: Squeezed States

NPTEL Video Course - Physics - NOC:Dynamics of Classical and Quantum Fields

Subject Co-ordinator - Prof. Girish S. Setlur

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Lagrangian Formalism
Lecture 3 - Hamiltonian Mechanics
Lecture 4 - Flows and Symmetries
Lecture 5 - Examples of Continuum Systems
Lecture 6 - Symmetries and Noether's Theorem
Lecture 7 - Dynamical Symmetries
Lecture 8 - Symmetries in Field Theories
Lecture 9 - The Relativistic Electromagnetic Field
Lecture 10 - Stress-Energy (Energy-Momentum) Tensor
Lecture 11 - Green's Theorem and Green's Functions
Lecture 12 - Diffraction Theory
Lecture 13 - Introduction to Elasticity Theory
Lecture 14 - Solution of the rubber band problem
Lecture 15 - The Stress Function Method
Lecture 16 - Strain Energy
Lecture 17 - The Euler Equation
Lecture 18 - Bernoulli's Principle
Lecture 19 - Matter, Momentum and Energy Transport
Lecture 20 - Stokes' Drag - I
Lecture 21 - Stokes' Drag - II
Lecture 22 - Towards Quantum Fields
Lecture 23 - Right and Left Movers
Lecture 24 - Functional Integration - I
Lecture 25 - Functional Integration - II
Lecture 26 - Perturbation theory
Lecture 27 - Quantum Mechanics using Lagrangians
Lecture 28 - Path Integrals - Formalism
Lecture 29 - Path Integrals - Free particles

Lecture 30 - Path Integrals - Harmonic oscillator
Lecture 31 - Creation and annihilation operators - Excitations
Lecture 32 - Creation and annihilation operators - Photons
Lecture 33 - Creation and annihilation operators - Many-body physics
Lecture 34 - Particle and Hole Green functions
Lecture 35 - Current Algebra
Lecture 36 - Tight Binding Models - I
Lecture 37 - Tight Binding Models - II
Lecture 38 - Order Parameters
Lecture 39 - Schrieffer Wolff Transformation
Lecture 40 - Matsubara Green functions - I
Lecture 41 - Matsubara Green functions - II
Lecture 42 - Self Energy and Spectral Functions
Lecture 43 - S-Matrix Perturbation Theory
Lecture 44 - Keldysh Contour
Lecture 45 - Bosonic Coherent States
Lecture 46 - Fermionic Coherent States
Lecture 47 - Nonlocal particle hole operators - Bosons
Lecture 48 - Nonlocal particle hole operators - Fermions

NPTEL Video Course - Physics - NOC:Quantum Hall Effects

Subject Co-ordinator - Prof. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Conductance in Nanostructures
Lecture 2 - S-Matrix, Reflection and Transmission
Lecture 3 - Introduction to Classical and Quantum Hall Effect
Lecture 4 - Quantum Hall Effect
Lecture 5 - Landau Levels
Lecture 6 - Degenracy of Landau levels
Lecture 7 - Shubnikov de Haas Oscillations
Lecture 8 - Kubo Formula
Lecture 9 - Symmetric gauge
Lecture 10 - Tight binding model, Hofstadter Butterfly
Lecture 11 - Topological Invariant, Chern number
Lecture 12 - Electronic structure of Graphene
Lecture 13 - Low energy Dispersion
Lecture 14 - Dirac Hamiltonian, Hofstadter Butterfly
Lecture 15 - QHE, Landau Levels
Lecture 16 - Properties of Spin angular Momentum, Spin Hall Effect
Lecture 17 - Quantum spin Hall insulator, Kene-Mele Model
Lecture 18 - Kene-Mele Model
Lecture 19 - Landau gauge in fractional quantum Hall effect
Lecture 20 - Laughlin States, Properties
Lecture 21 - Plasma analogy
Lecture 22 - Composite Fermions, Hierarchy

NPTEL Video Course - Physics - NOC:Quantum Entanglement: Fundamentals, Measures and Applications

Subject Co-ordinator - Prof. Amarendra Kumar Sarma

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Review of Quantum Mechanics
Lecture 3 - Mathematical Tools: Density Matrix - Part 1
Lecture 4 - Mathematical Tools: Density Matrix - Part 2
Lecture 5 - Problem solving session - 1
Lecture 6 - Basic Technical Introduction to Quantum Entanglement
Lecture 7 - Schmidt Decomposition Method
Lecture 8 - The EPR Paradox and Bell Inequalities
Lecture 9 - Problem solving session - 2
Lecture 10 - Quantum Measurements
Lecture 11 - Properties of Quantum Entanglement
Lecture 12 - Quantum Entanglement Measures - I
Lecture 13 - Problem solving session - 3
Lecture 14 - Quantum Entanglement Measures - II
Lecture 15 - Applications of Quantum Entanglement - I
Lecture 16 - Applications of Quantum Entanglement - II
Lecture 17 - Problem solving session - 4

NPTEL Video Course - Physics - NOC:Topology and Condensed Matter Physics

Subject Co-ordinator - Prof. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Topology
Lecture 2 - Topological invariant, Berry phase
Lecture 3 - Second quantization
Lecture 4 - Ten Fold Classification
Lecture 5 - Symmetries and SSH - model
Lecture 6 - SSH - model, Introduction to superconductivity
Lecture 7 - Kitaev model
Lecture 8 - Introduction to Classical and Quantum Hall effect
Lecture 9 - Quantum Hall Effect
Lecture 10 - Landau Levels
Lecture 11 - Properties of Landau Levels
Lecture 12 - Edge modes of Landau levels, Incompressibility of Quantum Hall States
Lecture 13 - Kubo formula
Lecture 14 - Hall quantization and Topological invariant
Lecture 15 - Electronic structure of Graphene
Lecture 16 - Symmetries and QHE in Graphene
Lecture 17 - Haldane model
Lecture 18 - Anomalous quantum Hall effect in Haldane model
Lecture 19 - Introduction of spin Hall effect
Lecture 20 - Spin current, quantum spin Hall effect
Lecture 21 - Quantum spin Hall insulator, Kane Mele model
Lecture 22 - Kane Mele model with Rashba spin-orbit coupling, spin Hall conductivity
Lecture 23 - Symmetric gauge in FQHE
Lecture 24 - Laughlin States
Lecture 25 - Plasma analogy
Lecture 26 - Composite Fermions, Hierarchy picture
Lecture 27 - Topological Consideration of FQHE
Lecture 28 - 3D Topological Insulators

NPTEL Video Course - Physics - NOC:Statistical Physics of Non-Interacting and Interacting Systems

Subject Co-ordinator - Prof. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Review of Thermodynamics
Lecture 2 - Laws of Thermodynamics, Entropy
Lecture 3 - Maxwell's relations, velocity distribution
Lecture 4 - Thermodynamic Potentials
Lecture 5 - Binomial expansion, Random Walk
Lecture 6 - Ensemble Theory, Micro and Macrostates and Liouvilles's Theorem
Lecture 7 - Ergodic Hypothesis, Phase Space
Lecture 8 - Microcanonical Ensemble and Its Applications
Lecture 9 - Canonical Ensemble, Parition Function, Central Limit Theorem
Lecture 10 - Applications of Canonical Ensemble
Lecture 11 - Bounded System, Negative Temparature, Specific Heat of Solids
Lecture 12 - Virial Theorem, Grand Canonical Distribution
Lecture 13 - Grand Canonical Distribution, Photon Gas
Lecture 14 - Canonical Ensemble, Parition Function, Central Limit Theorem
Lecture 15 - Applications of Canonical Ensemble
Lecture 16 - Bounded System, Negative Temparature, Specific Heat of Solids
Lecture 17 - Virial Theorem, Grand Canonical Distribution
Lecture 18 - Grand Canonical Distribution, Photon Gas
Lecture 19 - Quantum Statistical Mechanics, Indistinguishability of Particles, Ensembles
Lecture 20 - Density Matrix, Exchange Statistics, Bosons and Fermions
Lecture 21 - MB, BE, FD Statistics
Lecture 22 - Bose Statistics, Bose Einstein Condensation
Lecture 23 - Properties of BEC, Phase Transition
Lecture 24 - Experimental Aspects of BEC, Black Body Radiation, Phonons
Lecture 25 - FD Statistics, Properties of Fermi Systems
Lecture 26 - Bethe Ansatz
Lecture 27 - Cluster expansion, Critical Isotherms
Lecture 28 - Virial Coefficients, Equation of State for real gases
Lecture 29 - de Haas-van Alphen effect

Lecture 30 - Black Hole Thermodynamics

NPTEL Video Course - Physics - NOC:Elements of Modern Physics

Subject Co-ordinator - Prof. Saurabh Basu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Reviews of Classical Physics - Newtons Laws of Motion
Lecture 2 - Lagrangian Mechanics
Lecture 3 - Special Theory of Relativity
Lecture 4 - Postulates of Quantam Mechanics, Old Quantam Theory
Lecture 5 - Hydrogen Spectra, Stern Gerlach, Compton Effect
Lecture 6 - Wavefunction, Operators, Representations in QM
Lecture 7 - Solution of Schroedinger Equation for 1D potentials
Lecture 8 - Harmonic Oscillator, Hydrogen Atom
Lecture 9 - Spin Angular Momentum, Perturbation Theory
Lecture 10 - Degenerate Perturbation Theory, Stark Effect
Lecture 11 - Zeeman Effect
Lecture 12 - Operator Methods for Harmonic Oscillator
Lecture 13 - Variational Theory
Lecture 14 - Time Dependent Perturbation Theory
Lecture 15 - Clebsch-Gordon Coefficients
Lecture 16 - Electrostatics
Lecture 17 - Dielectrics
Lecture 18 - Laplaces Equation, Magnetostatics, Maxwell's Equations
Lecture 19 - Ensembles, Microstates and Macrostates
Lecture 20 - Sackur-Tetrode Equation, Density Matrices
Lecture 21 - Identical Particles
Lecture 22 - Quantum Statistics
Lecture 23 - Crystal Structure, Bragg's Law
Lecture 24 - Lattice Vibrations, Specific Heat
Lecture 25 - Free Electron Theory
Lecture 26 - Magnetism and Magnetic Materials
Lecture 27 - Superconductivity, Meissner Effect, Type I and II Superconductors
Lecture 28 - Nuclear Models
Lecture 29 - Radioactive Decay, Half Life

Lecture 30 - Binding Energy, Shell Model, Liquid drop model
Lecture 31 - Klein-Gordon and Dirac Equations
Lecture 32 - Elementary Particles, Detectors
Lecture 33 - Periodic Table of Elementary Particles, Quark Model

NPTEL Video Course - Physics - NOC:Essentials of Quantum Optics

Subject Co-ordinator - Prof. Amarendra Kumar Sarma

Co-ordinating Institute - IIT Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Quantum Mechanics of Two-level Atom - I
Lecture 2 - Quantum Mechanics of Two-level Atom - II
Lecture 3 - Problem Solving Session - 1
Lecture 4 - Interaction of classical light with two-level atom - I
Lecture 5 - Interaction of classical light with two-level atom - II
Lecture 6 - Problem Solving Session - 2
Lecture 7 - Quantum States: Density Operator - I
Lecture 8 - Quantum States: Density Operator - II
Lecture 9 - Problem Solving Session - 3
Lecture 10 - Quantum States of Composite Systems
Lecture 11 - Quantum Computation Fundamentals - I
Lecture 12 - Quantum Computation Fundamentals - II
Lecture 13 - Problem Solving Session - 4
Lecture 14 - The Quantum Master Equation - I
Lecture 15 - The Quantum Master Equation - II
Lecture 16 - Problem Solving Session - 5
Lecture 17 - Electromagnetically Induced Transparency
Lecture 18 - Quantization of Light
Lecture 19 - Photon Statistics
Lecture 20 - Coherent States of Light
Lecture 21 - Squeezed States of Light
Lecture 22 - Problem Solving Session - 6
Lecture 23 - Circuit QED - I
Lecture 24 - Circuit QED - II
Lecture 25 - The Jaynes Cummings Model
Lecture 26 - Problem Solving Session - 7
Lecture 27 - Cavity Quantum Optomechanics - I
Lecture 28 - Cavity Quantum Optomechanics - II
Lecture 29 - Cavity Quantum Optomechanics - III

Lecture 30 - Problem Solving Session - 8

NPTEL Video Course - Physics - Nuclear Physics: Fundamentals and Applications

Subject Co-ordinator - Prof. H.C. Verma

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Brief Overview of the course
Lecture 2 - Nuclear Size
Lecture 3 - Nuclear Size (Continued...)
Lecture 4 - Nuclear Size (Continued...)
Lecture 5 - Semi empirical Mass Formula
Lecture 6 - Semi empirical Mass Formula (Continued...)
Lecture 7 - Semi empirical Mass Formula (Continued...)
Lecture 8 - Semi empirical Mass Formula (Continued...)
Lecture 9 - Semi empirical Mass Formula (Continued...)
Lecture 10 - How are Neutron stars bound
Lecture 11 - Deuteron
Lecture 12 - Deuteron (Continued...)
Lecture 13 - Deuteron (Continued...)
Lecture 14 - Scattering of nucleons
Lecture 15 - Low energy n-p scattering
Lecture 16 - Theories of nuclear forces
Lecture 17 - Shell model
Lecture 18 - Shell model (Continued...)
Lecture 19 - Shell model (Continued...)
Lecture 20 - Shell model (Continued...)
Lecture 21 - Shell model (Continued...)
Lecture 22 - Collective models
Lecture 23 - Vibrational and Rotational levels
Lecture 24 - Radioactivity, Alpha Decay
Lecture 25 - Alpha decay (Continued...)
Lecture 26 - Beta decay
Lecture 27 - Beta decay (Continued...)
Lecture 28 - Beta decay (Continued...)
Lecture 29 - Gamma decay

Lecture 30 - Nuclear Reactions
Lecture 31 - Nuclear reaction (Continued...)
Lecture 32 - Nuclear reaction (Continued...)
Lecture 33 - Nuclear Fission basics
Lecture 34 - Nuclear fission of uranium
Lecture 35 - Nuclear Fission Reactor
Lecture 36 - Nuclear Energy Programme of India
Lecture 37 - Nuclear Fusion
Lecture 38 - Nuclear fusion (Continued...)
Lecture 39 - Thermonuclear fusion reactors
Lecture 40 - Fusion reactions in Stars and stellar neutrinos
Lecture 41 - Nucleosynthesis of elements in Stars
Lecture 42 - Mossbauer Spectroscopy
Lecture 43 - RBS, PIXE, NAA, Summary

NPTEL Video Course - Physics - NOC:Introduction to Electromagnetism

Subject Co-ordinator - Prof. Manoj K Harbola

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Coloumb's Law
Lecture 2 - Coloumb's Force due to several Point charges
Lecture 3 - Force due to distribution of Charges
Lecture 4 - What is an Electric Field?
Lecture 5 - Electric Field due to a Charged Distribution
Lecture 6 - Helmholtz's Theorem for Electric Field
Lecture 7 - Divergence of a Field
Lecture 8 - Divergence of Electric Field & Gauss's Law
Lecture 9 - Curl Of a Field - I
Lecture 10 - Curl of a Field - II & Stokes' Theorem
Lecture 11 - Line surface area & volume elements in Cartesian & Cylindrical Coordinates
Lecture 12 - Line surface area & volume elements in Spherical Polar Coordinates
Lecture 13 - Examples of application of the divergence and stokes' theorems
Lecture 14 - Electrostatic Potential
Lecture 15 - Electric field as the gradient of electrostatic potential
Lecture 16 - Laplace's and Poisson's equations for electrostatic potential
Lecture 17 - Elecrostatic potential due to a charge distribution - I; a line charge of finite length
Lecture 18 - Elecrostatic potential due to a charge distribution - II;a ring and a spherical shell of charge
Lecture 19 - Uniqueness of the solution of Laplace's and Poisson's equations
Lecture 20 - Method of images I
Lecture 21 - Method of imagesII
Lecture 22 - Laplaces equations in some other physical phenomena
Lecture 23 - Energy of a charge distribution - I
Lecture 24 - Energy of a charge distribution - II An example
Lecture 25 - Energy of a charge distribution - III Energy density in terms of electric field
Lecture 26 - Electric field and potential in a conductor
Lecture 27 - Reciprocity theorem for conductors - I
Lecture 28 - Reciprocity theorem for conductors - II
Lecture 29 - Electric polarization and bound charges - I

Lecture 30 - Electric polarization and bound charges - II
Lecture 31 - Electric Displacement
Lecture 32 - Elecrostatics in presence of Dielectric Materials - I
Lecture 33 - Elecrostatics in presence of Dielectric Materials - II
Lecture 34 - Introduction to Magnetostatics; The BiO-Savart law
Lecture 35 - Divergence and curl of Magnetic Field
Lecture 36 - Amperes law for Magnetic Fields
Lecture 37 - Vector Potential for Magnetic Fields
Lecture 38 - Calculation of Vector Potential for a given magnetic field
Lecture 39 - Equation for the Vector Potentialin terms of current density
Lecture 40 - Vector potential from Current Densities - I
Lecture 41 - Vector potential from Current Densities - II
Lecture 42 - Magnetic Materials - I
Lecture 43 - Magnetic Materials - II Bound Current Densities
Lecture 44 - The Auxiliary Field - H
Lecture 45 - Solving for Magnetic Field of a magnet - I
Lecture 46 - Solving for Magnetic Field of a magnet in presence of Magnetic Materials
Lecture 47 - Faradays Law
Lecture 48 - Induced Electric field due to changing Magnetic Field
Lecture 49 - Demonstrations on faradays law, Lenzs law and Nonconservative nature of Induced electric field
Lecture 50 - Energy stord in a magnetic Field-I
Lecture 51 - Energy stord in a magnetic Field-I;solved examples
Lecture 52 - Displacement Current
Lecture 53 - Quasistatic approximation
Lecture 54 - Energy transport by electromagnetic fields; The Poynting Vector
Lecture 55 - The Poynting Vector;solved examples
Lecture 56 - Linear Momentum and Angular Momentum carried by Electromagnetic Fields
Lecture 57
Lecture 58
Lecture 59
Lecture 60
Lecture 61
Lecture 62
Lecture 63
Lecture 64
Lecture 65
Lecture 66 - Solution Assignment 1 - Problems 1 to 3
Lecture 67 - Solution Assignment 1 - Problems 4 to 9
Lecture 68 - Solution Assignment 2 - Problems 1 to 4

Lecture 69 - Solution Assignment 2 - Problems 5 to 11
Lecture 70 - Solution Assignment 3 - Problems 1 to 5
Lecture 71 - Solution Assignment 3 - Problems 6 to 10
Lecture 72 - Solution Assignment 4- Problems 1 to 5
Lecture 73 - Solution Assignment 4- Problems 6 to 10
Lecture 74 - Solution Assignment 5- Problems 6 to 11
Lecture 75 - Solution Assignment 5- Problems 1to 5
Lecture 76 - Solution Assignment 6- Problems 1 to 4
Lecture 77 - Solution Assignment 6- Problems 5 to 8
Lecture 78 - Solution Problem Set 7

NPTEL Video Course - Physics - NOC:Engineering Mechanics

Subject Co-ordinator - Prof. Manoj K Harbola

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Vectors
Lecture 2 - Addition and subtraction of vectors
Lecture 3 - Multiplying vectors
Lecture 4 - Introduction to vectors
Lecture 5 - Transformation of vectors under rotation
Lecture 6 - Vector products and their geometric interpretation
Lecture 7 - Vector Product
Lecture 8 - Vector Product
Lecture 9 - Introduction to vectors
Lecture 10 - Equilibrium of rigid bodies Â Forces and torques
Lecture 11 - Calculating torques and couple moments - I
Lecture 12 - Calculating torques and couple moments - II
Lecture 13 - Finding a force and a couple equivalent to an applied force
Lecture 14 - Different elements and associated forces and torques - I
Lecture 15 - Different elements and associated forces and torques - II
Lecture 16 - Solved examples; equilibrium of bodies Â I
Lecture 17 - Solved examples; equilibrium of bodies Â II
Lecture 18 - Forces in different geometric configuration
Lecture 19 - Plane trusses I - building a truss and condition for it to be statically determinate
Lecture 20 - Plane trusses II - calculating forces in a simple truss and different types of trusses
Lecture 21 - Plane trusses III - calculating forces in a simple truss by method of joints
Lecture 22 - Plane trusses IV- Solved examples for calculating forces in a simple truss by method of joints
Lecture 23 - Plane trusses V - Solved examples for calculating forces in a simple truss by method of joints
Lecture 24 - Plane trusses VI - method of sections for calculating forces in a simple truss
Lecture 25 - Dry friction I - introduction with an example
Lecture 26 - Dry friction II - a solved example
Lecture 27 - Dry friction III - Dry thrust bearing and belt friction with demonstration
Lecture 28 - Dry friction IV - Screw friction and rolling friction
Lecture 29 - Dry friction V - Solved examples

Lecture 30 - Properties of plane surfaces I - First moment and centroid of an area
Lecture 31 - Properties of plane surfaces II - Centroid of an area made by joining several plane surfaces
Lecture 32 - Properties of plane surfaces III - Centroid of a distributed force and its relation with centre
Lecture 33 - Properties of plane surfaces IV - solved examples of calculation of first moment and centroid of
Lecture 34 - Properties of plane surfaces V- Second moment and product of an area and radius of gyration
Lecture 35 - Properties of plane surfaces VI - Parallel axis transfer theorem for second moment and product o
Lecture 36 - Properties of plane surfaces VII - transformation of second moment and product of an area under
Lecture 37 - Properties of plane surfaces VIII - second moment and product of an area, solved examples
Lecture 38 - Method of virtual work I - degrees of freedom, constraints and constraint forces
Lecture 39 - Method of virtual work II - virtual displacement, virtual work and equilibrium condition in term
Lecture 40 - Method of virtual work III - solved examples
Lecture 41 - Motion of a particle in a plane in terms of planar polar coordinates
Lecture 42 - Planar polar coordinates
Lecture 43 - Description of motion in cylindrical and spherical coordinate systems
Lecture 44 - Using planar polar, cylindrical and spherical coordinate systems
Lecture 45 - Motion with constraints, constraint forces and free body diagram
Lecture 46 - Motion with constraints Â solved examples
Lecture 47 - Motion with dry friction Â solved examples
Lecture 48 - Motion with drag Â solved examples
Lecture 49 - Equation of motion in terms of linear momentum and the principle of conservation of linear momen
Lecture 50 - Linear momentum and centre of mass
Lecture 51 - Momentum transfer, impulse and force due to a stream of particles hitting an object
Lecture 52 - Momentum and the variable mass problem
Lecture 53 - Linear momentum Â solved examples
Lecture 54 - Work and energy I - work energy theorem; conservative and non-conservative force fields
Lecture 55 - Work and energy II - Definition of potential energy for conservative forces; total mechanical en
Lecture 56 - Work and energy III - Two solved examples using conservation principles
Lecture 57 - Work and energy IV Â Further discussion on potential energy
Lecture 58 - Work and energy V - Solved examples
Lecture 59 - Work and energy VI Â Applying conservation principles to solve a collision problem
Lecture 60 - Work and energy VII - Solved examples
Lecture 61 - Rigid body motion I - degrees of freedom and number of variables required to describe motion of
Lecture 62 - Rigid body motion II - Equation of motion for a single particle in terms of angular momentum and
Lecture 63 - Rigid body motion III - Conservation of angular momentum; angular momentum for a collection of p
Lecture 64 - Rigid body motion IV - applying angular momentum conservation, a solved example
Lecture 65 - Rigid body motion V (fixed axis rotation) - some demonstrations of conservation of angular momen
Lecture 66 - Rigid body motion VI (fixed axis rotation) - Some more demonstrations and related problems
Lecture 67 - Rigid body motion VII (fixed axis rotation) - Kinetic energy and moment of inertia for fixed axi
Lecture 68 - Rigid body motion VIII (fixed axis rotation) - solved examples for calculating moment of inertia

Lecture 69 - Rigid body motion IX (fixed axis rotation) - solved examples
Lecture 70 - Rigid body motion X - rotation and translation with axis moving parallel to itself
Lecture 71 - Rigid body motion XI - solved examples for rotation and translation with axis moving parallel to
Lecture 72 - Rigid-body dynamics XII - Some demonstrations on general motion of rigid bodies
Lecture 73 - Rigid-body dynamics XIII - Infinitesimal angles as vector quantities and change of a vector when
Lecture 74 - Rigid-body dynamics XIV - Angular velocity and the rate of change of a rotating vector; relating
Lecture 75 - Rigid-body dynamics XV - Relationship between angular momentum and angular velocity Â the momen
Lecture 76 - Rigid-body dynamics XVI - Solved examples
Lecture 77 - Rigid body motion XVII Â A review of the relation between angular momentum and angular velocity
Lecture 78 - Rigid body motion XVIII- Solved examples for calculating rate of change of angular momentum and
Lecture 79 - Rigid body dynamics XIX - understanding demonstrations shown earlier using equation of motion
Lecture 80 - Rigid body dynamics XX - understanding demonstrations shown earlier using equation of motion (Eu
Lecture 81 - Rigid body dynamics XXI - Euler equations, solved examples
Lecture 82 - Simple harmonic motion I - expanding potential energy about the equilibrium point and the corres
Lecture 83 - Simple harmonic motion II - solving the equation of motion with given initial conditions
Lecture 84 - Simple harmonic motion III - solved examples
Lecture 85 - Simple harmonic motion IV - representing simple harmonic motion on a phasor diagram; energy of a
Lecture 86 - Simple harmonic motion V - solved examples
Lecture 87 - Simple harmonic motion VI - solving the equation of motion with constant friction in the system
Lecture 88 - Simple harmonic motion VII - harmonic oscillator with velocity-dependent damping (heavy damping)
Lecture 89 - Simple harmonic motion VIII - harmonic oscillator with velocity-dependent damping (critical damp
Lecture 90 - Simple harmonic motion IX - solved examples
Lecture 91 - Simple harmonic motion X - harmonic oscillator with velocity-dependent damping (light damping)
Lecture 92 - Simple harmonic motion XI - solved examples
Lecture 93 - Simple harmonic motion XII - oscillations of an un-damped harmonic oscillator subjected to an os
Lecture 94 - Simple harmonic motion XIII - oscillations of a forced damped harmonic oscillator - I
Lecture 95 - Simple harmonic oscillator XIV - oscillations of a forced damped harmonic oscillator - II
Lecture 96 - Simple harmonic oscillator XV - Energy and power in a forced damped harmonic oscillator
Lecture 97 - Simple harmonic oscillator XVI - Solved examples
Lecture 98 - Equation of motion in a uniformly accelerating frame
Lecture 99 - Motion described in a uniformly accelerating frame; solved examples - I
Lecture 100 - Motion described in a uniformly accelerating frame; solved examples - II

NPTEL Video Course - Physics - NOC:Computational Science and Engineering Using Python

Subject Co-ordinator - Prof. Mahendra Verma

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Lecture 1 - About Computers
Lecture 2 - Lecture 2 - Python
Lecture 3 - Lecture 3 - Python
Lecture 4 - Lecture 4 - Python
Lecture 5 - Lecture 5A - Python packages; Programming
Lecture 6 - Lecture 5B - Some suggestions on programming
Lecture 7 - Lecture 6 - Plotting in Python
Lecture 8 - Lecture 7 - Errors and Nondimensionalization
Lecture 9 - Lecture 8 - Data I/O and Mayavi
Lecture 10 - Lecture 9 - Lagrange interpolation
Lecture 11 - Lecture 10 - Interpolation II
Lecture 12 - Lecture 11 - Integration I
Lecture 13 - Lecture 12 - Integration II
Lecture 14 - Lecture 13 - Gaussian quadrature continued
Lecture 15 - Lecture 14 - Numerical Differentiation
Lecture 16 - Lecture 15 - ODE solvers
Lecture 17 - Lecture 16 - ODE solvers continued
Lecture 18 - Lecture 17 - Fourier transform
Lecture 19 - Lecture 18 - PDE solver
Lecture 20 - Lecture 19A - PDE solver
Lecture 21 - Lecture 19B - PDE solver
Lecture 22 - Lecture 20 - Linear algebra
Lecture 23 - Lecture 21 - Summary

NPTEL Video Course - Physics - NOC:Introductory Quantum Mechanics

Subject Co-ordinator - Prof. Manoj K Harbola

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Black Body Radiation I - Relevant Definitions and Black Body as cavity
Lecture 2 - Black Body Radiation II - Intensity of radiation in terms of energy density
Lecture 3 - Black Body Radiation III - Spectral energy density and radiation pressure inside a black body rad
Lecture 4 - Black Body Radiation IV - Stephen's Boltzman law
Lecture 5 - Black Body Radiation V - Wein's Displacement law and analysis for spectral density
Lecture 6 - Black Body Radiation VI - Wein's distribution law and rayleigh - Jeans distribution law
Lecture 7 - Black Body Radiation VII - Quantum Hypothesis and plank's distribution Formula
Lecture 8 - Radiation as a collection of particles called photons
Lecture 9 - Quantum Hypothesis and specific heat of soilds
Lecture 10 - Bohr's Model of hydrogen spectrum
Lecture 11 - Wilson Sommerfeld quantum condition I - Harmonic oscillator and particle in a box
Lecture 12 - Wilson Sommerfeld quantum condition II - Particle moving in a coulomb potential in a plane and r
Lecture 13 - Wilson Sommerfeld quantum condition III - Particle moving in a coulomb potential in 3D and relat
Lecture 14 - Quantum conditions and atomic structure, electron spin and Pauli exclusion principle
Lecture 15 - Interaction of atoms with radiation
Lecture 16 - Stimulated emmision and amplification of light in a LASER
Lecture 17 - Brief description of a LASER
Lecture 18 - Introduction to the correspondence principle
Lecture 19 - General nature of the correspondence principle
Lecture 20 - Selection rules (for transitions) through the correspondence principle
Lecture 21 - Applications of the correspondence principle
Lecture 22 - Heisenberg's formulations of quantum mechanics
Lecture 23 - Heisenberg's formulation of quantum mechanics
Lecture 24 - Heisenberg's formulation of the quantum mechanics
Lecture 25 - Brief introduction to matrix mechanics and the quantum condition in matrix form
Lecture 26 - Introduction to waves and wave equation
Lecture 27 - Sationary waves eigen values and eigen functions
Lecture 28 - Matter waves and their experimental detection
Lecture 29 - Represenating a moving paticle by a wave packet

Lecture 30 - Stationary-state Schrodinger equation and its solution for a particle in a box
Lecture 31 - Solution of the stationary-state Schrodinger equation for a simple harmonic oscillator
Lecture 32 - Equivalance of Heisenberg and the Schrodinger formulations
Lecture 33 - Equivalance of Heisenberg and Schrodinger formulations
Lecture 34 - Born interpretation of the wavefunction and expectation values of x and p operators
Lecture 35 - Uncertainty principle and its simple applications
Lecture 36 - Time dependent Schrodinger equation the probability current density and the continuity equation
Lecture 37 - Ehrenfest theorem for the expectation values of x and p operators
Lecture 38 - Solution of Schrodinger equation for a particle in one and two delta function potentials
Lecture 39 - Solution of Schrodinger equation for a particle in a finite well
Lecture 40 - Numerical solution of a one dimensional Schrodinger equation for bound states - I
Lecture 41 - Numerical solution of a one dimensional Schrodinger equation for bound states - II
Lecture 42 - Reflection and transmission of particles across a potential barrier
Lecture 43 - Quantum-tunneling and its examples
Lecture 44 - Solution of the Schrodinger for free paticles and periodic boundary conditions
Lecture 45 - Electrons in a metal
Lecture 46 - Schrodinger equation for particles in spherically symmetric potential, angular momentum operator
Lecture 47 - Angular momentum operator and its eigenfunctions
Lecture 48 - Equation for radial component of the wavefunction in spherically symmteric potentials and genera
Lecture 49 - Solution for radial component of the wavefunction for the hydrogen atom
Lecture 50 - Numerical solution for the radial component of wavefunction for spherically symmetric potentials
Lecture 51 - Solution of the Schrodinger equation for one dimensional periodic potential
Lecture 52 - Kroning-Penny model and energy bands
Lecture 53 - Kroning-Penny model with periodic Dirac delta function and energy bands
Lecture 54 - Discussion on bands
Lecture 55 - Summary of the course

NPTEL Video Course - Physics - NOC:Introduction to Solid State Physics

Subject Co-ordinator - Prof. Satyajit Banerjee

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Drude's theory of electrons in a metal - Part 1
Lecture 2 - Introduction to Drude's theory of electrons in a metal - Part 2
Lecture 3 - Postulates of Drude's theory
Lecture 4 - Calculating electrical conductivity of metal using Drude's theory of electrons in metal - Part 1
Lecture 5 - Calculating the electrical conductivity of metal using Drude's Model - Part 2
Lecture 6 - Introduction to Hall effect in Metals - Part 1
Lecture 7 - Introduction to Hall effect in metals - Part 2
Lecture 8 - Introduction to Hall effect in metals - Part 3
Lecture 9 - Understanding thermal conductivity of a metal using Drude's model - Part 1
Lecture 10 - Understanding thermal conductivity of a metal using Drude's model - Part 2
Lecture 11 - Introduction to Sommerfeld's Theory of electrons in a metal - Part 1
Lecture 12 - Introduction to Sommerfeld's Theory of electrons in a metal - Part 2
Lecture 13 - Introduction to Sommerfeld's Theory of electrons in a metal - Part 3
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19 - Electronic Contribution to the Specific heat of a Solid - Part 1
Lecture 20 - Electronic Contribution to the Specific heat of a Solid - Part 2
Lecture 21 - Electronic Contribution to the Specific heat of a Solid - Part 3
Lecture 22 - Electronic Contribution to the Specific heat of a Solid - Part 4
Lecture 23 - Understanding Thermal conductivity of Metals
Lecture 24 - Introduction to Magnetism in Metal - Part 1
Lecture 25 - Introduction to Magnetism in Metal - Part 2
Lecture 26
Lecture 27 - Introduction to crystals and bonding in crystals
Lecture 28 - Understanding crystal structure using Bravais Lattice
Lecture 29 - Bravais Lattice Types - Part 1

Lecture 30 - Bravais Lattice Types - Part 2
Lecture 31 - Introduction to different crystal types - Part 1
Lecture 32 - Introduction to different crystal types - Part 2
Lecture 33 - Indexing crystal planes
Lecture 34 - Scattering of X rays from crystals - Part 1
Lecture 35 - Scattering of X rays from crystals - Part 2
Lecture 36 - Reciprocal lattice vectors - Part 1
Lecture 37 - Reciprocal lattice vectors - Part 2
Lecture 38 - Reciprocal lattice vectors and Laue's condition for diffraction of waves in crystals - Part 1
Lecture 39 - Reciprocal lattice vectors and Laue's condition for diffraction of waves in crystals - Part 2
Lecture 40 - Reciprocal lattice vectors, Laue's condition and Bragg's law for diffraction of waves by a cryst
Lecture 41 - Wave equation in a continuous medium and generalization to a discrete medium
Lecture 42 - Derivation of wave equation for motion of atoms in a crystal
Lecture 43 - Solution of the wave equation for a crystal and the relation between frequency Ã•â ° and waveved
Lecture 44 - Group velocity of waves and speed of sound in a crystal
Lecture 45 - Waves in a crystal considering interaction among atoms beyond their nearest neighbours
Lecture 46 - Normal modes in a crystal
Lecture 47 - Experimental determination of Phonon dispersion curves
Lecture 48 - Lattice with two atom basis
Lecture 49 - Displacement of the atoms for the acoustic and optical Phonons
Lecture 50 - Density of states of phonons
Lecture 51 - Calculating the density of states of Phonons
Lecture 52 - Average energy of Phonons at Temperature T
Lecture 53 - Debye's Model of specific heat of crystals
Lecture 54 - Anharmonic effects in crystals
Lecture 55 - Going beyond free electron model
Lecture 56 - Applying perturbation theory to free electron wavefunctions and nearly free electron model
Lecture 57 - Applying perturbation theory to free electron wavefunctions and creation of energy gap at zone b
Lecture 58 - Mixing of plane waves to get Bloch Wavefunction - I
Lecture 59 - Mixing of plane waves to get Bloch Wavefunction - II
Lecture 60 - Equivalence of wave vectors k and k+G and reduced zone scheme
Lecture 61 - Applying periodic boundary condition to Bloch wavefunction and counting the number of states
Lecture 62 - Band theory of metals, insulators and semiconductors
Lecture 63 - Kronig- Penney model
Lecture 64 - Bloch wavefunction as a linear combination of atomic orbitals
Lecture 65 - Tight Binding Model - II
Lecture 66 - Semiclassical dynamics of a particle in a band and Bloch oscillations
Lecture 67 - Experimental observations of Bloch oscillations
Lecture 68 - Concept of hole as a current carrier in semiconductors - I

Lecture 69 - Concept of hole as a current carrier in semiconductors - II
Lecture 70 - Calculating carrier density in semiconductors - I
Lecture 71 - Calculating carrier density in semiconductors - II
Lecture 72 - Donor and acceptor energy levels in a semiconductor
Lecture 73 - charge carrier density in n-type and p-type semiconductors
Lecture 74 - Electrical conductivity and hall coefficient in semiconductors
Lecture 75 - Paramagnetism in solids I - Magnetic moment and Lande g factor for atoms
Lecture 76 - Paramagnetism in solids II - temperature dependence of paramagnetic susceptibility and Curie's L
Lecture 77 - Hund's rule for calculating the total angular momentum J, orbital angular momentum L and spin ar
Lecture 78 - Examples of performing paramagnetic susceptibility calculations
Lecture 79 - Diamagnetism in Solids
Lecture 80 - Understanding quenching of orbital angular momentum in transition metal ions
Lecture 81 - Ferromagnetism in solids
Lecture 82 - Introduction to Meissner state of superconductors and levitation
Lecture 83 - Superconducting materials and Type-I and Type-II superconductors
Lecture 84 - London's equation for superconductors
Lecture 85 - Application of London's equation, behavior
Lecture 86 - A qualitative introduction to BCS theory of superconductivity
Lecture 87 - Josephson's effect in superconductors and tunneling current across barriers

NPTEL Video Course - Physics - NOC:Physics of Turbulence

Subject Co-ordinator - Prof. Mahendra Verma

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - The turbulence problem
Lecture 2 - Basic hydrodynamics - Governing equations
Lecture 3 - Basic hydrodynamics - Vorticity
Lecture 4 - Basic hydrodynamics - Quadratic quantities
Lecture 5 - Basic hydrodynamics - Example problems
Lecture 6 - Fourier space representation - Definitions
Lecture 7 - Fourier space representation - Flow equations
Lecture 8 - Fourier space representation - Kinetic energy
Lecture 9 - Fourier space representation - Vorticity, Kinetic Helicity, and Enstrophy
Lecture 10 - Fourier space representation - Examples
Lecture 11 - Fourier space representation - Examples (Continued...)
Lecture 12 - Craya-Herring Basis
Lecture 13 - Craya-Herring Basis
Lecture 14 - Craya-Herring Basis
Lecture 15 - Thermal Instability
Lecture 16 - Thermal Instabilities (Continued...)
Lecture 17 - Rotating Convection
Lecture 18 - Magnetoconvection
Lecture 19 - Nonlinear Saturation
Lecture 20 - Patterns, Chaos, and Turbulence
Lecture 21 - Energy Transfers
Lecture 22 - Energy Transfers
Lecture 23 - Energy Transfers
Lecture 24 - Energy Transfers
Lecture 25 - Energy Transfers
Lecture 26 - Energy Transfers
Lecture 27 - Kolmogorov's Theory
Lecture 28 - Kolmogorov's Theory
Lecture 29 - Kolmogorov's Theory

Lecture 30 - Kolmogorov's four-fifth law
Lecture 31 - Kolmogorov's four-fifth law
Lecture 32 - Kolmogorov's four-fifth law
Lecture 33 - Enstrophy Spectrum and Flux
Lecture 34 - Two-dimensional Turbulence
Lecture 35 - Helical turbulence
Lecture 36 - Flow with a scalar
Lecture 37 - Passive scalar turbulence
Lecture 38 - Stably stratified turbulence
Lecture 39 - Turbulent thermal convection
Lecture 40 - Flow with a vector
Lecture 41 - MHD Turbulence
Lecture 42 - MHD Turbulence
Lecture 43 - MHD Turbulence
Lecture 44 - MHD Turbulence

NPTEL Video Course - Physics - NOC:Introduction to Astrophysical Fluids

Subject Co-ordinator - Prof. Supratik Banerjee

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - General introduction
Lecture 2 - Phase space and Liouville's theorem
Lecture 3 - Collisionless Boltzmann equation
Lecture 4 - Boltzmann equation for collisional system - I
Lecture 5 - Boltzmann equation for collisional system - II
Lecture 6 - Equilibrium distribution function - I
Lecture 7 - Equilibrium distribution function - II
Lecture 8 - Derivation of moment equations - I
Lecture 9 - Derivation of moment equations - II
Lecture 10 - Application of moment equations in collisionless systems
Lecture 11 - Derivation of ideal fluid equations
Lecture 12 - Macroscopic forces on an ideal fluid
Lecture 13 - Properties of ideal fluid
Lecture 14 - Kevin's vorticity theorem
Lecture 15 - Conservative form and invariants in ideal fluids
Lecture 16 - Steady flow, streamlines and stream function
Lecture 17 - Departure from Maxwellian distribution
Lecture 18 - Derivation of real fluid equations
Lecture 19 - Hydrostatics: Model of solar corona
Lecture 20 - Stellar/solar wind
Lecture 21 - Accretion disks - I
Lecture 22 - A small digression: Newtonian fluids
Lecture 23 - Accretion disk - II
Lecture 24 - Weak perturbation in a compressible fluid: sound wave
Lecture 25 - Effect of nonlinearity: shocks
Lecture 26 - Supernova explosion and spherical blast waves - I
Lecture 27 - Supernova explosion and spherical blast waves - II
Lecture 28 - de Laval nozzle and extragalactic jets
Lecture 29 - Convective instability and Swarzschild stability criterian

Lecture 30 - Rayleigh Benard convection - I
Lecture 31 - Rayleigh Benard convection - II
Lecture 32 - Jeans instability
Lecture 33 - Waves and instabilities in a two-fluid interface - I
Lecture 34 - Waves and instabilities in a two-fluid interface - II
Lecture 35 - Oscillations of stars
Lecture 36 - Oscillation of stars (Continued...)
Lecture 37 - Rotation in astrofluids and Rayleigh criterion
Lecture 38 - Fluid dynamics in a rotating frame of reference
Lecture 39 - Vorticity theorem in rotating frame and Taylor-Proudman theorem
Lecture 40 - Effect of rotation on a self gravitating mass
Lecture 41 - Effect of rotation in stars
Lecture 42 - Introduction to Plasmas
Lecture 43 - Description of Plasma
Lecture 44 - Kinetic to fluid picture of plasmas
Lecture 45 - MHD fluids: magnetic pressure, magnetic tension and plasma beta
Lecture 46 - Inviscid invariants in MHD
Lecture 47 - Inviscid invariants in MHD (Continued...)
Lecture 48 - Elsasser variables in MHD
Lecture 49 - Linear wave modes in MHD
Lecture 50 - MHD in space plasmas
Lecture 51 - Introduction to turbulence in fluids
Lecture 52 - Richardson-Kolmogorov phenomenology of turbulence
Lecture 53 - Turbulent diffusion
Lecture 54 - Turbulent viscosity
Lecture 55 - Turbulence in MHD fluids
Lecture 56 - Introduction to astrophysical dynamos
Lecture 57 - Anti-dynamo theorem and turbulent dynamos

NPTEL Video Course - Physics - NOC:Introduction to Electromagnetic Theory (Hindi)

Subject Co-ordinator - Prof. Manoj Harbola

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
Lecture 9
Lecture 10
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20
Lecture 21
Lecture 22
Lecture 23
Lecture 24
Lecture 25
Lecture 26
Lecture 27
Lecture 28
Lecture 29

Lecture 30
Lecture 31
Lecture 32
Lecture 33
Lecture 34
Lecture 35
Lecture 36
Lecture 37
Lecture 38
Lecture 39
Lecture 40
Lecture 41
Lecture 42
Lecture 43
Lecture 44
Lecture 45
Lecture 46
Lecture 47
Lecture 48
Lecture 49
Lecture 50
Lecture 51
Lecture 52
Lecture 53

NPTEL Video Course - Physics - NOC:Scientific Computing Using Python

Subject Co-ordinator - Prof. Mahendra K. Verma

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
Lecture 9
Lecture 10
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20
Lecture 21
Lecture 22
Lecture 23
Lecture 24
Lecture 25
Lecture 26
Lecture 27
Lecture 28
Lecture 29

Lecture 30
Lecture 31
Lecture 32
Lecture 33
Lecture 34
Lecture 35
Lecture 36
Lecture 37
Lecture 38
Lecture 39
Lecture 40
Lecture 41
Lecture 42
Lecture 43
Lecture 44
Lecture 45
Lecture 46
Lecture 47
Lecture 48
Lecture 49
Lecture 50
Lecture 51
Lecture 52
Lecture 53
Lecture 54
Lecture 55
Lecture 56
Lecture 57
Lecture 58
Lecture 59
Lecture 60
Lecture 61
Lecture 62
Lecture 63
Lecture 64
Lecture 65
Lecture 66
Lecture 67
Lecture 68

Lecture 69
Lecture 70
Lecture 71

NPTEL Video Course - Physics - NOC:Tapestry of Field theory: Classical and Quantum, Equilibrium and Nonequili

Subject Co-ordinator - Prof. Mahendra K. Verma

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Field Theory and Course
Lecture 2 - Integration using Complex Analysis
Lecture 3 - Cauchy Principal Value Theorem
Lecture 4 - Fourier Transform
Lecture 5 - Green's Function and Examples
Lecture 6 - Green's Function in Fourier Space
Lecture 7 - Fourier Transform, Time Frequency
Lecture 8 - Green's Function for Helmholtz Equation and Wave Equation
Lecture 9 - Green's Function for Diffusion and Schrodinger Equation
Lecture 10 - Dimensional Analysis
Lecture 11 - Functionals - Part 1
Lecture 12 - Lagrangian Formalism - Part 2
Lecture 13 - Relativistic Fields
Lecture 14 - Hamiltonian Formalism
Lecture 15 - Principle of Least Action
Lecture 16 - Relativistic Fields and Hamiltonian Formalism
Lecture 17 - Noether's Theorem and Symmetries
Lecture 18 - Review of Quantum Mechanics
Lecture 19 - Second Quantization
Lecture 20 - Field Operators
Lecture 21 - Fock Space and Vaccum Energy
Lecture 22 - Quantization of Bosons and Fermions
Lecture 23 - Examples
Lecture 24 - Free Fermi Gas
Lecture 25 - Propagators and Perturbations
Lecture 26 - Relativistic Quantum Field Theory
Lecture 27 - Feynman Propagator
Lecture 28 - Review of Statistical Mechanics (Partition Function)
Lecture 29 - Feynman Path Integral

Lecture 30 - Diagrammatic Field Theory (Wick's Theorem)
Lecture 31 - Wick's Theorem (Continued...)
Lecture 32 - Diagrammatic Perturbation Theory
Lecture 33 - Green's Function and Correlation Function
Lecture 34 - Feynman Diagrams
Lecture 35 - Phase Transition and Landau Theory
Lecture 36 - Failure of Landau's Theory
Lecture 37 - Scale Invariance
Lecture 38 - Renormalization Group - Preliminary
Lecture 39 - RG Steps
Lecture 40 - Pertubative Calculations
Lecture 41 - RG Fixed Points
Lecture 42 - Relevent and Irrelevant Variables
Lecture 43 - Behaviour Near Critical Points
Lecture 44 - Computing Critical Exponents
Lecture 45 - Mass and Charge Renormalization, Running Coupling const: Î¦4 Theory
Lecture 46 - Charge and Mass Renormalization: QED and QCD
Lecture 47 - Breaking a Continuous Symmetry (Goldstone Mode)
Lecture 48 - Covariant Electrodynamics (Gauge Interactions)
Lecture 49 - Higgs Mechanism
Lecture 50 - Introduction to Non-Equilibrium Field Theory (Langevin Equation)
Lecture 51 - Fluctuation Dissipation Theorem
Lecture 52 - Kolgomorov's Theory of Turbulence
Lecture 53 - Equilibrium and Non Equilibrium Solution of Navier Stokes
Lecture 54 - Energy Flux in Navier Stokes Equation
Lecture 55 - RG Analysis of Field Theory of Turbulence
Lecture 56 - Renormalized Viscosity and Discussion
Lecture 57 - Renormalization of the Coupling Constant for the Shell Model
Lecture 58 - Flux Computation for the Shell Model of Turbulence
Lecture 59 - Renormalization Group Analysis of Navier Stokes Equation
Lecture 60 - Flux Computation for the Navier Stokes Equation
Lecture 61 - Functional Form of a Dynamical Equation
Lecture 62 - Surface Growth Phenomena: Introduction
Lecture 63 - Surface Growth Phenomena: EW Equation
Lecture 64 - Surface Growth Phenomena: KPZ Equation
Lecture 65 - Surface Growth Phenomena: KPZ Equation (Continued...)
Lecture 66 - RG Procedure for KPZ Equation
Lecture 67 - Noise Renormalization
Lecture 68 - Fixed Point Solution

Lecture 69 - Weak Turbulence Theory using Examples
Lecture 70 - Weak Turbulence Applications (Rotating Turbulence, Internal and Surface Gravity Waves)
Lecture 71 - Nonlinear Schodinger Equation
Lecture 72 - Field Theory of Passive Scalar Turbulence
Lecture 73 - Course Summary

NPTEL Video Course - Physics - NOC:Coherence and Quantum Entanglement

Subject Co-ordinator - Prof. Anand Kumar Jha

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Main differences between classical and quantum mechanics
Lecture 2 - Introduction to Coherence and Stochastic Processes
Lecture 3 - The Joint Probability Function used in Classical Optics: The Correlation Functions
Lecture 4 - Second-order Coherence Theory (Temporal)
Lecture 5 - Quantifying the Temporal Correlations
Lecture 6 - Second-order Coherence Theory (Spatial); Spatial Correlations
Lecture 7 - Quantifying the Spatial Correlations
Lecture 8 - Second-order Coherence Theory (Angular); Angular Correlations
Lecture 9 - Second-order Coherence Theory (Polarization)
Lecture 10 - Degree of Polarization
Lecture 11 - Coherent Mode Representation of Optical Fields
Lecture 12 - Review of Quantum Mechanics
Lecture 13 - Quantum Mechanical Correlation Functions
Lecture 14 - Basics of Nonlinear Optics
Lecture 15 - Two-Photon State Produced by Parametric Down-Conversion
Lecture 16 - Coherence and Quantum Entanglement
Lecture 17 - Temporal Two-Photon Interference
Lecture 18 - Some example of Two-Photon Interference Effects
Lecture 19 - Spatial Two-Photon Interference
Lecture 20 - Quantum Measurements
Lecture 21 - Can the Quantum Mechanical Description of Physical Reality be Considered Complete ?
Lecture 22 - Hidden Variable Interpretation of Quantum Mechanics
Lecture 23 - Bell Inequalities
Lecture 24 - Entanglement Verification
Lecture 25 - Entanglement Quantification and Connection Between Coherence and Entanglement
Lecture 26 - 84 Quantum Cryptography
Lecture 27 - Quantum Teleportation

NPTEL Video Course - Physics - NOC:Classical Motion of a Single Particle

Subject Co-ordinator - Prof. Supratik Banerjee

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Newton's laws of motion
Lecture 2 - From dynamics to Kinematics
Lecture 3 - Equations of dynamics and constants of motion
Lecture 4 - Constants of motion (Continued...), Wrok-energy theorem and conservative forces
Lecture 5 - Dynamics under constants and central forces
Lecture 6 - Derivation of gradient form from zero curl condition
Lecture 7 - Concept of equilibrium
Lecture 8 - Terminal velocity, stable and unstable equilibria
Lecture 9 - Stable and unstable equilibria in more than one dimensions
Lecture 10 - Motion in one-dimensional potential
Lecture 11 - Solving equations of motion in one dimension
Lecture 12 - Calculation of Work Done in a Force Field
Lecture 13 - Central forces, Velocity and Acceleration in Plane Polar Coordinates
Lecture 14 - Dynamics and Trajectories Under a Central Force
Lecture 15 - Equation For Trajectories Under a Central Force (Continued...) : Binet Equation
Lecture 16 - Trajectory of a Particle Under Attractive Inverse-Square Force Law
Lecture 17 - Energy Diagram in an Effective One-Dimensional Motion
Lecture 18 - Two Interesting Problems On the motion Under Central Forces
Lecture 19 - Motion Under an Attractive Inverse-Square Force
Lecture 20 - Motion Under an Attractive Inverse-Square Force (Continued...)
Lecture 21 - Trajectories Under Attractive Inverse-Square Force, Laws of Kepler
Lecture 22 - Laplace Runge-Lenz Vector
Lecture 23 - Simple harmonic oscillators
Lecture 24 - Two examples of simple harmonic oscillation
Lecture 25 - Forced harmonic oscillator
Lecture 26 - Forced harmonic oscillator at resonance
Lecture 27 - Damped harmonic oscillator
Lecture 28 - Nature of motion under a harmonic potential
Lecture 29 - Comparison among three types of damped oscillation

Lecture 30 - Forced harmonic oscillator with damping
Lecture 31 - A problem on damped harmonic oscillator
Lecture 32 - Beats
Lecture 33 - Motion of a particle in electric and magnetic fields
Lecture 34 - E X B drift
Lecture 35 - Inertial frames of reference, Galilean transformation
Lecture 36 - Non-inertial frames of reference, pseudo forces
Lecture 37 - Motion of a particle in a rotating frame of reference
Lecture 38 - Motion of a particle relative to an observer on earth
Lecture 39 - Motion of a particle under various constraints
Lecture 40 - Principle of Virtual work, D'Alembert's principle
Lecture 41 - Lagrange's equation of first kind
Lecture 42 - Solving problems using Lagrange's equation of first kind
Lecture 43 - Generalized Coordinates and Generalized Velocities
Lecture 44 - Knetic Energy and Acceleration in Terms of Generalized Coordinates
Lecture 45 - Generalized Momentum and Generalized Force; Derivation of Euler-Lagrange Equation
Lecture 46 - Euler Lagrange Equation, Cyclic Coordinates and Other Properties
Lecture 47 - Properties of Euler-Lagrange equations (Continued...)
Lecture 48 - Lagrangian of various oscillating systems
Lecture 49 - Problem solving using Euler-Lagrange equations
Lecture 50 - Concept of Phase Space
Lecture 51 - Phase space trajectories and fixed points
Lecture 52 - Stability of fixed points
Lecture 53 - Different types of fixed points
Lecture 54 - Fixed points and their stability for mechanical systems
Lecture 55 - Linear two-dimensional phase space dynamics
Lecture 56 - Linear two-dimensional phase space dynamics (Continued...)
Lecture 57 - Concept of limit cycles
Lecture 58 - Lorenz equations and introduction to chaos

NPTEL Video Course - Physics - Astrophysics and Cosmology

Subject Co-ordinator - Prof. S. Bharadwaj

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Keplers Law
Lecture 3 - The Solar System
Lecture 4 - The Solar System (Continued...)
Lecture 5 - Binary Systems
Lecture 6 - Binary Systems (Continued...)
Lecture 7 - Tidal Forces and the Earth Moon System
Lecture 8 - Fluid Mechanics
Lecture 9 - Hydrostatics and the Solar Wind
Lecture 10 - Radiative Transfer
Lecture 11 - Radiative Transfer (Continued...)
Lecture 12 - Thermal Radiation
Lecture 13 - Thermal Radiation and the Sun
Lecture 14 - Virial Theorem and Its Application to Stars
Lecture 15 - Stars
Lecture 16 - Stellar Physics - I
Lecture 17 - Stellar Physics - II
Lecture 18 - Stellar Physics - III
Lecture 19 - Stellar Physics - IV
Lecture 20 - Stellar Physics - V
Lecture 21 - White Dwarfs
Lecture 22 - White Dwarfs and Neutron Stars
Lecture 23 - Galaxies
Lecture 24 - Galaxies and the Expanding Universe
Lecture 25 - The Expanding Universe
Lecture 26 - Dynamics of the Expanding Universe
Lecture 27 - Dynamics of the Expanding Universe (Continued...)
Lecture 28 - The Expanding Universe and the Cosmological Metric
Lecture 29 - The Cosmological Space - Time

Lecture 30 - Distances
Lecture 31 - Distances (Continued...)
Lecture 32 - Distances and the Hubble Parameter
Lecture 33 - Distances, the Hubble Parameter and Dark Energy (Continued...)
Lecture 34 - CMBR and Thermal History
Lecture 35 - CMBR and Thermal History (Continued...1)
Lecture 36 - CMBR and Thermal History (Continued...2)
Lecture 37 - Thermal History, Expansion Rate and Neutrino Mass
Lecture 38 - Thermal History
Lecture 39 - Big Bang Nucleosynthesis

NPTEL Video Course - Physics - NOC:Mathematics Methods in Physics - I

Subject Co-ordinator - Prof. Samudra Roy

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Set, Group, Field, Ring
Lecture 2 - Vector Space
Lecture 3 - Span, Linear combination of vectors
Lecture 4 - Linearly dependent and independent vector, Basis
Lecture 5 - Dual Space
Lecture 6 - Inner Product
Lecture 7 - Schwarz Inequality
Lecture 8 - Inner product space, Gram-Schmidt Ortho-normalization
Lecture 9 - Projection operator
Lecture 10 - Transformation of Basis
Lecture 11 - Transformation of Basis (Continued...)
Lecture 12 - Unitary transformation, Similarity Transformation
Lecture 13 - Eigen Value, Eigen Vectors
Lecture 14 - Normal Matrix
Lecture 15 - Diagonalization of a Matrix
Lecture 16 - Hermitian Matrix
Lecture 17 - Rank of a Matrix
Lecture 18 - Cayley - Hamilton Theorem, Function space
Lecture 19 - Metric Space, Linearly dependent - independent functions
Lecture 20 - Linearly dependent â independent functions (Continued...), Inner Product of functions
Lecture 21 - Orthogonal functions
Lecture 22 - Delta Function, Completeness
Lecture 23 - Fourier
Lecture 24 - Fourier Series (Continued...)
Lecture 25 - Parseval Theorem, Fourier Transform
Lecture 26 - Parseval Relation, Convolution Theorem
Lecture 27 - Polynomial space, Legendre Polynomial
Lecture 28 - Monomial Basis, Factorial Basis, Legendre Basis
Lecture 29 - Complex Numbers

Lecture 30 - Geometrical interpretation of complex numbers
Lecture 31 - de Moivreâ s Theorem
Lecture 32 - Roots of a complex number
Lecture 33 - Set of complex no, Stereographic projection
Lecture 34 - Complex Function, Concept of Limit
Lecture 35 - Derivative of Complex Function, Cauchy-Riemann Equation
Lecture 36 - Analytic Function
Lecture 37 - Harmonic Conjugate
Lecture 38 - Polar form of Cauchy-Riemann Equation
Lecture 39 - Multi-valued function and Branches
Lecture 40 - Complex Line Integration, Contour, Regions
Lecture 41 - Complex Line Integration (Continued...)
Lecture 42 - Cauchy-Goursat Theorem
Lecture 43 - Application of Cauchy-Goursat Theorem
Lecture 44 - Cauchyâ s Integral Formula
Lecture 45 - Cauchyâ s Integral Formula (Continued...)
Lecture 46 - Series and Sequence
Lecture 47 - Series and Sequence (Continued...)
Lecture 48 - Circle and radius of convergence
Lecture 49 - Taylor Series
Lecture 50 - Classification of singularity
Lecture 51 - Laurent Series, Singularity
Lecture 52 - Laurent series expansion
Lecture 53 - Laurent series expansion (Continued...), Concept of Residue
Lecture 54 - Classification of Residue
Lecture 55 - Calculation of Residue for quotient from
Lecture 56 - Cauchyâ s Residue Theorem
Lecture 57 - Cauchyâ s Residue Theorem (Continued...)
Lecture 58 - Real Integration using Cauchyâ s Residue Theorem
Lecture 59 - Real Integration using Cauchyâ s Residue Theorem (Continued...)
Lecture 60 - Real Integration using Cauchyâ s Residue Theorem (Continued...)

NPTEL Video Course - Physics - NOC:Classical Mechanics - from Newtonian to Lagrangian Formulation

Subject Co-ordinator - Prof. Debamalya Banerjee

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6 - Systems with variable mass - 3
Lecture 7 - Systems with variable mass - 4
Lecture 8 - Central force - 1
Lecture 9 - Central force - 2
Lecture 10 - Central force - 3
Lecture 11 - Central force - 4
Lecture 12 - Central force - 5
Lecture 13 - Central force - 6
Lecture 14 - Central force - 7
Lecture 15 - Central force - 8
Lecture 16 - Central force - 9
Lecture 17 - Central force - 10
Lecture 18 - Central force - 11
Lecture 19 - Central force - 12
Lecture 20 - Central force - 13
Lecture 21 - Central force - 14
Lecture 22 - Central force - 15
Lecture 23 - Mooring Co-ordinate Systems - 1
Lecture 24 - Mooring Co-ordinate Systems - 2
Lecture 25 - Mooring Co-ordinate Systems - 3
Lecture 26 - Mooring Co-ordinate Systems - 4
Lecture 27 - Rigid body dynamics - 1
Lecture 28 - Rigid body dynamics - 2
Lecture 29 - Rigid body dynamics - 3

Lecture 30 - Rigid body dynamics - 4
Lecture 31 - Rigid body dynamics - 5
Lecture 32 - Rigid body dynamics - 6
Lecture 33 - Rigid body dynamics - 7
Lecture 34 - Rigid body dynamics - 8
Lecture 35 - Rigid body dynamics - 9
Lecture 36 - Rigid body dynamics - 10
Lecture 37 - Rigid body dynamics - 11
Lecture 38 - Rigid body dynamics - 12
Lecture 39 - Rigid body dynamics - 13
Lecture 40 - Rigid body dynamics - 14
Lecture 41 - Rigid body dynamics - 15
Lecture 42 - Rigid body dynamics - 16
Lecture 43 - Lagrangian Formulation - 1
Lecture 44 - Lagrangian Formulation - 2
Lecture 45 - Lagrangian Formulation - 3
Lecture 46 - Lagrangian Formulation - 4
Lecture 47 - Lagrangian Formulation - 5
Lecture 48 - Lagrangian Formulation - 6
Lecture 49 - Lagrangian Formulation - 7
Lecture 50 - Lagrangian Formulation - 8
Lecture 51 - Lagrangian Formulation - 9
Lecture 52 - Lagrangian Formulation - 10
Lecture 53 - Small oscillation - 1
Lecture 54 - Small oscillation - 2
Lecture 55 - Small oscillation - 3
Lecture 56 - Small oscillation - 4
Lecture 57 - Small oscillation - 5
Lecture 58 - Small oscillation - 6
Lecture 59 - Small oscillation - 7
Lecture 60 - Small oscillation - 8

NPTEL Video Course - Physics - NOC:Solid State Physics

Subject Co-ordinator - Prof. Amal Kumar Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Atom to Solid Structure
Lecture 2 - Atom to Solid Structure (Continued...)
Lecture 3 - Structure of Solid
Lecture 4 - Structure of Solid (Continued...)
Lecture 5 - Crystal Structure
Lecture 6 - Crystal Structure (Continued...)
Lecture 7 - Crystal Structure (Continued...)
Lecture 8 - Crystal Structure (Continued...)
Lecture 9 - Crystal Structure (Continued...)
Lecture 10 - Crystal Structure (Continued...)
Lecture 11 - Crystal Structure (Continued...)
Lecture 12 - Crystal Structure (Continued...)
Lecture 13 - Crystal Structure (Continued...)
Lecture 14 - Crystal Structure (Continued...)
Lecture 15 - Crystal Structure (Continued...)
Lecture 16 - Crystal Structure (Continued...)
Lecture 17 - Crystal Structure (Continued...)
Lecture 18 - X-ray Diffraction from Crystal
Lecture 19 - X-ray Diffraction from Crystal (Continued...)
Lecture 20 - X-ray Diffraction from Crystal (Continued...)
Lecture 21 - X-ray Diffraction from Crystal (Continued...)
Lecture 22 - X-ray Diffraction from Crystal (Continued...)
Lecture 23 - X-ray Diffraction from Crystal (Continued...)
Lecture 24 - X-ray Diffraction from Crystal (Continued...)
Lecture 25 - Reciprocal Lattice
Lecture 26 - Reciprocal Lattice (Continued...)
Lecture 27 - Reciprocal Lattice (Continued...)
Lecture 28 - Reciprocal Lattice (Continued...)
Lecture 29 - Reciprocal Lattice (Continued...)

Lecture 30 - Intensity of Bragg Diffraction
Lecture 31 - Intensity of Bragg Diffraction (Continued...)
Lecture 32 - Electrical Properties of Metal
Lecture 33 - Electrical Properties of Metal (Continued...)
Lecture 34 - Electrical Properties of Metal (Continued...)
Lecture 35 - Electrical Properties of Metal (Continued...)
Lecture 36 - Electrical Properties of Metal (Continued...)
Lecture 37 - Electrical Properties of Metal (Continued...)
Lecture 38 - Electrical Properties of Metal (Continued...)
Lecture 39 - Electrical Properties of Metal (Continued...)
Lecture 40 - Band Theory of Solids
Lecture 41 - Band Theory of Solids (Continued...)
Lecture 42 - Band Theory of Solids (Continued...)
Lecture 43 - Band Theory of Solids (Continued...)
Lecture 44 - Band Theory of Solids (Continued...)
Lecture 45 - Band Theory of Solids (Continued...)
Lecture 46 - Band Theory of Solids (Continued...)
Lecture 47 - Physics of Semiconductor
Lecture 48 - Physics of Semiconductor (Continued...)
Lecture 49 - Physics of Semiconductor
Lecture 50 - Electrical Conduction
Lecture 51 - Electrical Conduction
Lecture 52
Lecture 53
Lecture 54 - Thermal Properties of Solid (Continued...)
Lecture 55 - Thermal Properties of Solid (Continued...)
Lecture 56 - Thermal Properties of Solid (Continued...)
Lecture 57 - Thermal Properties of Solid (Continued...)
Lecture 58 - Magnetic Property of Solid
Lecture 59 - Magnetic Property of Solid (Continued...)
Lecture 60 - Magnetic Property of Solid (Continued...)
Lecture 61 - Magnetic Property of Solid (Continued...)
Lecture 62 - Magnetic Property of Solid (Continued...)
Lecture 63 - Magnetic Property of Solid (Continued...)
Lecture 64 - Magnetic Property of Solid (Continued...)
Lecture 65 - Magnetic Property of Solid (Continued...)
Lecture 66 - Magnetic Property of Solid (Continued...)
Lecture 67 - Magnetic Property of Solid (Continued...)
Lecture 68 - Magnetic Property of Solid (Continued...)

Lecture 69 - Magnetic Property of Solid (Continued...)
Lecture 70 - Magnetic Property of Solid (Continued...)
Lecture 71 - Magnetic Property of Solids (Continued...)
Lecture 72 - Dielectric Properties of Solid
Lecture 73 - Dielectric Properties of Solid (Continued...)
Lecture 74 - Dielectric Properties of Solid (Continued...)
Lecture 75 - Superconductivity

NPTEL Video Course - Physics - NOC:Atomic and Molecular Physics

Subject Co-ordinator - Prof. Amal Kumar Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Experimental observations and theoretical development in discovery of constituents of an atom
Lecture 2 - Experimental observations and theoretical development in discovery of constituents of an atom (C
Lecture 3 - Experimental observations and theoretical development in discovery of constituents of an atom (C
Lecture 4 - Experimental observations and theoretical development in discovery of constituents of an atom (C
Lecture 5 - Experimental observations and theoretical development in discovery of constituents of an atom (C
Lecture 6 - Structure of an atom
Lecture 7 - Structure of an atom
Lecture 8 - Structure of an atom (Continued...)
Lecture 9 - Atomic structure of an atom
Lecture 10 - Atomic structure of an atom
Lecture 11 - Structure of an atom
Lecture 12 - Atomic structure of an atom
Lecture 13 - Atomic structure of an atom
Lecture 14 - Structure of an atom
Lecture 15 - Structure of an atom
Lecture 16 - Structure of an atom
Lecture 17 - Structure of an atom
Lecture 18 - Structure of an atom
Lecture 19 - Structure of an atom
Lecture 20 - Structure of an atom
Lecture 21 - Atomic spectra
Lecture 22 - Atomic spectra
Lecture 23 - Multielectron atoms
Lecture 24 - Multielectron atoms (Continued...)
Lecture 25 - Multielectron atoms (Continued...)
Lecture 26 - Multielectron atoms (Continued...)
Lecture 27 - Quantum mechanical treatment
Lecture 28 - Quantum mechanical treatment (Continued...)
Lecture 29 - Quantum mechanical treatment of H-like atom

Lecture 30 - Quantum mechanical treatment of H-like atom (Continued...)
Lecture 31 - Quantum mechanical treatment of Hydrogen like atom
Lecture 32 - Quantum mechanical treatment of Hydrogen like atom (Continued...)
Lecture 33 - Quantum mechanical treatment of hydrogen like atom (Continued...)
Lecture 34 - Quantum mechanical treatment of hydrogen like atom (Continued...)
Lecture 35 - Quantum mechanical treatment of hydrogen like atom (Continued...)
Lecture 36 - Quantum Mechanical treatment of Hydrogen like atom (Continued...)
Lecture 37 - Quantum Mechanical treatment of Hydrogen like atom (Continued...)
Lecture 38 - Hydrogen like atom in magnetic field
Lecture 39 - Hydrogen like atom in magnetic field (Continued...)
Lecture 40 - Hydrogen like atom in electric field
Lecture 41 - Physics of molecules
Lecture 42 - Rotation of a molecule
Lecture 43 - Rotation of a molecule (Continued...)
Lecture 44 - Rotation of a molecule (Continued...)
Lecture 45 - Rotation of a molecule (Continued...)
Lecture 46 - Vibration of a molecule
Lecture 47 - Vibration of a molecule (Continued...)
Lecture 48 - Vibration of a molecule (Continued...)
Lecture 49 - Vibration of a molecule (Continued...)
Lecture 50 - Vibration of a molecule (Continued...)
Lecture 51 - Electronic spectra of a molecule
Lecture 52 - Electronic spectra of a molecule (Continued...)
Lecture 53 - Electronic structure of molecules
Lecture 54 - Electronic structure of molecules (Continued...)
Lecture 55 - Electronic structure of a molecule
Lecture 56 - Atomic and Molecular Spectroscopy
Lecture 57 - Raman Spectroscopy
Lecture 58 - Raman Spectroscopy (Continued...)
Lecture 59 - Raman Spectroscopy (Continued...)
Lecture 60 - Resonance spectroscopy

NPTEL Video Course - Physics - NOC:Modern Optics

Subject Co-ordinator - Prof. Partha Roy Choudhuri

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Maxwells equations and electromagnetic waves
Lecture 2 - Maxwells equations and electromagnetic waves (Continued...)
Lecture 3 - Maxwells equations and electromagnetic waves (Continued...)
Lecture 4 - Maxwells equations and electromagnetic waves (Continued...)
Lecture 5 - Maxwells equations and electromagnetic waves (Continued...)
Lecture 6 - Maxwells equations and electromagnetic waves (Continued...)
Lecture 7 - Maxwells equations and electromagnetic waves (Continued...)
Lecture 8 - Wave propagation in anisotropic media
Lecture 9 - Wave propagation in anisotropic media (Continued...)
Lecture 10 - Wave propagation in anisotropic media (Continued...)
Lecture 11 - Wave propagation in anisotropic media (Continued...)
Lecture 12 - Wave propagation in anisotropic media (Continued...)
Lecture 13 - Wave propagation in layered structures
Lecture 14 - Wave propagation in layered structures (Continued...)
Lecture 15 - Wave propagation in layered structures (Continued...)
Lecture 16 - Wave propagation in layered structures (Continued...)
Lecture 17 - Wave propagation in layered structures (Continued...)
Lecture 18 - Waves in guided structures and modes
Lecture 19 - Waves in guided structures and modes (Continued...)
Lecture 20 - Waves in guided structures and modes (Continued...)
Lecture 21 - Waves in guided structures and modes (Continued...)
Lecture 22 - Waves in guided structures and modes (Continued...)
Lecture 23 - Waves in guided structures and modes (Continued...)
Lecture 24 - Coupling of waves and optical couplers
Lecture 25 - Coupling of waves and optical couplers (Continued...)
Lecture 26 - Coupling of waves and optical couplers (Continued...)
Lecture 27 - Coupling of waves and optical couplers (Continued...)
Lecture 28 - Coupling of waves and optical couplers (Continued...)
Lecture 29 - Electro-optic Effect

Lecture 30 - Electro-optic Effect (Continued...)
Lecture 31 - Electro-optic Effect (Continued...)
Lecture 32 - Electro-optic Effect (Continued...)
Lecture 33 - Electro-optic Effect (Continued...)
Lecture 34 - Electro-optic Modulators and Devices
Lecture 35 - Electro-optic Modulators and Devices (Continued...)
Lecture 36 - Electro-optic Modulators and Devices (Continued...)
Lecture 37 - Electro-optic Modulators and Devices (Continued...)
Lecture 38 - Electro-optic Modulators and Devices (Continued...)
Lecture 39 - Electro-optic Modulators and Devices (Continued...)
Lecture 40 - Electro-optic Modulators and Devices (Continued...)
Lecture 41 - Acousto-optic Effect
Lecture 42 - Acousto-optic Effect (Continued...)
Lecture 43 - Acousto-optic Effect (Continued...)
Lecture 44 - Acousto-optic Effect (Continued...)
Lecture 45 - Acousto-optic Effect (Continued...)
Lecture 46 - Acousto-optic Effect (Continued...)
Lecture 47 - Acousto-optic Effect (Continued...)
Lecture 48 - Acousto-optic Effect (Continued...)
Lecture 49 - Acousto-optic Effect (Continued...)
Lecture 50 - Acousto-optic Effect (Continued...)
Lecture 51 - Acousto-optic Effect (Continued...)
Lecture 52 - Acousto-optic Effect (Continued...)
Lecture 53 - Acousto-optic Effect (Continued...)
Lecture 54 - Acousto-optic Modulators and Devices
Lecture 55 - Acousto-optic Modulators and Devices (Continued...)
Lecture 56 - Acousto-optic Modulators and Devices (Continued...)
Lecture 57 - Acousto-optic Modulators and Devices (Continued...)
Lecture 58 - Magneto-optic Effect
Lecture 59 - Magneto-optic Effect (Continued...)

NPTEL Video Course - Physics - NOC:Introduction to Non-linear Optics and its Applications

Subject Co-ordinator - Prof. Samudra Roy

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Basic Linear Optics
Lecture 2 - Basic Linear Optics (Continued...)
Lecture 3 - Basic Linear Optics (Continued...)
Lecture 4 - Basic Linear Optics (Continued...)
Lecture 5 - Basic Linear Optics (Continued...)
Lecture 6 - Basic Linear Optics (Continued...)
Lecture 7 - Basic Linear Optics (Continued...)
Lecture 8 - Basic Linear Optics (Continued...)
Lecture 9 - Basic Linear Optics (Continued...)
Lecture 10 - Nonlinear Optics
Lecture 11 - Classical origin of optical nonlinearity
Lecture 12 - Millerâ s Rule
Lecture 13 - Second Harmonic Generation (SHG)
Lecture 14 - Optical Rectification, Linear electro-optic effect
Lecture 15 - Sum and Difference frequency generation
Lecture 16 - Nonlinear Maxwellâ s equation
Lecture 17 - Theory of SHG
Lecture 18 - Phase matching
Lecture 19 - Phase matching of SHG, Gain band width calculation
Lecture 20 - Manley-Rowe Relation, Energy conservation in SHG,
Lecture 21 - Birefringence phase-matching (BPM),Type I and Type II phase matching
Lecture 22 - Type II phase matching, Symmetry in nonlinear susceptibility
Lecture 23 - Kleinmanâ s Symmetry, Neumannâ s Principle
Lecture 24 - Neumannâ s Principle (Continued...) Centrosymmetric system
Lecture 25 - Matrix form
Lecture 26 - SHG in KDP crystal, Calculation of deff
Lecture 27 - SHG in LiNbO3
Lecture 28 - Quasi phase matching (QPM)
Lecture 29 - Quasi phase matching (QPM) (Continued...), Periodic d function

Lecture 30 - 1st, 2nd, 3rd order QPM, SHG under depleted pump
Lecture 31 - Realistic calculation of SHG, 3 wave interaction
Lecture 32 - 3 wave interaction, Equation for pump, signal and idler wave, Non-collinear phase matching
Lecture 33 - Manley-Rowe Relation (3 wave mixing), Parametric down conversion
Lecture 34 - Parametric down conversion (Continued...), Optical Parametric Amplification (OPA)
Lecture 35 - Optical Parametric Amplification (OPA), Difference frequency generation under OPA
Lecture 36 - Sum frequency generation under OPA
Lecture 37 - OPA under non-phase matching condition, Expression of gain
Lecture 38 - Optical parametric Oscillator (OPO), Singly resonant oscillator
Lecture 39 - Doubly Resonant Oscillator (DRO)
Lecture 40 - Doubly Resonant Oscillator (DRO) (Continued...)
Lecture 41 - 3rd order nonlinear effect
Lecture 42 - Optical Kerr effect and Self-focusing, Symmetry in 3rd order susceptibility
Lecture 43 - Symmetry in 3rd order susceptibility (Continued...), Self Phase Modulation (SPM)
Lecture 44 - Self Phase Modulation (Continued...), Frequency Shift
Lecture 45 - Third Harmonic Generation(3HG), Energy conservation
Lecture 46 - Third Harmonic Generation (Continued...)
Lecture 47 - Third Harmonic Generation (Continued...), Cross Phase Modulation (XPM)
Lecture 48 - Cross Phase Modulation (Continued...), Nonlinear Absorption
Lecture 49 - Four Wave Mixing
Lecture 50 - Four Wave mixing (Continued...)
Lecture 51 - Parametric Amplification under FWM
Lecture 52 - Parametric Amplification under FWM (Continued...)
Lecture 53 - Optical Phase Conjugation
Lecture 54 - Raman Scattering
Lecture 55 - Stimulated Raman Scattering
Lecture 56 - Raman Amplification
Lecture 57 - Raman Amplification (Continued...)
Lecture 58 - Linear pulse propagation
Lecture 59 - Nonlinear Pulse propagation
Lecture 60 - Optical Soliton

NPTEL Video Course - Physics - NOC:Upstream LNG Technology

Subject Co-ordinator - Prof. Pavitra Sandilya

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Concentration
Lecture 3 - Sources and Process Overview of Natural Gas
Lecture 4 - Pure Component Phase Behavior
Lecture 5 - Mixture Phase Behavior
Lecture 6 - Phase Behaviour of Natural Gas
Lecture 7 - Dew Point and Bubble Point Calculations
Lecture 8 - Vapor Liquid Equilibrium
Lecture 9 - Problems on Vapor Pressure, Gibb's Phase Rule, Dew Point Bubble Point Temperatures
Lecture 10 - Thermophysical Properties of Natural Gas - I
Lecture 11 - Thermophysical Properties of Natural Gas - II
Lecture 12 - Thermodynamic and Chemical Properties
Lecture 13 - Combustion Properties
Lecture 14 - Flow in Natural Gas Systems
Lecture 15 - Flow Measurement In Natural Gas - I
Lecture 16 - Flow Measurement In Natural Gas - II
Lecture 17 - Temperature and Quality Measurement in Natural Gas Systems
Lecture 18 - Pressure measurement in natural gas systems
Lecture 19 - Tutorial on the estimation of thermophysical properties
Lecture 20 - Tutorial on the combustion and thermodynamic properties of natural gas
Lecture 21 - Tutorial on fluid mechanics
Lecture 22 - Tutorial on flow and pressure measurement in natural gas systems
Lecture 23 - Tutorial on temperature and quality measurement in natural gas
Lecture 24 - Heat transfer in natural gas systems
Lecture 25 - Tutorial on heat transfer in natural gas systems
Lecture 26 - Heat exchangers in natural gas systems
Lecture 27 - Analysis of heat exchangers in natural gas systems
Lecture 28 - Tutorial on heat exchanger analysis
Lecture 29 - Equillibrium vapour-liquid separation

Lecture 30 - Equillibrium in multicomponent systems
Lecture 31 - Separation by distillation
Lecture 32 - Design of distillation column
Lecture 33 - Equillibrium fluid solid separation
Lecture 34 - Membrane separation in natural gas systems
Lecture 35 - Estimation of water content in natural gas
Lecture 36 - Multistage single component equillibrium separation
Lecture 37 - Tutorial on vapour liquid separation
Lecture 38 - Tutorial on ideal binary distillation
Lecture 39 - Tutorial on equillibrium gas- solid separation
Lecture 40 - Tutorial on membrane gas separation
Lecture 41 - Dehydration of natural gas
Lecture 42 - Natural gas Processing - hydrate removal
Lecture 43 - Acid gas removal in natural gas system - I
Lecture 44 - Acid gas removal in natural gas system - II
Lecture 45 - Nitrogen removal in natural gas system - I
Lecture 46 - Nitrogen removal in natural gas system - II
Lecture 47 - Compression in natural gas systems
Lecture 48 - Compressors used in natural gas systems
Lecture 49 - Tutorial on hydrate removal
Lecture 50 - Multicomponent distillation column design
Lecture 51 - Sulfur recovery in natural gas systems - I
Lecture 52 - Tutorial on compression
Lecture 53 - Pigging
Lecture 54 - Sulfur recovery in natural gas systems - II
Lecture 55 - Trace components in natural gas
Lecture 56 - Helium recovery, upgradation and purification
Lecture 57 - Fundamentals of absorption and stripping for natural gas processing
Lecture 58 - Tutorial on absorption and stripping
Lecture 59 - Gas liquid separation in natural gas systems - I
Lecture 60 - Gas liquid separation in natural gas systems - II
Lecture 61 - Tutorial on equillibrium in multicomponent systems
Lecture 62 - Tutorial on multicomponent distillation - I
Lecture 63 - Tutorial on multicomponent distillation - II
Lecture 64 - Pumps in natural gas systems - I
Lecture 65 - Pumps in natural gas systems - II
Lecture 66 - Pumps in natural gas systems - III
Lecture 67 - Tutorial on pumps - I
Lecture 68 - Tutorial on pumps - II

Lecture 69 - Cryogenic refrigeration and liquefaction in natural gas systems - I
Lecture 70 - Cryogenic refrigeration and liquefaction in natural gas systems - II
Lecture 71 - Tutorial on refrigeration - I
Lecture 72 - Tutorial on refrigeration - II
Lecture 73 - Cryogenic refrigeration and liquefaction in natural gas systems - III
Lecture 74 - Cryogenic refrigeration and liquefaction in natural gas systems - IV
Lecture 75 - Cryogenic refrigeration and liquefaction in natural gas systems - V
Lecture 76 - Tutorial on refrigeration - III
Lecture 77 - Tutorial on refrigeration and liquefaction - IV
Lecture 78 - Tutorial on refrigeration and liquefaction - V
Lecture 79 - Hydrocarbon recovery in natural gas system - I
Lecture 80 - Hydrocarbon recovery in natural gas system - II
Lecture 81 - Hydrocarbon recovery in natural gas system - III
Lecture 82 - Tutorial on hydrocarbon recovery in natural gas
Lecture 83 - Piping in natural gas systems - I
Lecture 84 - Piping in natural gas systems - II
Lecture 85 - Tutorial on piping in natural gas systems - I
Lecture 86 - Tutorial on piping in natural gas systems - II

NPTEL Video Course - Physics - NOC:Experimental Physics-I

Subject Co-ordinator - Prof. Amal Kumar Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Basic tools and apparatus
Lecture 3 - Basic tools and apparatus (Continued...)
Lecture 4 - Basic tools and apparatus (Continued...)
Lecture 5 - Basic tools and apparatus (Continued...)
Lecture 6 - Basic tools and apparatus (Continued...)
Lecture 7 - Basic components
Lecture 8 - Basic apparatus
Lecture 9 - Basic apparatus (Continued...)
Lecture 10 - Basic analysis
Lecture 11 - Basics analysis (Continued...)
Lecture 12 - Basics analysis (Continued...)
Lecture 13 - Basics analysis (Continued...)
Lecture 14 - Basics analysis (Continued...)
Lecture 15 - Basics analysis (Continued...)
Lecture 16 - Basics analysis (Continued...)
Lecture 17 - Basics analysis (Continued...)
Lecture 18 - Basics analysis (Continued...)
Lecture 19 - Basics analysis (Continued...)
Lecture 20 - Determination of Young's modulus
Lecture 21 - Demonstration on the experiment of Young's modulus of mettalic bar and data collection
Lecture 22 - Calculate the value of young's modulus of given metallic bar form the recorded datas
Lecture 23 - Experimental demonstration to calculate the spring constant of a given spring
Lecture 24 - Calculate the value of calculate the spring constant of a given spring form the recorded datas
Lecture 25 - Theory regarding Moment of inertia of a flywheel
Lecture 26 - Experimental demonstration to calculate the moment of inertia of a given flywheel
Lecture 27 - How to calculate the value of moment of inertia of a flywheelform the recorded data
Lecture 28 - Theory regarding surface tension of the liquid
Lecture 29 - Demonstration on the experiment of surface tension and data collection

Lecture 30 - How to calculate the value of surface tension of water from the recorded data
Lecture 31 - Theory regarding viscosity of liquid
Lecture 32 - Demonstration on the experiment of viscosity
Lecture 33 - Data analysis of recorded data on viscosity
Lecture 34 - Forced Oscillations Pohls pendulum
Lecture 35 - Coupled Pendulum
Lecture 36 - Demonstration on the experiment of compound pendulum
Lecture 37 - Theory regarding compound pendulum has been discussed
Lecture 38 - Experimental demonstration on the standing Waves on a String has been shown clearly how to deter
Lecture 39 - Linear expansion of metal
Lecture 40 - Expt. to study linear expansion
Lecture 41 - Determine the coefficient of thermal conductivity of a bad conductor
Lecture 42 - Determination of electrical equivalent of heat
Lecture 43 - Determination of specific heat of the given solid metals using Dulong-Petit's law
Lecture 44 - Determination of the calibration curve of a given (Type K chromelÃ¢â ¬â alumel) thermocouple ar
Lecture 45 - Theorey and Demonstartion Platinum Resistance thermometer
Lecture 46 - Experiment on Platinum Resistance thermometer
Lecture 47 - To study the current-voltage relationship of an L-R circuit
Lecture 48 - To study the variation in current and voltage in a series LCR circuit
Lecture 49 - Sensitivity of Blastic Galvanometer
Lecture 50 - Expt. for Sensitivity of Blastic Galvanometer
Lecture 51 - Theory on RC Circuit
Lecture 52 - Expt. on RC Circuit
Lecture 53 - Theory regarding the magnetic field along the axis of a circular coil
Lecture 54 - Experiment regarding the magnetic field along the axis of a circular coil
Lecture 55 - Study the induced e.m.f of inductance coil
Lecture 56 - Mutual inductance
Lecture 57 - Theory regarding permeability of air
Lecture 58 - Experiment to determination the permeability of air
Lecture 59 - Devices around us
Lecture 60 - Devices around us (Continued...)

NPTEL Video Course - Physics - NOC:Experimental Physics-II

Subject Co-ordinator - Prof. Amal Kumar Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Summary of Experimental Physics - I
Lecture 3 - Summary of Experimental Physics - I (Continued...)
Lecture 4 - Summary of Experimental Physics - I (Continued...)
Lecture 5 - Summary of Experimental Physics - I (Continued...)
Lecture 6 - Basic analysis
Lecture 7 - Basic analysis (Continued...)
Lecture 8 - Basic components
Lecture 9 - Basic components (Continued...)
Lecture 10 - Basic components (Continued...)
Lecture 11 - Basic idea on mirros and lenses and their applications
Lecture 12 - Determination of focal length of concave mirror
Lecture 13 - Determination of focal length of concave mirror (Continued...)
Lecture 14 - Determination of focal length of convex mirror
Lecture 15 - Determination of focal length of convex lens
Lecture 16 - Determination of focal length of concave lens
Lecture 17 - Determination of focal length of convex lens by diplacement method
Lecture 18 - Applications of mirrors and lenses
Lecture 19 - Determination of refractive index of liquid using travelling microscope
Lecture 20 - Basic discussion on spectrometer and prism
Lecture 21 - Basic discussion on spectrometer and prism (Continued...)
Lecture 22 - Basic discussion on spectrometer and prism (Continued...)
Lecture 23 - Schuster's method
Lecture 24 - Discussion on angle of the prism, angular dispersion and dispersive power of given prism
Lecture 25 - Determination of the angle of prism
Lecture 26 - Determination of the angle of minimum deviation for a given prism and hence to determine the ref
Lecture 27 - Discussion on the angle of incidence and corresponding deviation of light through a prism and de
Lecture 28 - Determination of the angle of minimum deviation from (i-D) plot for a given prism and hence to c
Lecture 29 - Determination of the calibration plot of deviation versus wavelength for a given prism and hence

Lecture 30 - Determination of the dispersive power, Cauchy constant and resolving power of a given prism.
Lecture 31 - Interference Phenomena
Lecture 32 - Interference Phenomena (Continued...)
Lecture 33 - Interference Phenomena (Continued...)
Lecture 34 - Bi-prism
Lecture 35 - Bi-prism (Continued...)
Lecture 36 - Interference phenomena by Newton ring (Theory)
Lecture 37 - Interference phenomena by Newton ring (Experiment)
Lecture 38 - Michelson interferometer (Theory)
Lecture 39 - Michelson interferometer (Experiment)
Lecture 40 - Theory of diffraction
Lecture 41 - Theory of diffraction (Continued...)
Lecture 42 - Theory of diffraction (Continued...)
Lecture 43 - Single slit diffraction
Lecture 44 - Double slit diffraction
Lecture 45 - Plane transmission grating
Lecture 46 - Plane transmission grating (Continued...)
Lecture 47 - Theory of polarization
Lecture 48 - Theory of polarization (Continued...)
Lecture 49 - Experiment for Verification of Malus law
Lecture 50 - Experiment for brewester
Lecture 51 - Experiment for Brewester angle
Lecture 52 - Experiment on e-ray and o-ray
Lecture 53 - Polarimeter
Lecture 54 - Zone-plate Theory
Lecture 55 - Zone-plate Experiment
Lecture 56 - Theory of Photoelectric Effect
Lecture 57 - Experiment on Photoelectric Effect
Lecture 58 - Thomson experiment to determine the specific charge of an electron (e/m)
Lecture 59 - Frank-Hertz Experiment
Lecture 60 - Experiment on Rydberg constant
Lecture 61 - Experiment on Rydberg constant (Continued...)

NPTEL Video Course - Physics - NOC:Experimental Physics-III

Subject Co-ordinator - Prof. Amal Kumar Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Basic Tools and Instruments in the Laboratory
Lecture 2 - Basic Tools and Instruments in the Laboratory (Continued...)
Lecture 3 - Cathode Ray Oscilloscope (CRO)
Lecture 4 - Cathode Ray Oscilloscope (CRO) (Continued...)
Lecture 5 - Electro Magnet and Constant Current Power Supply
Lecture 6 - Electro Magnet and Constant Current Power Supply (Continued...)
Lecture 7 - Electro Magnet and Constant Current Power Supply (Continued...)
Lecture 8 - Gaussmeter/Teslameter
Lecture 9 - Gaussmeter/Teslameter (Continued...)
Lecture 10 - Lock in Amplifier
Lecture 11 - Lock in Amplifier (Continued...)
Lecture 12 - Measurement of magneto resistance
Lecture 13 - Magneto resistance for Semiconductor
Lecture 14 - Hall Effect
Lecture 15 - Hall Effect as a function of magnetic Field
Lecture 16 - Hall Effect as a function of temperature
Lecture 17 - To study the variation of resistivity of metal and semiconductor at low temperature region (Cont
Lecture 18 - To study the variation of resistivity of metal and semiconductor at low temperature region (Cont
Lecture 19 - Measurement of magnetisation of ferromagnetic material
Lecture 20 - Measurement of magnetisation of ferromagnetic material (Continued...)
Lecture 21 - Susceptibility of paramagnetic substance by Quincke's tube method
Lecture 22 - Experiment of Quincke's Tube Method
Lecture 23 - Susceptibility of paramagnetic substance by Gouy's method
Lecture 24 - Dielectric constant of solid
Lecture 25 - Dielectric constant of non-conducting liquid
Lecture 26 - P-E Loop of Ferroelectric Material
Lecture 27 - Measurement of Ionic Conductivity
Lecture 28 - Measurement of Ionic Conductivity (Continued...)
Lecture 29 - Electron Spin Resonance (ESR)

Lecture 30 - Electron Spin Resonance (ESR) Experiment
Lecture 31 - Superconductivity
Lecture 32 - Superconductivity (Continued...)
Lecture 33 - Superconductivity (Continued...)
Lecture 34 - Nuclear g-factor
Lecture 35 - Nuclear g-factor (Continued...)
Lecture 36 - P-N Junction
Lecture 37 - P-N Junction (Continued...)
Lecture 38 - P-N Junction (Continued...)
Lecture 39 - Zeeman Effect
Lecture 40 - Zeeman Effect (Continued...)
Lecture 41 - Zeeman Effect (Continued...)
Lecture 42 - Sodium Yellow Doublet
Lecture 43 - Sodium Yellow Doublet (Continued...)
Lecture 44 - Study of Absorption Spectrum of Iodine Vapour
Lecture 45 - Study of Absorption Spectrum of Iodine Vapour (Continued...)
Lecture 46 - Study of Absorption Spectrum of Iodine Vapour (Continued...)
Lecture 47 - Determination of Wavelength of Spectral Lines using Constant Deviation Spectrometer
Lecture 48 - Determination of Wavelength of Spectral Lines using Constant Deviation Spectrometer (Continued..
Lecture 49 - Photoelastic Property of Materials
Lecture 50 - Photoelastic Property of Materials (Continued...)
Lecture 51 - Photoelastic Property of Materials (Continued...)
Lecture 52 - Faraday Effect
Lecture 53 - Faraday Effect (Continued...)
Lecture 54 - Electron Diffraction
Lecture 55 - Electron Diffraction (Continued...)
Lecture 56 - Determination of Velocity of Light in Free Space
Lecture 57 - Determination of Velocity of Light in Free Space (Continued...)
Lecture 58 - X-Ray Diffraction and Crystal Structure
Lecture 59 - X-Ray Diffraction and Crystal Structure (Continued...)
Lecture 60 - X-Ray Diffraction and Crystal Structure (Continued...)
Lecture 61 - X-Ray Diffraction and Crystal Structure (Continued...)
Lecture 62

NPTEL Video Course - Physics - NOC:Electronic Theory of Solids

Subject Co-ordinator - Prof. Arghya Taraphder

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Free electrons
Lecture 2 - Weidemann Franz Law
Lecture 3 - Drude Model continued
Lecture 4 - Schrodinger Equation
Lecture 5 - Density of States
Lecture 6 - Properties of Degenerate Fermi Gas
Lecture 7 - Statistics Fermi-Dirac distribution and Maxwell-Boltzmann Distribution
Lecture 8 - Sommerfeld Expansion and Band Formation
Lecture 9 - Bonding and Band Formation
Lecture 10 - Variational Method
Lecture 11 - Bonding and Band Formation (LCAO)
Lecture 12 - Bonding and Band Formation (LCAO) (Continued...)
Lecture 13 - Bloch's Theorem
Lecture 14 - Proof of Bloch's Theorem
Lecture 15 - N atoms Solid
Lecture 16 - Brillouin Zones
Lecture 17 - Tight binding
Lecture 18 - Fermi Surfaces
Lecture 19 - Lattice with basis
Lecture 20 - Energy spectrum (Continued...)
Lecture 21 - Graphene and Fermi Surfaces
Lecture 22 - Fermi Surfaces Instabilities
Lecture 23 - Low Dimensional Systems
Lecture 24 - Integer Quantum Hall Effect (IQHE)
Lecture 25 - Integer Quantum Hall Effect (Continued...)
Lecture 26 - Electron in a Strong Magnetic Field and IQHE
Lecture 27 - Spintronics
Lecture 28 - Magnetism
Lecture 29 - Magnetism

Lecture 30 - Hund's Rule
Lecture 31 - Curie's Law and Van Vleck Paramagnetism
Lecture 32 - Curie's law for any J, Susceptibility
Lecture 33 - Susceptibility and Thermal Properties
Lecture 34 - Adiabatic Demagnetisation
Lecture 35 - Pauli Paramagnetism
Lecture 36 - Paramagnetism of metals
Lecture 37 - Exchange interaction for 2 electrons
Lecture 38 - Exchange interactions of different types
Lecture 39 - Magnetic Order
Lecture 40 - Magnetic Order of different types and Heisenberg model
Lecture 41 - Ising Model
Lecture 42 - Mean Field Theory
Lecture 43 - Spontaneous magnetisation and 1D Ising Model
Lecture 44 - Symmetries of Ising model, Exact Solution
Lecture 45 - Ferromagnetic Heisenberg Model
Lecture 46 - Ground State and Magnons/Excitations
Lecture 47 - Superconductivity
Lecture 48 - London Equation
Lecture 49 - Meisner Effect from London Equation
Lecture 50 - Cooper problem
Lecture 51 - Instability of the Fermi Surface
Lecture 52 - Ground state of cooper problem, BCS Ground state
Lecture 53 - BCS Theory, Excitation Spectrum
Lecture 54 - BCS
Lecture 55 - Tunneling and Ginzberg Landau Theory
Lecture 56 - Electrodynamics of Superconductivity
Lecture 57 - Type II superconductors
Lecture 58 - Josephson junction
Lecture 59 - Vortices, SQUID, Quantum Supremacy and Qubits
Lecture 60 - Topological state of matter, XY Model, Topological Insulators

NPTEL Video Course - Physics - NOC:Physics of Linear and Nonlinear Optical Waveguides

Subject Co-ordinator - Prof. Samudra Roy

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Wave Equation, Maxwellâ s equation, Plane wave
Lecture 2 - EM wave in vacuum, Poynting vector, Maxwellâ s equation in Dielectric Medium
Lecture 3 - Poynting Vector, Maxwellâ s equation in dielectric medium (Continued...)
Lecture 4 - Total Internal reflection, Evanescent wave
Lecture 5 - Step-index fiber (SIF), Light guidance in SIF
Lecture 6 - Light guidance in SIF (Skew Ray), V-Parameter, Discrete Ray
Lecture 7 - Cutoff wavelength, Fiber characteristics
Lecture 8 - Fiber Loss, dB units, Dispersion
Lecture 9 - Dispersion, Ray Path constant
Lecture 10 - Ray path constant, Ray equation
Lecture 11 - Ray equation (Continued...)
Lecture 12 - Ray transit time
Lecture 13 - Ray transit time (Continued...)
Lecture 14 - Material dispersion
Lecture 15 - Material dispersion (Continued...)
Lecture 16 - Material Dispersion (Continued...), Dispersion Coefficient
Lecture 17 - Pulse Broadening
Lecture 18 - Pulse Propagation in Dispersive Medium
Lecture 19 - Pulse Propagation in Dispersive Medium (Continued...)
Lecture 20 - Concept of Modes
Lecture 21 - TE and TM Modes
Lecture 22 - TE and TM Modes (Continued...)
Lecture 23 - Modes in Slab waveguide
Lecture 24 - Modes in Slab waveguide (Continued...)
Lecture 25 - Modes in Slab waveguide (Continued...)
Lecture 26 - Modes in Slab Waveguide (Continued...)
Lecture 27 - Waveguide Dispersion
Lecture 28 - Physical Understanding of Modes
Lecture 29 - Power Associated with a Modes

Lecture 30 - Modes in an Optical Fiber
Lecture 31 - Modes in an optical fiber (Continued...)
Lecture 32 - Modes in an optical fiber (Continued...)
Lecture 33 - LPlm mode structure
Lecture 34 - Optical fiber mode morphology (Continued...)
Lecture 35 - Effective area of mode, Fiber optics components
Lecture 36 - Directional Coupler
Lecture 37 - Coupled Mode Theory
Lecture 38 - Coupled Mode Theory (Continued...)
Lecture 39 - 3 dB power splitter
Lecture 40 - Working principle of WDM coupler
Lecture 41 - Fiber Bragg Grating
Lecture 42 - Fiber Bragg Grating (Continued...)
Lecture 43 - Reflectivity Calculation
Lecture 44 - Reflectivity Calculation (Continued...)
Lecture 45 - Reflectivity calculation of FBG (Continued...)
Lecture 46 - Reflectivity calculation of FBG (Continued...)
Lecture 47 - Reflectivity calculation of FBG (Continued...)
Lecture 48 - Bandwidth of reflectivity
Lecture 49 - Basic nonlinear optics
Lecture 50 - Frequency mixing, Optical Kerr effect
Lecture 51 - Optical Kerr effect (Continued...)
Lecture 52 - Self Phase Modulation
Lecture 53 - Self Phase Modulation (Continued...)
Lecture 54 - Self Phase Modulation (Continued...)
Lecture 55 - Pulse propagation in nonlinear waveguide
Lecture 56 - Pulse propagation in nonlinear waveguide (Continued...)
Lecture 57 - Pulse propagation in nonlinear dispersive waveguide
Lecture 58 - Pulse propagation in nonlinear dispersive waveguide (Continued...)
Lecture 59 - Concept of optical soliton
Lecture 60 - Concept of optical soliton (Continued...)

NPTEL Video Course - Physics - NOC:Physics of Renewable Energy Systems

Subject Co-ordinator - Prof. Amreesh Chandra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and relevance of the course
Lecture 2 - Energy sources
Lecture 3 - Solar Radiation
Lecture 4 - Solar Photovoltaic Systems
Lecture 5 - Origin of Band Structure and Energy Band Gap
Lecture 6 - Basics of Semiconductors
Lecture 7 - Construction of Solar Cells
Lecture 8 - Characterization of Solar Cells and Future Direction
Lecture 9 - Solar Heaters
Lecture 10 - Introduction to Wind Energy
Lecture 11 - Continuity Equation and its applications
Lecture 12 - Betz Criteria for extracting wind power
Lecture 13 - Wind turbines and their operation
Lecture 14 - Materials Aspects and future direction
Lecture 15 - Introduction to Hydroelectric Power
Lecture 16 - Hydroelectric Power Station and Turbines
Lecture 17 - Wave power and converters
Lecture 18 - Introduction to Tidal Power
Lecture 19 - Tidal Power and Geothermal Energy
Lecture 20 - Introduction to Energy Storage Systems
Lecture 21 - Thermal Energy Storage
Lecture 22 - Basics of Mechanical Energy Storage
Lecture 23 - Pumped Hydroelectric to Flywheels (Mechanical Energy Storage Systems)
Lecture 24 - Introduction to Li-ion battery
Lecture 25 - Characteristics and Parameters of Li-ion batteries
Lecture 26 - Cathode Materials for Li-ion batteries
Lecture 27 - Anode Materials for Li-ion batteries
Lecture 28 - Electrolytes and Separators for Li-batteries
Lecture 29 - From battery to supercapacitors

Lecture 30 - Construction, development and classification of Supercapacitors
Lecture 31 - Electric double layer capacitors (EDLCs)
Lecture 32 - Pseudocapacitors
Lecture 33 - Electrochemical Techniques for Supercapacitors and Batteries
Lecture 34 - From material to a supercapacitor device
Lecture 35 - Effect of temperature on supercapacitor performance
Lecture 36 - Effect of external magnetic field and frequency on supercapacitors
Lecture 37 - Introduction to Fuel Cells
Lecture 38 - Explanation of Fuel cell systems
Lecture 39 - Microbial Fuel Cells
Lecture 40 - Nanotechnology and Nanomaterials for Energy Applications
Lecture 41 - Synthesis of nanomaterials
Lecture 42 - Carbon- and metal-oxide based nanomaterials
Lecture 43 - Nanocatalysts
Lecture 44 - Characterization techniques for solid materials
Lecture 45 - X-ray diffraction method
Lecture 46 - UV-Visible Spectroscopy
Lecture 47 - Fourier Transform Infrared Spectroscopy
Lecture 48 - SEM, TEM and XPS
Lecture 49 - Particle size and zeta potential analysis
Lecture 50 - BET analysis
Lecture 51 - Electrochemical Impedance Spectroscopy

NPTEL Video Course - Physics - NOC:Thermal Physics

Subject Co-ordinator - Prof. Debamalya Banerjee

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Foundation of kinetic theory of gasses
Lecture 2 - Maxwell's law for speed distribution of gas molecules
Lecture 3 - Average speeds in an ideal gas assembly
Lecture 4 - Principle of equipartition of energy
Lecture 5 - Maxwell's law for energy distribution of gas molecules
Lecture 6 - The mean free path of a gas assembly
Lecture 7 - Expression for mean free path
Lecture 8 - Experimental determination of mean free path
Lecture 9 - Pressure an molecular flux from mean free path
Lecture 10 - Problems on mean free path
Lecture 11 - Transport in fluids: introduction
Lecture 12 - Viscosity: transport of momentum
Lecture 13 - Thermal conductivity: trasnport of thermal energy
Lecture 14 - Diffusion coefficient: transport of mass
Lecture 15 - Molecular effusion: theory and applications
Lecture 16 - Brownian motion: concept, features, theory of fluctuation
Lecture 17 - Brownian motion: mean square displacement and vertical distribution of particles
Lecture 18 - Perrin's experiment on Brownian motion - Part 1
Lecture 19 - Perrin's experiment on Brownian motion - Part 2
Lecture 20 - Problems on Brownian motion, Rotational brownian motion
Lecture 21 - Specific heat of solids: Dulong-Petit law and Einstein theory
Lecture 22 - Limitaion of Einstein theory of specific heat
Lecture 23 - Debye theory of specific heat
Lecture 24 - Behavior of real gasses
Lecture 25 - Van der Waals equation of state
Lecture 26 - Critical parameters from Van der Waal's equation
Lecture 27 - Determination of Van der Waals' constants and Boyle temperature
Lecture 28 - Other equations of state
Lecture 29 - Measurement of temperature: Celcius scale, ideal gas scale, absolute zero

Lecture 30 - The platinum resistance thermometer
Lecture 31 - Basic concepts of classical thermodynamics
Lecture 32 - Basic concepts of classical thermodynamics (Continued...)
Lecture 33 - First law of thermodynamics
Lecture 34 - General description of work done and specific heat
Lecture 35 - General discussion on Heat conduction and elastic properties
Lecture 36 - Cyclic processes
Lecture 37 - The reversible heat engine: Carnot cycle
Lecture 38 - Refrigarator and Carnot Theorem
Lecture 39 - 2nd law and Clausius theorem
Lecture 40 - Concept of Entropy and mathematical form of 2nd law
Lecture 41 - The entropy principle
Lecture 42 - Efficiency of a cycle from T-S diagram
Lecture 43 - The Otto cycle
Lecture 44 - The Diesel cycle
Lecture 45 - Entropy and available energy
Lecture 46 - Thermodynamic relations
Lecture 47 - Application of thermodynamic relation
Lecture 48 - The free energy functions
Lecture 49 - Condition for thermodynamic equilibri
Lecture 50 - Thermodynamics of chemical reaction
Lecture 51 - Equilibruim between phases: The Clapeyron equation
Lecture 52 - 1st order phase transion along liquid-vapor equilibrium
Lecture 53 - Phase diagram and triple point
Lecture 54 - The 2nd latent heat equation
Lecture 55 - Gibbs phase rule and basics of second order phase transion
Lecture 56 - Basic concepts of radiation
Lecture 57 - Diffused radiation and Kirchhoff's law
Lecture 58 - Cavity radiation as a thermodynamic system: Stefan-Boltzmann law
Lecture 59 - Thermodynamics of cavity radiation
Lecture 60 - 3rd law of thermodynamics

NPTEL Video Course - Physics - NOC:Concepts in Magnetism and Superconductivity

Subject Co-ordinator - Prof. A Taraphder

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction: Magnetism and superconductivity as macroscopic quantum phenomena
Lecture 2 - Bohr magneton, BvL theorem
Lecture 3 - An electron in a magnetic field, magnetism of isolated atoms
Lecture 4 - Magnetism of isolated atoms (Continued...), Diamagnetism
Lecture 5 - Magnetism of atoms-dia and paramagnetic susceptibilities. Hund's rules,Van Vleck paramagnetism
Lecture 6 - Van Vleck paramagnetism (Continued...), Paramagnetism
Lecture 7 - Curie's law for arbitrary J, adiabatic demagnetization
Lecture 8 - Paramagnetism of conduction electrons - Pauli paramagnetism
Lecture 9 - Ions in a solid: crystal field, orbital quenching, Jahn-Teller effect
Lecture 10 - Jahn-Teller effect (Continued...), Magnetic resonance techniques NMR, ESR
Lecture 11 - Resonance techniques (Continued...), Recapitulation and overview
Lecture 12 - Recapitulation, interacting moments and long range order, dipolar exchange
Lecture 13 - Interacting moments, 2-electron system, origin of exchange and spin Hamiltonian
Lecture 14 - Spin Hamiltonian, Heisenberg model, Exchange interactions: direct
Lecture 15 - GMR, spin model and mean-field theory, Ising model
Lecture 16 - Ising model and its properties
Lecture 17 - Ising model and its properties (Continued...), absence of LRO in d=1, mean-field theory
Lecture 18 - Ising model recap, applications, exact solutions
Lecture 19 - Exact solution of Ising model in d=1, exact results in d=2. Mermin-Wagner theorem
Lecture 20 - Recap - Exact solution of Ising model. Mermin-Wagner theorem on the absence
Lecture 21 - Ferromagnetic Heisenberg model ground state
Lecture 22 - Ferromagnetic Heisenberg model, spin-waves and magnons
Lecture 23 - Antiferromagnetic Heisenberg model, AF magnetic structures
Lecture 24 - AF magnetic structures, susceptibility and excitations
Lecture 25 - Antiferromagnets and frustration, spin glass
Lecture 26 - Superconductivity: discovery, properties
Lecture 27 - Superconductivity: Meissner effect, London Equation
Lecture 28 - Electron-phonon interaction, Cooper problem
Lecture 29 - Cooper problem, setting up the BCS theory

Lecture 30 - BCS wave function, the Superconducting state and calculations of various properties
Lecture 31 - BCS theory (Continued...), energy gap, transition temperature
Lecture 32 - Consequences of BCS theory, gap vs T, Transition temperature, specific heat, tunnelling
Lecture 33 - Transition temperature, specific heat, tunnelling
Lecture 34 - Andreev reflection, Ginzburg-Landau Theory and electrodynamics of superconductors
Lecture 35 - Ginzburg-Landau theory, coherence length and Type I and II superconductors
Lecture 36 - Flux lattice, Flux quantization, Josephson junctions
Lecture 37 - Josephson effect and Josephson junctions
Lecture 38 - SQUID, Quantum computers and Josephson junction Qubits
Lecture 39 - High-Temperature Superconductivity: an enduring enigma
Lecture 40 - Overview and conclusion

NPTEL Video Course - Physics - NOC:Foundations of Classical Electrodynamics

Subject Co-ordinator - Prof. Samudra Roy

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Vector analysis, Scalar and vector fields, vector identities
Lecture 2 - Vector Analysis (Continued...)
Lecture 3 - Use of Levi-Civita Symbol, Coordinate system
Lecture 4 - Coordinate system, Orthogonal Transformation
Lecture 5 - Spherical Coordinate system, Line, surface and volume element
Lecture 6 - Line, surface and volume element (Continued...)
Lecture 7 - Line, surface and volume integral
Lecture 8 - Differential calculus, Gradient
Lecture 9 - Gradient operator, Concept of divergence
Lecture 10 - Divergence operator, Divergence Theorem
Lecture 11 - Curl operator, Stokes Theorem
Lecture 12 - Gradient, Divergence and Curl (A recap), Vector identities
Lecture 13 - Curvilinear coordinate system
Lecture 14 - Curvilinear coordinate system (Continued...)
Lecture 15 - Curvilinear coordinate system (Continued...)
Lecture 16 - Delta Function
Lecture 17 - Delta Function (Continued...)
Lecture 18 - Helmholtz's Theorem
Lecture 19 - Helmholtz's Theorem(Recap), Tutorial
Lecture 20 - Tutorial (Continued...)
Lecture 21 - Concept of charge, Charge density
Lecture 22 - Coulomb's Law
Lecture 23 - Coulomb's Law (Continued...), Charge distribution
Lecture 24 - Charge distribution problem, Gauss's Law
Lecture 25 - Topics More on Gauss's Law
Lecture 26 - Application of Gauss's Law
Lecture 27 - Electrostatic potential
Lecture 28 - Electrostatic potential (Continued...)
Lecture 29 - Electrostatic energy

Lecture 30 - Electrostatic energy (Continued...)
Lecture 31 - Electrostatic energy calculation
Lecture 32 - Electrostatic dipole
Lecture 33 - Electric dipole (Continued...)
Lecture 34 - Multipole expansion
Lecture 35 - Monopole and Dipole moment
Lecture 36 - Quadrupole moment
Lecture 37 - Dipole and Quadrupole moment (Continued...)
Lecture 38 - Conductor
Lecture 39 - Conductor (Continued...)
Lecture 40 - Boundary condition
Lecture 41 - Electrostatic pressure, Capacitor
Lecture 42 - Energy of the Capacitor, Dielectric
Lecture 43 - Dielectric (Continued...)
Lecture 44 - Displacement Vector
Lecture 45 - Electrostatic boundary value problem
Lecture 46 - Electrostatic boundary value problem (Continued...)
Lecture 47 - Electrostatic boundary value problem (Continued...), Image method
Lecture 48 - Image method (Continued...)
Lecture 49 - Charge particle in magnetic field
Lecture 50 - Biot-Savart Law
Lecture 51 - Application of Biot-Savart Law
Lecture 52 - Ampere's Law
Lecture 53 - Application of Ampere's Law
Lecture 54 - Magnetic vector potential
Lecture 55 - Magnetic vector potential (Continued...)
Lecture 56 - Magnetic dipole moment
Lecture 57 - Magnetic dipole moment (Continued...)
Lecture 58 - Torque and potential energy of magnetic dipole, Magnetization
Lecture 59 - Bound Current
Lecture 60 - Magnetic materials
Lecture 61 - Electromagnetic Induction
Lecture 62 - Self and mutual inductance
Lecture 63 - Wave equation, Maxwellâ s Equation
Lecture 64 - Maxwells Equation (Continued...)
Lecture 65 - Maxwells Equation: a complete overview
Lecture 66 - Maxwells Equation: a complete overview (Continued...)
Lecture 67 - Lorentz Gauge, Maxwell's wave equation
Lecture 68 - Maxwell's wave equation (Coninued...)

Lecture 69 - Maxwell's Equation in matter
Lecture 70 - Maxwell's Equation in matter (Continued...)
Lecture 71 - Tutorial 2 (Electrostatic)
Lecture 72 - Tutorial 3 (Magnetostatic)
Lecture 73 - Tutorial 4 (Magnetostatic and EM Wave)

NPTEL Video Course - Physics - NOC:Physics of Functional Materials and Devices

Subject Co-ordinator - Prof. Amreesh Chandra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to solid state materials - From conventional to functional
Lecture 2 - Ceramics and Composites - I
Lecture 3 - Ceramics and Composites - II
Lecture 4 - Polymers
Lecture 5 - Introduction to Nanomaterials and functionality
Lecture 6 - Synthesis protocols - I
Lecture 7 - Synthesis protocols - II
Lecture 8 - Synthesis protocols - III
Lecture 9 - Crystal structure - I
Lecture 10 - Crystal structure - II
Lecture 11 - Crystal structure - III
Lecture 12 - Crystal imperfections
Lecture 13 - Alloys and Melts
Lecture 14 - Theory of Solids
Lecture 15 - Nearlly free electron model
Lecture 16 - Bonds in molecules and solids
Lecture 17 - Transformations kinetics and reaction rates
Lecture 18 - Themodynamics
Lecture 19 - Phase and phase transitions
Lecture 20 - Diffusion and various properties
Lecture 21 - Mechanical properties of solids
Lecture 22 - Thermal Properties of Solids
Lecture 23 - Negative and Zero Expansion Ceramics
Lecture 24 - Heat Capacity
Lecture 25 - Thermogravimetric (TGA) analysis
Lecture 26 - Introduction to magnetism and Magnetic properties of solids
Lecture 27 - From magnetic to multiferroic materials
Lecture 28 - Magnetic materials and their applications
Lecture 29 - Magnetism at nanoscale

Lecture 30 - GMR materials
Lecture 31 - CMR materials
Lecture 32 - Ferrofluids
Lecture 33 - Spintronics and devices
Lecture 34 - Introduction to the basic properties of liquids and melts
Lecture 35 - Heat capacity and diffusion of liquids and melts
Lecture 36 - Viscosity, electric and thermal conduction of liquids and melts
Lecture 37 - Sensors
Lecture 38 - Electrochemical Sensors
Lecture 39 - Introduction to energy storage devices and basics of supercapacitors
Lecture 40 - Supercapacitors - II
Lecture 41 - Magnetic supercapacitors
Lecture 42 - Battery - I
Lecture 43 - Battery - II
Lecture 44 - Solar Cells - I
Lecture 45 - Solar Cells - II
Lecture 46 - X-ray Diffraction (XRD)
Lecture 47 - Fourier Transform Infrared Spectroscopy
Lecture 48 - UV- Vis Spectroscopy
Lecture 49 - Scanning and Transmission Electron Microscopy
Lecture 50 - Summary

NPTEL Video Course - Physics - NOC:Fundamentals of Attosecond Science and Technology (FAST)

Subject Co-ordinator - Prof. Sivarama Krishnan

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to waves, 1D wave equation and its solutions
Lecture 2 - 1D Light waves
Lecture 3 - Characteristics of light waves - amplitude, absolute phase, wavelenght and frequency
Lecture 4 - Phase, Phase velocity and Phase delay
Lecture 5 - Complex notation for the description light waves and superposition
Lecture 6 - Maxwell's equations to the 3D wave equation and its solutions
Lecture 7 - Recap of Week 1
Lecture 8 - 3D wave equation and plane waves
Lecture 9 - Complex notation for Electric fields, Superposition and interference
Lecture 10 - Fabry-Perot inteferometer and it transmittance
Lecture 11 - Physical interpretation of FP transmittance
Lecture 12 - Recap of Fabry-Perot modes
Lecture 13 - Free spectral range of a Fabry-Perot etalon
Lecture 14 - Resonator modes and optical pulses - insight
Lecture 15 - Table - Top Coherent and Incoherent Imaging
Lecture 16 - Recap of Etalon free spectral range
Lecture 17 - Line width and finesse of an etalon
Lecture 18 - Actual resonator modes
Lecture 19 - Resonator configurations and stability
Lecture 20 - Recap of optical resonators
Lecture 21 - Introduction of light pulses
Lecture 22 - Complex amplitude, Gaussian pulse
Lecture 23 - Recap of light pulses
Lecture 24 - Introduction of Fourier Transforms
Lecture 25 - Tutorial 1
Lecture 26 - Motivating Fourier Transforms
Lecture 27 - Fourier Transform Properties
Lecture 28 - Frequency domain electric field
Lecture 29 - Recap of Fourier transform properties

Lecture 30 - Frequency domain description of pulses
Lecture 31 - Spectral Phase
Lecture 32 - Recap of spectral phase
Lecture 33 - Instantaneous Frequency and group delay
Lecture 34 - Phase wrapping, blanking, and Tayor series expansion
Lecture 35 - Recap of instantaneous frequency, phase wrapping, and phase blanking
Lecture 36 - Frequency domain phase expansion, group delay dispersion
Lecture 37 - Absolute Phase
Lecture 38 - Recap of concepts + discussion
Lecture 39 - Absolute Phase (revisited)
Lecture 40 - Carrier envelope phase, frequency comb
Lecture 41 - Discussion
Lecture 42 - Recap of concepts
Lecture 43 - First order phase
Lecture 44 - Second order phase
Lecture 45 - Recap of first order and second order phase
Lecture 46 - Chirped pulse: Instantaneous frequency and Fourier transform
Lecture 47 - Group delay, nonlinearly chirped pulse
Lecture 48 - Recap of chirped pulses
Lecture 49 - Quadratic chirp pulses
Lecture 50 - Higher order spectral phase
Lecture 51 - Recap and discussion on higher order phase
Lecture 52 - Relative importance of intensity and phase
Lecture 53 - Pulse propagation through a medium
Lecture 54 - Recap of pulse propagation and pulse length
Lecture 55 - Discussion of RMS pulse width and uncertainty principle
Lecture 56 - Time-bandwidth product
Lecture 57 - Recap of previous module
Lecture 58 - Introduction of Lorentz Oscillator Model
Lecture 59 - Effect of matter on light
Lecture 60 - Recap of Lorentz oscillator, Polarization tensor
Lecture 61 - Dynamics of electrons in the Lorentz oscillator
Lecture 62 - Solving the inhomogeneous wave equation
Lecture 63 - Inhomogeneous wave equation, absorption coefficient, refractive index
Lecture 64 - Nonlinear response of matter
Lecture 65 - Origin of nonlinear optical effects
Lecture 66 - Wave equation in an inert gas
Lecture 67 - Perturbation theory and second harmonics
Lecture 68 - Numerical simulation strategy

Lecture 69 - Atoms in the presence of fields
Lecture 70 - Ionization models
Lecture 71 - Attosecond pulse generation and metrology
Lecture 72 - Nonlinear optics review
Lecture 73 - Nonlinear response of matter to light
Lecture 74 - Sum and difference frequency generation
Lecture 75 - Recap of sum and difference frequency generation, second harmonic generation
Lecture 76 - Generalized nonlinear effects, conservation laws in SHG
Lecture 77 - Phase matching in SHG, polarization dependent refractive index

NPTEL Video Course - Physics - NOC:Wave Optics

Subject Co-ordinator - Prof. Samudra Roy

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction (Continued...)
Lecture 3 - Concept of wave, Wave Equation
Lecture 4 - Plane wave, Spherical wave
Lecture 5 - Maxwell's wave equation, Poynting Vector
Lecture 6 - Superposition of waves
Lecture 7 - Superposition of wave (Complex method)
Lecture 8 - Random and coherent sourse, standing wave formation
Lecture 9 - Group and Phase velocity
Lecture 10 - Material Dispersion
Lecture 11 - Material Dispersion (Continued...)
Lecture 12 - Concept of Coherence
Lecture 13 - Concept of Coherence (Continued...)
Lecture 14 - Concept of Coherence (Continued...)
Lecture 15 - Concept of Coherence (Continued...)
Lecture 16 - Two beam interference
Lecture 17 - Young's double slit experiment
Lecture 18 - Youngâ s double slit experiment (Continued...)
Lecture 19 - Interference by division of amplitude
Lecture 20 - Interference by division of amplitude (Continued...)
Lecture 21 - Newton's Ring
Lecture 22 - Newtonâ s Ring (Continued...)
Lecture 23 - Newtonâ s Ring (Continued...)
Lecture 24 - Optical Interferometers
Lecture 25 - Michelson Interferometer
Lecture 26 - Multiple beam interference
Lecture 27 - Febry-Perot Interferometer
Lecture 28 - Febry-Perot Interferometer (Continued...)
Lecture 29 - Resolving power of Fabry-Perot interferometer

Lecture 30 - Diffraction of Light
Lecture 31 - Huygenâ s Theory
Lecture 32 - Fraunhofer Diffraction
Lecture 33 - Single-slit Diffraction
Lecture 34 - Single-slit Diffraction (Continued...)
Lecture 35 - Doubleâ Slit Diffraction
Lecture 36 - Multiâ Slit Diffraction
Lecture 37 - Multi-Slit Diffraction (Continued...)
Lecture 38 - Grating spectra
Lecture 39 - Grating spectra (Continued...)
Lecture 40 - Resolving power of grating
Lecture 41 - Fraunhofer diffraction for a circular aperture
Lecture 42 - Fraunhofer diffraction for a rectangular aperture
Lecture 43 - Fresnel Diffraction
Lecture 44 - Fresnelâ s half period zone
Lecture 45 - Fresnelâ s half period zone (Continued...)
Lecture 46 - Zone Plate
Lecture 47 - Fresnelâ s diffraction from an aperture
Lecture 48 - Fresnelâ s diffraction for a circular aperture
Lecture 49 - Fresnelâ s diffraction for a rectangular aperture
Lecture 50 - Fresnelâ s diffraction for a rectangular aperture (Continued...)
Lecture 51 - Fresnelâ s diffraction for semi-infinite opaque screen
Lecture 52 - Polarization of light (Basic concept)
Lecture 53 - Circularly polarized light
Lecture 54 - Matrix treatment of polarization
Lecture 55 - Jones Matrix for polarization
Lecture 56 - Jones Matrix for polarization (Continued...)
Lecture 57 - Jones Matrix for polarization (Continued...)
Lecture 58 - Jones Matrix for polarization (Continued...)
Lecture 59 - Jones matrix for polarization (Continued...)
Lecture 60 - Production of polarized light
Lecture 61 - Production of polarized light (Continued...)
Lecture 62 - Birefrigent Crystal
Lecture 63 - Birefrigent Crystal (Continued...)
Lecture 64 - Index Ellipsoid
Lecture 65 - Analyzing Polarised Light
Lecture 66 - Babinet Compensator

NPTEL Video Course - Physics - NOC:Physics of Nanomaterials

Subject Co-ordinator - Prof. Amreesh Chandra

Co-ordinating Institute - IIT Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to nanomaterials and nanotechnology
Lecture 2 - Classification of Nanomaterials
Lecture 3 - Need of nanomaterials
Lecture 4 - Application of nanomaterials
Lecture 5 - Concept and Quantum Mechanical Explanation of Electron Confinement
Lecture 6 - Energy Band Diagram in Solid State Materials
Lecture 7 - Crystal Structures and Phase Transitions in Nanomaterials
Lecture 8 - Dimensionality Effects on the Electrical properties
Lecture 9 - Introduction to Synthesis Methods for Nanomaterials
Lecture 10 - Kinetically and Thermodynamically Controlled Routes
Lecture 11 - Top Down and Bottom Up Synthesis Routes - 1
Lecture 12 - Top Down and Bottom Up Synthesis Routes - 2
Lecture 13 - Low Dimensional Structures - Quantum Wells, Wires and Dots; Conduction Electrons and Dimensional
Lecture 14 - Fermi Gas and Density of States
Lecture 15 - Fermi Gas and Density of States
Lecture 16 - Coulomb Potential and Single Electron Tunnelling
Lecture 17 - Metal Nanoclusters
Lecture 18 - Semiconducting Nanoparticle Clusters
Lecture 19 - Molecular Clusters
Lecture 20 - Quantum Devices - Infrared Detectors and Quantum Dot lasers
Lecture 21 - Application of carbon nanotubes
Lecture 22 - Carbon clusters and nanotubes
Lecture 23 - Electrical, Vibrational and Mechanical Properties of Carbon Nanotubes
Lecture 24 - Application of carbon nanotubes
Lecture 25 - Magnetism at Nanoscale
Lecture 26 - Nanostructured Magnetic Materials
Lecture 27 - Dynamics of Nanomagnets - I
Lecture 28 - Dynamics of Nanomagnets - II
Lecture 29 - Giant Magnetoresistance

Lecture 30 - Colossal Magnetoresistance
Lecture 31 - Nanocarbon Ferromagnets
Lecture 32 - Superparamagnetism and ferrofluids
Lecture 33 - Self Assembly and Catalysis
Lecture 34 - Process of Self Assembly
Lecture 35 - Monolayers and Porous Materials
Lecture 36 - Nature of Catalysis,Pillard Clays and Colloids
Lecture 37 - Nanomaterials for Energy Devices
Lecture 38 - Secondary Batteries
Lecture 39 - Supercapacitors
Lecture 40 - Porous Silicon, Photoluminescence and Photovoltaics
Lecture 41 - Introduction to useful various techniques
Lecture 42 - Particle size determination
Lecture 43 - Phase Transition Using X-ray Diffraction
Lecture 44 - Strain Estimation
Lecture 45 - TEM and SEM
Lecture 46 - Infrared and Raman Spectroscopy
Lecture 47 - Porosity and Specific Surface Areas
Lecture 48 - Infrared and Raman Spectroscopy

NPTEL Video Course - Physics - Special Topics in Atomic Physics

Subject Co-ordinator - Prof. P.C. Deshmukh

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introductory lecture about this course
Lecture 2 - Quantum Mechanics and Symmetry of the Hydrogen Atom
Lecture 3 - Hydrogen atom
Lecture 4 - Hydrogen atom
Lecture 5 - Degeneracy of the Hydrogen Atom
Lecture 6 - Wavefunctions of the Hydrogen Atom
Lecture 7 - Angular Momentum in Quantum Mechanics
Lecture 8 - Angular Momentum in Quantum Mechanics
Lecture 9 - Angular Momentum in Quantum Mechanics
Lecture 10 - Angular Momentum in Quantum Mechanics Dimensionality of the Direct-Product (Composite) Vector Sp
Lecture 11 - Angular Momentum in Quantum Mechanics CGC matrix, Wigner D Rotation Matrix, Irreducible Tensor C
Lecture 12 - Angular Momentum in Quantum Mechanics - more on ITO, and the Wigner-Eckart Theorem
Lecture 13 - Angular Momentum in Quantum Mechanics Wigner-Eckart Theorem - 2
Lecture 14 - Relativistic Quantum Mechanics of the Hydrogen Atom - 1
Lecture 15 - Relativistic Quantum Mechanics of the Hydrogen Atom - 2
Lecture 16 - Relativistic Quantum Mechanics of the Hydrogen Atom - PAULI Equation - Foldy - Wouthysen Transfo
Lecture 17 - Relativistic Quantum Mechanics of the Hydrogen Atom - Foldy - Wouthysen Transformations - 2
Lecture 18 - Relativistic Quantum Mechanics of the Hydrogen Atom - Foldy - Wouthysen Transformations - 3
Lecture 19 - Relativistic Quantum Mechanics of the Hydrogen Atom - Spherical Symmetry of the Coulomb Potentia
Lecture 20 - Hartree-Fock Self-Consistent Field formalism - 1
Lecture 21 - Hartree-Fock Self-Consistent Field formalism - 2
Lecture 22 - Hartree-Fock Self-Consistent Field formalism - 3
Lecture 23 - Hartree-Fock Self-Consistent Field formalism - 4
Lecture 24 - Hartree-Fock Self-Consistent Field formalism - 5
Lecture 25 - Perturbative treatment of relativistic effectsâ ¦ Schrodinger's and Dirac QM
Lecture 26 - Perturbative treatment of relativistic effectsâ ¦ Schrodinger's and Dirac QM
Lecture 27 - Probing the atom - Collisions and Spectroscopy - boundary conditions - 1
Lecture 28 - Atomic Probes - Collisions and Spectroscopy - boundary conditions - 2
Lecture 29 - Atomic Probes - Collisions and Spectroscopy - Scattering phase shifts and boundary conditions

Lecture 30 - Atomic Probes - Time reversal symmetry - applications in atomic collisions and photoionization p
Lecture 31 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 1
Lecture 32 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 2
Lecture 33 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 3
Lecture 34 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 4
Lecture 35 - Atomic Photoionization cross sections, angular distributions of photoelectrons Cooper Zare Formu
Lecture 36 - Stark- Zeeman Spectroscopy - Stark effect
Lecture 37 - Stark- Zeeman Spectroscopy - Stark effect on n=2 excited state of the H atom Zeeman effect
Lecture 38 - Stark- Zeeman Spectroscopy - Normal, Anomalous Zeeman effect; Paschen- Back effect
Lecture 39 - Stark- Zeeman Spectroscopy - Anomalous Zeeman effect
Lecture 40 - Zeeman effect Fine structure, Hyperfine structure - Elemental, rudimentary introduction to Laser

NPTEL Video Course - Physics - Classical Field Theory

Subject Co-ordinator - Prof. Suresh Govindarajan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - What is Classical Field Theory?
Lecture 2 - Symmetries and Invariances - I
Lecture 3 - Symmetries and Invariances - II
Lecture 4 - Group Theory in Physics - I
Lecture 5 - Group Theory in Physics - II
Lecture 6 - Finite Groups - I
Lecture 7 - Finite Groups - II
Lecture 8 - Basics of CFT - I
Lecture 9 - Basics of CFT - II
Lecture 10 - Basics of CFT - III
Lecture 11 - Green Functions - I
Lecture 12 - Green Functions - II
Lecture 13 - Noether's Theorem - I
Lecture 14 - Noether's Theorem - II
Lecture 15 - Kink Soliton
Lecture 16 - Hidden Symmetry
Lecture 17 - Local Symmetries
Lecture 18 - The Abelian Higgs model
Lecture 19 - Lie Algebras - I
Lecture 20 - Lie Algebras - II
Lecture 21 - Magnetic Vortices - I
Lecture 22 - Magnetic Vortices - II
Lecture 23 - Non-abelian gauge theories - I
Lecture 24 - Non-abelian gauge theories - II
Lecture 25 - Irreps of Lie algebras - I
Lecture 26 - Irreps of Lie algebras - II
Lecture 27 - The Standard Model - I
Lecture 28 - The Standard Model - II
Lecture 29 - Irreps of the Lorentz/Poincare algebras

Lecture 30 - The Dirac mononpole
Lecture 31 - The 't Hooft-Polaykov monopole
Lecture 32 - Revisiting Derrickâ s Theorem
Lecture 33 - The Julia-Zee dyon
Lecture 34 - Instantons - I
Lecture 35 - Instantons - II
Lecture 36 - Instantons - III
Lecture 37 - Instantons - IV
Lecture 38 - Dualities
Lecture 39 - Geometrization of Field Theory

NPTEL Video Course - Physics - Topics in Nonlinear Dynamics

Subject Co-ordinator - Prof. V. Balakrishnan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview
Lecture 2 - Critical points of a dynamical system
Lecture 3 - Two-dimensional flows
Lecture 4 - Stable and unstable manifolds
Lecture 5 - Hamiltonian dynamics - Part I
Lecture 6 - Hamiltonian dynamics - Part II
Lecture 7 - Hamiltonian dynamics - Part III
Lecture 8 - Hamiltonian dynamics - Part IV
Lecture 9 - Hamiltonian dynamics - Part V
Lecture 10 - Elementary bifurcations
Lecture 11 - Limit cycles
Lecture 12 - PoincarÃ´e index
Lecture 13 - Illustrative examples
Lecture 14 - Quiz 1. Questions and answers
Lecture 15 - Bead on a rotating hoop
Lecture 16 - Types of dynamical behaviour
Lecture 17 - Discrete time dynamics - Part I
Lecture 18 - Discrete time dynamics - Part II
Lecture 19 - Discrete time dynamics - Part III
Lecture 20 - Discrete time dynamics - Part IV
Lecture 21 - Coarse-grained dynamics in phase space - Part I
Lecture 22 - Coarse-grained dynamics in phase space - Part II & Stochastic dynamics - Part I
Lecture 23 - Stochastic dynamics - Part II
Lecture 24 - Stochastic dynamics - Part III
Lecture 25 - Coarse-grained dynamics in phase space - Part IV & Stochastic dynamics - Part IV
Lecture 26 - Discrete time dynamics - Part V
Lecture 27 - Quiz 2. Questions and answers
Lecture 28 - Stochastic dynamics - Part V
Lecture 29 - Stochastic dynamics - Part VI

NPTEL Video Course - Physics - Condensed Matter Physics

Subject Co-ordinator - Prof. G. Rangarajan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Principles of Condensed Matter Physics
Lecture 2 - Symmetry in Perfect Solids
Lecture 3 - Symmetry in Perfect Solids (Continued...)
Lecture 4 - Symmetry in Perfect Solids - Worked Examples
Lecture 5 - Diffraction Methods For Crystal Structures
Lecture 6 - Diffraction Methods For Crystal Structures (Continued...)
Lecture 7 - Diffraction Methods For Crystal Structures - Worked Examples
Lecture 8 - Physical Properties of Crystals
Lecture 9 - Physical Properties of Crystals (Continued...)
Lecture 10 - Physical Properties of Crystals - Worked Examples
Lecture 11 - Cohesion in Solids
Lecture 12 - Cohesion in Solids - Worked Examples
Lecture 13 - The Free Electron Theory of Metals
Lecture 14 - The Free Electron Theory of Metals - Worked Examples
Lecture 15 - The Free Electron Theory of Metals - Electrical Conductivity
Lecture 16 - The Free Electron Theory of Metals - Electrical Conductivity - Worked Examples
Lecture 17 - Thermal Conductivity of Metals
Lecture 18 - Thermal Conductivity of Metals - Worked Examples
Lecture 19 - The Concept of Phonons
Lecture 20 - Debye Theory of Specific Heat, Lattice Vibrations
Lecture 21 - Debye Theory of Specific Heat, Lattice Vibrations - Worked Examples
Lecture 22 - Lattice Vibrations (Continued) Phonon thermal conductivity
Lecture 23 - Lattice Vibrations (Continued) Phonon Thermal Conductivity - Worked Examples
Lecture 24 - Anharmonicity and Thermal Expansion
Lecture 25 - Dielectric (Insulating) Solids
Lecture 26 - Dispersion and Absorption of Electromagnetic Waves in Dielectric Media, Ferro-and Antiferroelect
Lecture 27 - Optical Properties of Metals; Ionic Polarization in Alkali Halides; Piezoelectricity
Lecture 28 - Dielectric Solids - Worked Examples
Lecture 29 - Dia - and Paramagnetism

Lecture 30 - Paramagnetism of Transition Metal and Rare Earth Ions
Lecture 31 - Quenching of Orbital Angular Momentum; Ferromagnetism
Lecture 32 - Exchange Interactions, Magnetic Order, Neutron Diffraction
Lecture 33 - Hysteresis and Magnetic Domains; Spin Waves and Magnons
Lecture 34 - Magnetic Resonance
Lecture 35 - Magnetism and Magnetic Resonance - Worked Examples
Lecture 36 - Magnetism - Worked Examples (Continued...)
Lecture 37 - Pauli Paramagnetism and Landau Diamagnetism
Lecture 38 - Band Magnetism; Itinerant Electrons; Stoner Model
Lecture 39 - Superconductivity - Perfect Electrical Conductivity and Perfect Diamagnetism
Lecture 40 - Type I and Type II Superconductors
Lecture 41 - Ginsburg - Landau Theory, Flux Quantization
Lecture 42 - Cooper Pairs
Lecture 43 - Microscopic (BCS) Theory of Superconductivity
Lecture 44 - BCS Theory (Continued...)
Lecture 45 - Josephson Effect (Continued...); High Temperature Superconductors
Lecture 46 - Superconductors - Worked Examples
Lecture 47 - Energy Bands in Solids
Lecture 48 - Electron Dynamics in a Periodic Solid
Lecture 49 - Semiconductors
Lecture 50 - Semiconductors (Continued...)
Lecture 51 - Semiconductors - Worked Examples
Lecture 52 - Defects in Solids - Point Defects
Lecture 53 - Point Defects in Solids - Worked Examples
Lecture 54 - Defects in Solids - Line and Surface Defects
Lecture 55 - Dislocations in Solids - Worked Examples
Lecture 56 - Quantum Fluids and Quantum Solids
Lecture 57 - Quantum Liquids and Quantum Solids - Worked Examples
Lecture 58 - Epilogue

NPTEL Video Course - Physics - Quantum Field Theory

Subject Co-ordinator - Dr. Prasanta Tripathy

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction to Classical Field Theory
Lecture 3 - Quantization of Real Scalar Field - I
Lecture 4 - Quantization of Real Scalar Field - II
Lecture 5 - Quantization of Real Scalar Field - III
Lecture 6 - Quantization of Real Scalar Field - IV
Lecture 7 - Quantization of Complex Scalar Field
Lecture 8 - Interacting Field Theory - I
Lecture 9 - Interacting Field Theory - II
Lecture 10 - Interacting Field Theory - III
Lecture 11 - Interacting Field Theory - IV
Lecture 12 - Interacting Field Theory - V
Lecture 13 - Interacting Field Theory - VI
Lecture 14 - Interacting Field Theory - VII
Lecture 15 - Quantuzation of Electromagnetic Field - I
Lecture 16 - Quantuzation of Electromagnetic Field - II
Lecture 17 - Fermion Quantization - I
Lecture 18 - Fermion Quantization - II
Lecture 19 - Fermion Quantization - III
Lecture 20 - Fermion Quantization - IV
Lecture 21 - Fermion Quantization - V
Lecture 22 - Fermion Quantization - VI
Lecture 23 - The S-Matrix Expansion in QED - I
Lecture 24 - The S-Matrix Expansion in QED - II
Lecture 25 - Feynman Rules in QED - I
Lecture 26 - Feynman Rules in QED - II
Lecture 27 - Compton Scattering - I
Lecture 28 - Compton Scattering - II
Lecture 29 - Compton Scattering - III

Lecture 30 - Moller Scattering - I
Lecture 31 - Moller Scattering - II
Lecture 32 - Vertex Correction - I
Lecture 33 - Vertex Correction - II
Lecture 34 - Vertex Correction - III
Lecture 35 - Vertex Correction - IV
Lecture 36 - Electron Selfenergy
Lecture 37 - Photon Selfenergy - I
Lecture 38 - Photon Selfenergy - II

NPTEL Video Course - Physics - Quantum Mechanics I

Subject Co-ordinator - Prof. S. Lakshmi Bala

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Quantum Mechanics â An Introduction
Lecture 2 - Linear Vector Spaces - I
Lecture 3 - Linear Vector Spaces - II
Lecture 4 - Linear Vector Spaces - III
Lecture 5 - Postulates of Quantum Mechanics - I
Lecture 6 - Postulates of Quantum Mechanics - II
Lecture 7 - The Uncertainty Principle
Lecture 8 - The Linear Harmonic Oscillator
Lecture 9 - Introducing Quantum Optics
Lecture 10 - An Interesting Quantum Superposition
Lecture 11 - The Displacement and Squeezing Operators
Lecture 12 - Exercises in Finite Dimensional Linear Vector Spaces
Lecture 13 - Exercises on Angular Momentum Operators and their algebra
Lecture 14 - Exercises on Quantum Expectation Values
Lecture 15 - Composite Systems
Lecture 16 - The Quantum Beam Splitter
Lecture 17 - Addition of Angular Momenta - I
Lecture 18 - Addition of Angular Momenta - II
Lecture 19 - Addition of Angular Momenta - III
Lecture 20 - Infinite Dimensional Linear Vector Spaces
Lecture 21 - Square-Integrable Functions
Lecture 22 - Ingredients of Wave Mechanics
Lecture 23 - The Schrodinger equation
Lecture 24 - Wave Mechanics of the Simple Harmonic Oscillator
Lecture 25 - One-Dimensional Square Well Potential
Lecture 26 - The Square Well and the Square Potential Barrier
Lecture 27 - The Particle in a one-dimensional Box
Lecture 28 - A Charged Particle in a Uniform Magnetic Field
Lecture 29 - The Wavefunction

Lecture 30 - The Central Potential
Lecture 31 - The Spherical Harmonics
Lecture 32 - Central Potential
Lecture 33 - Illustrative Exercises - I
Lecture 34 - Illustrative Exercises - II
Lecture 35 - Ehrenfest's Theorem
Lecture 36 - Perturbation Theory - I
Lecture 37 - Perturbation Theory - II
Lecture 38 - Perturbation Theory - III
Lecture 39 - Perturbation Theory - IV
Lecture 40 - Time-dependent Hamiltonians
Lecture 41 - The Jaynes-Cummings model

NPTEL Video Course - Physics - Special Topics in Classical Mechanics

Subject Co-ordinator - Prof. P.C. Deshmukh

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Overview
Lecture 2 - Equations of Motion (i)
Lecture 3 - Equations of Motion (ii)
Lecture 4 - Equations of Motion (iii)
Lecture 5 - Equations of Motion (iv)
Lecture 6 - Equations of Motion (v)
Lecture 7 - Oscillators, Resonances, Waves (i)
Lecture 8 - Oscillators, Resonances, Waves (ii)
Lecture 9 - Oscillators, Resonances, Waves (iii)
Lecture 10 - Oscillators, Resonances, Waves (iv)
Lecture 11 - Polar Coordinates (i)
Lecture 12 - Polar Coordinates (ii)
Lecture 13 - Dynamical Symmetry in the Kepler Problem (i)
Lecture 14 - Dynamical Symmetry in the Kepler Problem (ii)
Lecture 15 - Real Effects of Pseudo-Forces (i)
Lecture 16 - Real Effects of Pseudo-Forces (ii)
Lecture 17 - Real Effects of Pseudo-Forces (iii)
Lecture 18 - Real Effects of Pseudo-Forces (iv)
Lecture 19 - Special Theory of Relativity (i)
Lecture 20 - Special Theory of Relativity (ii)
Lecture 21 - Special Theory of Relativity (iii)
Lecture 22 - Special Theory of Relativity (iv)
Lecture 23 - Potentials Gradients Fields (i)
Lecture 24 - Potentials Gradients Fields (ii)
Lecture 25 - Potentials Gradients Fields (iii)
Lecture 26 - Gauss Law Eq of continuity (i)
Lecture 27 - Gauss Law Eq of continuity (ii)
Lecture 28 - Gauss Law Eq of continuity (iii)
Lecture 29 - Fluid Flow Bernoulli Principle (i)

Lecture 30 - Fluid Flow Bernoulli Principle (ii)
Lecture 31 - Classical Electrodynamics (i)
Lecture 32 - Classical Electrodynamics (ii)
Lecture 33 - Classical Electrodynamics (iii)
Lecture 34 - Classical Electrodynamics (iv)
Lecture 35 - Chaotic Dynamical Systems (i)
Lecture 36 - Chaotic Dynamical Systems (ii)
Lecture 37 - Chaotic Dynamical Systems (iii)
Lecture 38 - Chaotic Dynamical Systems (iv)
Lecture 39 - Chaotic Dynamical Systems (v)
Lecture 40 - The Scope and Limitations of Classical Mechanics

NPTEL Video Course - Physics - Special, Select Topics in the Theory of Atomic Collisions and Spectroscopy

Subject Co-ordinator - Prof. P.C. Deshmukh

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the STiTACS course
Lecture 2 - Quantum Theory of collisions
Lecture 3 - Quantum Theory of collisions
Lecture 4 - Quantum Theory of collisions
Lecture 5 - Quantum Theory of collisions
Lecture 6 - Quantum Theory of collisions
Lecture 7 - Quantum Theory of collisions
Lecture 8 - Quantum Theory of collisions
Lecture 9 - Quantum Theory of collisions
Lecture 10 - Quantum Theory of collisions
Lecture 11 - Quantum Theory of collisions
Lecture 12 - Quantum Theory of collisions
Lecture 13 - Many body theory, electron correlations
Lecture 14 - Second Quantization Creation, Destruction and Number operators
Lecture 15 - Many-particle Hamiltonian & Schrodinger Equation in 2nd Quantization
Lecture 16 - Many-electron problem in quantum mechanics
Lecture 17 - Hartree-Fock Self-Consistent-Field
Lecture 18 - Exchange, Statistical, Fermi-Dirac correlations
Lecture 19 - Limitations of the Hartree-Fock Self-Consistent-Field formalism
Lecture 20 - Many-Body formalism, II Quantization
Lecture 21 - Density fluctuations in an electron gas
Lecture 22 - Bohm-Pines approach to Random Phase Approximation
Lecture 23 - Bohm-Pines approach to Random Phase Approximation (Continued...)
Lecture 24 - Bohm-Pines approach to Random Phase Approximation (Continued...)
Lecture 25 - Schrodinger, Heisenberg and Dirac Â picturesÂ of QM
Lecture 26 - DysonÂ s chronological operator
Lecture 27 - Gell-Mann-Low Theorem
Lecture 28 - Reyleigh-Schrodinger perturbation methods and adiabatic switching
Lecture 29 - Feynman Diagrams

Lecture 30 - I Order Feynman Diagrams
Lecture 31 - II and higher order Feynman Diagrams
Lecture 32 - Linear response of electron correlations
Lecture 33 - Lippman Schwinger equation of potential scattering
Lecture 34 - Born Approximation
Lecture 35 - Coulomb scattering
Lecture 36 - Scattering of partial waves
Lecture 37 - Scattering at high energy
Lecture 38 - Resonances in Quantum Collisions
Lecture 39 - Breit-Wigner Resonances
Lecture 40 - Fano parameterization of Breit-Wigner formula
Lecture 41 - Discrete state embedded in the continuum
Lecture 42 - Resonance life times
Lecture 43 - Wigner-Eisenbud formalism of time-delay in scattering
Lecture 44 - Photoionization and Photoelectron Angular Distributions
Lecture 45 - Ionization and Excitation of Atoms by Fast Charged Particles
Lecture 46 - Photo-absorption by Free and Confined Atoms and Ions

NPTEL Video Course - Physics - Selected Topics in Mathematical Physics

Subject Co-ordinator - Prof. V. Balakrishnan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Analytic functions of a complex variable - Part I
Lecture 2 - Analytic functions of a complex variable - Part II
Lecture 3 - Calculus of residues - Part I
Lecture 4 - Calculus of residues - Part II
Lecture 5 - Calculus of residues - Part III
Lecture 6 - Calculus of residues - Part IV
Lecture 7 - Linear response; dispersion relations - Part I
Lecture 8 - Linear response; dispersion relations - Part II
Lecture 9 - Analytic continuation and the gamma function - Part I
Lecture 10 - Analytic continuation and the gamma function - Part II
Lecture 11 - MÃ¶bius transformations - Part I
Lecture 12 - MÃ¶bius transformations - Part II
Lecture 13 - MÃ¶bius transformations - Part III
Lecture 14 - Multivalued functions; integral representations - Part I
Lecture 15 - Multivalued functions; integral representations - Part II
Lecture 16 - Multivalued functions; integral representations - Part III
Lecture 17 - Multivalued functions; integral representations - Part IV
Lecture 18 - Laplace transforms - Part I
Lecture 19 - Laplace transforms - Part II
Lecture 20 - Fourier transforms - Part I
Lecture 21 - Fourier transforms - Part II
Lecture 22 - Fourier transforms - Part III
Lecture 23 - Fundamental Green function forÎ 2 - Part I
Lecture 24 - Fundamental Green function forÎ 2 - Part II
Lecture 25 - The diffusion equation - Part I
Lecture 26 - The diffusion equation - Part II
Lecture 27 - The diffusion equation - Part III
Lecture 28 - The diffusion equation - Part IV
Lecture 29 - Green function for (Î 2 + k2); nonrelativistic scattering - Part I

Lecture 30 - Green function for (Î 2 + k2); nonrelativistic scattering - Part II
Lecture 31 - Green function for (Î 2 + k2); nonrelativistic scattering - Part III
Lecture 32 - The wave equation - Part I
Lecture 33 - The wave equation - Part II
Lecture 34 - The rotation group and all that - Part I
Lecture 35 - The rotation group and all that - Part II
Lecture 36 - The rotation group and all that - Part III

NPTEL Video Course - Physics - Nuclear Reactors and Safety - An Introduction

Subject Co-ordinator - Dr.G.Vaidyanathan

Co-ordinating Institute - SRM University

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Energy Sources
Lecture 2 - Nuclear Power Production Cycle
Lecture 3 - Basic Physics of Nuclear Fission
Lecture 4 - Basic Physics of Nuclear Fission (Continued...)
Lecture 5 - Nuclear Reactors
Lecture 6 - Reactors Generation
Lecture 7 - Radiation Sources and Protection
Lecture 8 - Biological Effects of Radiation
Lecture 9 - Safety Principles
Lecture 10 - Safety Principles (Continued...)
Lecture 11 - Safety Approach
Lecture 12 - Risk and Probabilistic safety analysis (PSA)
Lecture 13 - History of Events in Nuclear Power Plants and Radiation facilities
Lecture 14 - Other Events
Lecture 15 - Validation and Dynamic Analysis
Lecture 16 - Validation and Dynamic Analysis (Continued...)
Lecture 17 - Quality Assurance
Lecture 18 - Siting of Nuclear Plants
Lecture 19 - Siting of Nuclear Plants (Continued...)
Lecture 20 - Engineered Safety Systems
Lecture 21 - Engineered Safety Systems (Continued...)
Lecture 22 - Assessment of Radiological Consequences of Incidents
Lecture 23 - Safety Regulation in India
Lecture 24 - Safety Regulation in India (Continued...)
Lecture 25 - Safety Regulation in India (Continued...)
Lecture 26 - Safety Practices in Indian NPPs
Lecture 27 - Safety Practices in Indian NPPs (Continued...)
Lecture 28 - Safety Practices in Indian NPPs (Continued...)
Lecture 29 - Passive Safety

Lecture 30 - Passive Safety (Continued...)

NPTEL Video Course - Physics - Physical Applications of Stochastic Processes

Subject Co-ordinator - Prof. V. Balakrishnan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Discrete probability distributions - Part 1
Lecture 2 - Discrete probability distributions - Part 2
Lecture 3 - Continuous random variables
Lecture 4 - Central Limit Theorem
Lecture 5 - Stable distributions
Lecture 6 - Stochastic processes
Lecture 7 - Markov processes - Part 1
Lecture 8 - Markov processes - Part 2
Lecture 9 - Markov processes - Part 3
Lecture 10 - Birth-and-death processes
Lecture 11 - Continuous Markov processes
Lecture 12 - Langevin dynamics - Part 1
Lecture 13 - Langevin dynamics - Part 2
Lecture 14 - Langevin dynamics - Part 3
Lecture 15 - Langevin dynamics - Part 4
Lecture 16 - ItÂ o and Fokker-Planck equations for di?usion processes
Lecture 17 - Level-crossing statistics of a continuous random process
Lecture 18 - Diffusion of a charged particle in a magnetic field
Lecture 19 - Power spectrum of noise
Lecture 20 - Elements of linear response theory
Lecture 21 - Random pulse sequences
Lecture 22 - Dichotomous di?usion
Lecture 23 - First passage time - Part 1
Lecture 24 - First passage time - Part 2
Lecture 25 - First passage and recurrence in Markov chains
Lecture 26 - Recurrent and transient random walks
Lecture 27 - Non-Markovian random walks
Lecture 28 - Statistical aspects of deterministic dynamics - Part 1
Lecture 29 - Statistical aspects of deterministic dynamics - Part 2

NPTEL Video Course - Physics - NOC:Mechanics, Heat Oscillations and Waves

Subject Co-ordinator - Prof. V. Balakrishnan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - The Nature of Physical Laws
Lecture 2 - Fundamental Constants and Dimensional Analysis
Lecture 3 - Dimensional analysis and scaling
Lecture 4 - sketching Elementary Functions
Lecture 5 - The fundamental forces of nature
Lecture 6 - Scalars, Victors and All That
Lecture 7 - Plane Polar Coordinates
Lecture 8 - Vectors In a Plane, Scalars and Pseudoscalars
Lecture 9 - Kinematics In a Plane
Lecture 10 - Vectors in 3-Dimensional Space
Lecture 11 - Vectors in 3-Dimensional space (Continued...)
Lecture 12 - The Finite Rotation Formula, Polar Coordinates in 3-dimensions
Lecture 13 - Cylindrical and Spherical polar coordinates
Lecture 14 - Motion in a circle - Acceleration
Lecture 15 - Newtons laws of motion
Lecture 16 - Conservation Laws and Newtons Equations
Lecture 17 - Conservation of Angular Momentum
Lecture 18 - Two-Body Scattering
Lecture 19 - Two-Body Collision Kinematics
Lecture 20 - Conservative Forces - The Concept of a Potential
Lecture 21 - Central Potential and Central Force
Lecture 22 - The 2-Body Central Force Problem
Lecture 23 - Keplers Laws of Planetary Motion
Lecture 24 - Non-Inertial Forces (Pseudo-forces)
Lecture 25 - More on the Kepler problem; Satellite motion
Lecture 26 - Linear Elasticity of Solids
Lecture 27 - Simple Harmonic Motion
Lecture 28 - Some Physical Examples of Simple Harmonic Motion
Lecture 29 - More on Simple Harmonic Motion

Lecture 30 - Damped Simple Harmonic Motion
Lecture 31 - Wave Motion - Travelling and Standing Waves
Lecture 32 - Wave Motion - Wave Equation, General Solution
Lecture 33 - Fluid Dynamics - Hydrostatic Equilibrium
Lecture 34 - Fluid Dynamics - Equation of Continuity
Lecture 35 - Fluid Flow - Bernoullis Principle
Lecture 36 - Circulation and Vorticity
Lecture 37 - What is Thermodynamics?
Lecture 38 - The Classical Ideal Gas
Lecture 39 - The Laws of Thermodynamics
Lecture 40 - Specific Heat of an Ideal Gas
Lecture 41 - Van der Waals Equation
Lecture 42 - Phase Transitions
Lecture 43 - Summary

NPTEL Video Course - Physics - Nonequilibrium Statistical Mechanics

Subject Co-ordinator - Prof. V. Balakrishnan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Recapitulation of equilibrium statistical mechanics
Lecture 2 - The Langevin model (Part 1)
Lecture 3 - The Langevin model (Part 2)
Lecture 4 - The Langevin model (Part 3)
Lecture 5 - The Langevin model (Part 4)
Lecture 6 - Linear response theory (Part 1)
Lecture 7 - Linear response theory (Part 2)
Lecture 8 - Linear response (Part 3)
Lecture 9 - Linear response(Part 4)
Lecture 10 - Linear response (Part 5)
Lecture 11 - Linear response (Part 6)
Lecture 12 - Linear response theory (Part 7)
Lecture 13 - Quiz 1 - Questions and answers
Lecture 14 - Linear response theory (Part 8)
Lecture 15 - Linear response theory (Part 9)
Lecture 16 - The dynamic mobility
Lecture 17 - Fokker-Planck equations (Part 1)
Lecture 18 - Fokker-Planck equations (Part 2)
Lecture 19 - Fokker-Planck equations (Part 3)
Lecture 20 - The generalized Langevin equation (Part 1)
Lecture 21 - The generalized Langevin equation (Part 2)
Lecture 22 - Diffusion in a magnetic field
Lecture 23 - The Boltzmann equation for a dilute gas (Part 1)
Lecture 24 - The Boltzmann equation for a dilute gas (Part 2)
Lecture 25 - The Boltzmann equation for a dilute gas (Part 3)
Lecture 26 - The Boltzmann equation for a dilute gas (Part 4)
Lecture 27 - The Boltzmann equation for a dilute gas (Part 5)
Lecture 28 - Quiz 2 - Questions and answers
Lecture 29 - Critical phenomena (Part 1)

Lecture 30 - Critical phenomena (Part 2)
Lecture 31 - Critical phenomena (Part 3)
Lecture 32 - Critical phenomena (Part 4)
Lecture 33 - Critical phenomena (Part 5)
Lecture 34 - Critical phenomena (Part 6)
Lecture 35 - Critical phenomena (Part 7)
Lecture 36 - The Wiener process (standard Brownian motion)

NPTEL Video Course - Physics - NOC:Statistical Mechanics

Subject Co-ordinator - Prof. Ashwin Joy

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Discrete Probability
Lecture 2 - Continous Probability
Lecture 3 - Characteristic Function
Lecture 4 - Gausssian Distribution
Lecture 5 - Binomial Distribution
Lecture 6 - Poisson Distribution
Lecture 7 - Central Limit Theorem
Lecture 8 - Many Random Variables
Lecture 9 - Entropy and Probability
Lecture 10 - Entropy Maximization
Lecture 11 - Transformation of Random Variables
Lecture 12 - Tutorial
Lecture 13 - Mathematical Preliminaries - 1
Lecture 14 - Microcanonical Ensemble
Lecture 15 - Two Level System (Microcanonical Ensemble)
Lecture 16 - Classical Ideal Gas (Microcanonical Ensemble)
Lecture 17 - Entropy of Mixing
Lecture 18 - Canonical Ensemble
Lecture 19 - Two Level System (Canonical Ensemble)
Lecture 20 - Classical Ideal Gas (Canonical Ensemble)
Lecture 21 - Gibbs Canonical Ensemble
Lecture 22 - Classical Ideal Gas (Gibbs Canonical Ensemble)
Lecture 23 - N Spins in a Uniform Magnetic Field
Lecture 24 - Grand Canonical Ensemble
Lecture 25 - Ideal Gas (Grand Canonical Ensemble)
Lecture 26 - N Non - Interacting Spins in Constant Magnetic Field
Lecture 27 - Qunatum Statistical Mechanics
Lecture 28 - Statistics of Fermions and Bosons
Lecture 29 - Quantum to Classical Correspondance

Lecture 30 - Vibrations of Solid (Low Temperature)
Lecture 31 - Vibrations of Solid (Continuation)
Lecture 32 - Free Electrons(Fermi Gas) in a Metal
Lecture 33 - Free Electrons(Fermi Gas) in a Metal (Continuation)
Lecture 34 - Problem solving demo - Part 1
Lecture 35 - Problem solving demo - Part 2

NPTEL Video Course - Physics - NOC:Computational Physics

Subject Co-ordinator - Prof. Prasenjit Ghosh

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Fortran - Part 1
Lecture 2 - Introduction to Fortran - Part 2
Lecture 3 - Introduction to Fortran - Part 3
Lecture 4 - Introduction to Fortran - Part 4
Lecture 5 - Introduction to Fortran - Part 5
Lecture 6 - Numerical Integration - Part 1
Lecture 7 - Numerical Integration - Part 2
Lecture 8 - Numerical Integration - Part 3
Lecture 9 - Numerical Integration - Part 4
Lecture 10 - Numerical Integration - Part 5
Lecture 11 - Numerical Integration - Part 6
Lecture 12 - Numerical Integration - Part 7
Lecture 13 - Numerical Integration - Part 8
Lecture 14 - Numerical Integration - Part 9
Lecture 15 - Numerical Integration - Part 10
Lecture 16 - Monte Carlo Simulation Introduction - Part 1
Lecture 17 - Monte Carlo Simulation Introduction - Part 2
Lecture 18 - Implementing the Ising model on computer
Lecture 19 - Periodic Boundary conditions and the Metropolis scheme
Lecture 20 - Testing the simulation and relaxation to equilibrium, finte size effects
Lecture 21 - Monte Carlo Simulation Analysis - Part 1
Lecture 22 - Monte Carlo Simulation Analysis - Part 2
Lecture 23 - Monte Carlo Simulation Analysis
Lecture 24 - Monte Carlo Simulation Analysis
Lecture 25 - Calculating T_c using Binders cumulant; Principle of detailed balance
Lecture 26 - Differential Equations Euler and Runge Kutta - Part 1
Lecture 27 - Differential Equations Euler and Runge Kutta - Part 2
Lecture 28 - Differential Coupled Equation Non Linear Equation - Part 1
Lecture 29 - Differential Coupled Equation Non Linear Equation - Part 2

Lecture 30 - Coupled Differential Equation Visualisation and Making Movie
Lecture 31 - Differential Equations With Specified Boundary Conditions - Part 1
Lecture 32 - Differential Equations With Specified Boundary Conditions - Part 2
Lecture 33 - Partial Differential equations - 1
Lecture 34 - Partial Differential equations - 2
Lecture 35 - Partial Differential equations - 3
Lecture 36 - Differential Equation for Quantum Mechanical Problems
Lecture 37 - Differential Equation for Quantum Mechanical Problems
Lecture 38 - Differential Equation for Quantum Mechanical Problems
Lecture 39 - Differential Equation for Quantum Mechanical Problems
Lecture 40 - Differential Equation for Quantum Mechanical Problems
Lecture 41 - Differential Equation for Quantum Mechanical Problems
Lecture 42 - Differential Equation for Quantum Mechanical Problems
Lecture 43 - Differential Equation for Quantum Mechanical Problems
Lecture 44 - Differential Equation for Quantum Mechanical Problems
Lecture 45 - Differential Equation for Quantum Mechanical Problems
Lecture 46 - Molecular Dynamics Introduction - Part 1
Lecture 47 - Molecular Dynamics Introduction - Part 2
Lecture 48 - Molecular Dynamics Details and Algorithm - Part 1
Lecture 49 - Molecular Dynamics Details and Algorithm - Part 2
Lecture 50 - Molecular Dynamics Details and Algorithm - Part 3
Lecture 51 - Molecular Dynamics Analysis - Part 1
Lecture 52 - Molecular Dynamics Analysis - Part 2
Lecture 53 - Molecular Dynamics Neighbours Lists - Part 1
Lecture 54 - Molecular Dynamics Neighbours Lists - Part 2
Lecture 55 - Molecular Dynamics
Lecture 56 - Molecular Dynamics Diffusion Constant Calculation - Part 1
Lecture 57 - Molecular Dynamics Diffusion Constant Calculation - Part 2
Lecture 58 - Molecular Dynamics Diffusion Constant Calculation - Part 3

NPTEL Video Course - Physics - NOC:Waves and Oscillations

Subject Co-ordinator - Prof. M. S. Santhanam

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Simple Harmonic Motion
Lecture 2 - Superposition of Oscillations
Lecture 3 - Superposition of Oscillations
Lecture 4 - Superposition of Oscillations
Lecture 5 - Simple Harmonic Motion
Lecture 6 - Damped oscillator - Part 1
Lecture 7 - Damped oscillator - Part 2
Lecture 8 - Damped oscillator and Q-factor
Lecture 9 - Damped oscillator
Lecture 10 - Forced oscillator - Part 1
Lecture 11 - Forced oscillator - Part 2
Lecture 12 - Resonances
Lecture 13 - Q-factor of forced oscillator
Lecture 14 - Applications of forced oscillator
Lecture 15 - Forced Oscillator
Lecture 16 - Coupled Oscillations - Part 1
Lecture 17 - Coupled Oscillations - Part 2
Lecture 18 - Solving for normal modes
Lecture 19 - Coupled oscillations - More examples
Lecture 20 - Coupled oscillator
Lecture 21 - Coupled Oscillations of Loaded String
Lecture 22 - Solutions for Loaded String
Lecture 23 - Oscillations of Loaded String
Lecture 24 - Continuum Limit of Loaded String
Lecture 25 - Wave equation and its solutions
Lecture 26 - Wave equation - impedance and velocities
Lecture 27 - Standing waves
Lecture 28 - Transverse waves in periodic structures
Lecture 29 - Wave equation

Lecture 30 - Reflection and transmission of waves
Lecture 31 - Impedance matching
Lecture 32 - Energy of vibrating string
Lecture 33 - Dispersion of waves
Lecture 34 - Bandwidth theorem and problems
Lecture 35 - Longitudnal Waves and Speed of Sound
Lecture 36 - Longitudnal Standing Waves
Lecture 37 - Sound Intensity
Lecture 38 - Longitudnal Waves
Lecture 39 - Fourier Series - Part 1
Lecture 40 - Fourier Series - Part 2
Lecture 41 - Fourier Series and Energy of Vibrating String
Lecture 42 - Frequency Spectrum and Fourier Transforms
Lecture 43 - Fourier Series
Lecture 44 - Waves in Optical Systems
Lecture 45 - Waves in Optical Systems
Lecture 46 - Waves in Optical Systems
Lecture 47 - Waves in Optical Systems
Lecture 48 - Waves in Optical Systems
Lecture 49 - Interference
Lecture 50 - Interference
Lecture 51 - Michelson and Fabry-Perot Interferometers
Lecture 52 - Young's Double Slit Experiment
Lecture 53 - Diffraction
Lecture 54 - Beyond Linear Oscillators
Lecture 55 - Beyond Linear Oscillators
Lecture 56 - Beyond Linear Oscillators
Lecture 57 - Beyond Linear Waves
Lecture 58 - Waves in Quantum Mechanics and Summary

NPTEL Video Course - Physics - NOC:Physics through Computational Thinking

Subject Co-ordinator - Prof. Auditya Sharma, Prof. Ambar Jain

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Mathematica, Wolfram language and Wolfram Cloud
Lecture 2 - Technical Prelim 1
Lecture 3 - Plotting Simple Functions
Lecture 4 - Function Behaviour near Extrema
Lecture 5 - Radicals and Logarithms
Lecture 6 - Properties of Functions
Lecture 7 - Vector Fields, Vector and Streamline Plots and Contour Plots
Lecture 8 - Introduction to Non-dimesionalisation
Lecture 9 - Non-dimensionalization and visual thinking
Lecture 10 - Non-dimensionalisation and Parametric Plot
Lecture 11 - Technical Prelim 2
Lecture 12 - Introduction to Simple Harmonic Oscillator
Lecture 13 - Simple Harmonic Oscillator with a spring mass system
Lecture 14 - More Examples of Simple Harmonic Oscillator
Lecture 15 - Anharmonic Oscillator
Lecture 16 - Introduction to Data Analysis - 1
Lecture 17 - Introduction to Data Analysis - 2
Lecture 18 - Curve fitting
Lecture 19 - Linear superposition of oscillations
Lecture 20 - Technical Prelim 3
Lecture 21 - Damped Harminic Oscillator
Lecture 22 - Solving Initial Value Problem with Mathemtica
Lecture 23 - Damped Harmonic Oscillator
Lecture 24 - Technical Prelim 4
Lecture 25 - Introduction to Euler's Method for Solving Differential Equation
Lecture 26 - Technical Prelim 5
Lecture 27 - Writing Euler's Method as a custom function
Lecture 28 - Mean Global Error in Euler's method and Application of Euler's method to damped oscillator
Lecture 29 - Improved Euler (RK2) and RK4 Methods for solving ODEs

Lecture 30 - Driven oscillations
Lecture 31 - Driven oscillations using the Improved Euler method
Lecture 32 - Falling Bodies
Lecture 33 - Escape velocity
Lecture 34 - Driven oscillations
Lecture 35 - Linear systems
Lecture 36 - Linear systems
Lecture 37 - Linearization - 1
Lecture 38 - Linearization - 2
Lecture 39 - The Monte Carlo Method - 1
Lecture 40 - The Monte Carlo Method - 2
Lecture 41 - The Monte Carlo Method - 3
Lecture 42 - The Monte Carlo Method - 4
Lecture 43 - The Monte Carlo Method - 5
Lecture 44 - Random Walks - 1
Lecture 45 - Random Walks - 2
Lecture 46 - Random Walks - 3
Lecture 47 - Random Walks - 4
Lecture 48 - Random Walks - 5
Lecture 49 - Random Walks - 6
Lecture 50 - Random Walks - 7

NPTEL Video Course - Physics - NOC:Electromagnetism

Subject Co-ordinator - Prof. Nirmal Ganguli

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Vector algebra
Lecture 2 - Vector algebra in component form
Lecture 3 - Vector triple products
Lecture 4 - Vector differential calculus
Lecture 5 - Divergence
Lecture 6 - Curl
Lecture 7 - Tutorial on differential vector calculus
Lecture 8 - More problems on vector differential calculus
Lecture 9 - Vector integral calculus
Lecture 10 - Surface integral
Lecture 11 - Volume integral
Lecture 12 - Fundamental theorems of vector calculus
Lecture 13 - The divergence theorem (Gauss's theorem)
Lecture 14 - The curl theorem (Stokes' theorem)
Lecture 15 - Curvilinear coordinates
Lecture 16 - Generic curvilinear coordinate systems
Lecture 17 - Differential vector calculus in curvilinear coordinate systems
Lecture 18 - Special curvilinear coordinate systems
Lecture 19 - Vector calculus in spherical coordinate system
Lecture 20 - Vector calculus in cylindrical coordinate system
Lecture 21 - Introduction to Dirac delta function
Lecture 22 - Tutorial on vector calculus and curvilinear coordinates
Lecture 23 - Introduction to electrostatics
Lecture 24 - Continuous charge distribution
Lecture 25 - Electric field due to a line charge distribution
Lecture 26 - Electric field lines, Flux, Gauss law
Lecture 27 - Application of Gauss law with cylindrical symmetry
Lecture 28 - Application of Gauss law on a flat 2D surface
Lecture 29 - Tutorial on Dirac delta function and electrostatics

Lecture 30 - Tutorial on electrostatics
Lecture 31 - The curl of an electric field
Lecture 32 - Scalar potential
Lecture 33 - Calculation of electric potential from different approaches
Lecture 34 - Boundary conditions on electric field and potential
Lecture 35 - Work and energy of an assembly of point charges
Lecture 36 - General idea of energy in electrostatics
Lecture 37 - Electrostatics with conductors
Lecture 38 - Capacitors
Lecture 39 - Laplace equation
Lecture 40 - Boundary conditions and the uniqueness theorems
Lecture 41 - The method of images
Lecture 42 - Induced charge
Lecture 43 - Force and energy
Lecture 44 - Another example of the method of images
Lecture 45 - Electric dipoles
Lecture 46 - Multipole expansion, continuous charge distriution, and assembly of point charges
Lecture 47 - Electric field due to a dipole
Lecture 48 - Introduction to electric polarization in matter
Lecture 49 - Electric polarization and bound charges
Lecture 50 - Electric displacement vector and Gauss law
Lecture 51 - Boundary conditions on the displacement vector and linear dielectric materials
Lecture 52 - Parallel plate capacitors
Lecture 53 - Energy in dielectric materials
Lecture 54 - Force on dielectric materials
Lecture 55 - Motion of a charged particle in electromagnetic field
Lecture 56 - Work done by a magnetic field
Lecture 57 - Electric current
Lecture 58 - Surface and volume current
Lecture 59 - Biot Savart law
Lecture 60 - Biot Savart law with surface and volume currents
Lecture 61 - A tutorial on currents and magnetic field
Lecture 62 - Straight line current
Lecture 63 - Divergence and curl of a generic magnetic field
Lecture 64 - Ampere's law in integral form and its applications
Lecture 65 - Magnetic field in a long solenoid
Lecture 66 - A comparison between electrostatics nad magnetostatics
Lecture 67 - Magnetic vector potential
Lecture 68 - Tutorial on magnetic fields

Lecture 69 - Calculation of vector potential
Lecture 70 - Boundary conditions on magnetic field
Lecture 71 - Magnetic dipole
Lecture 72 - Multipole expansion of the vector potential
Lecture 73 - Magnetism, force and torque on magnetic dipole
Lecture 74 - Fringing magnetic field
Lecture 75 - Magnetization
Lecture 76 - A tutorial on the magnetic dipole moment
Lecture 77 - Ampere's law in magnetized materials
Lecture 78 - Electrodynamics
Lecture 79 - Electromagnetic induction
Lecture 80 - Laws of electromagnetism so far
Lecture 81 - Maxwell's correction to electromagnetism
Lecture 82 - Fictitious discussion about symmetry
Lecture 83 - Maxwell's equations in matter and the boundary conditions

NPTEL Video Course - Physics - NOC:Introduction to Classical Mechanics

Subject Co-ordinator - Prof. Anurag Tripathi

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction. Symmetries of space and time
Lecture 2 - Generalized coordinates and degrees of freedom
Lecture 3 - Virtual Work
Lecture 4 - Virtual Work (rigid body)
Lecture 5 - d'Alembert Principle
Lecture 6 - Euler Lagrange Equation for a holonomic system
Lecture 7 - Euler Lagrange Equations. Examples
Lecture 8 - Euler Lagrange Equations. Examples (Continued...)
Lecture 9 - Properties of Lagrangian
Lecture 10 - Kinetic term in generalized coordinates
Lecture 11 - Cyclic coordinates
Lecture 12 - Conservation laws - Conservation of Energy
Lecture 13 - Energy Function, Jacobi's Integral
Lecture 14 - Momemtum conservation
Lecture 15 - Matrices and all that
Lecture 16 - Matrices, Forms, and all that
Lecture 17 - Principal axis transformation
Lecture 18 - Small Oscilaltions
Lecture 19 - Oscillations, Normal Coordinates
Lecture 20 - Oscillations, Triatomic molecule
Lecture 21 - Triatomic molecule normal coordinates
Lecture 22 - Coupled pendulums, normal modes
Lecture 23 - Coupled pendulums, Beats
Lecture 24 - Oscillations, General solution
Lecture 25 - Forced oscillations
Lecture 26 - Damped oscillations
Lecture 27 - Forced Damped oscillations
Lecture 28 - one dimensional systems
Lecture 29 - Two-body problem

Lecture 30 - Two-body problem, Kepler's second law
Lecture 31 - Two-body problem, Kepler problem
Lecture 32 - Two-body problem, Conic Sections in Polar Coordinates
Lecture 33 - Two-body problem, Ellipse in polar coordinates
Lecture 34 - Orbits in Kepler Problem
Lecture 35 - Apsidal distances, eccentricity of orbits
Lecture 36 - Kepler's Third law; Laplace-Runge-Lenz vector
Lecture 37 - Rigid Body, degrees of freedom
Lecture 38 - Rigid Body, Transfromation matrix
Lecture 39 - Rigid Body, Euler Angles
Lecture 40 - Parameterization using Euler Angles
Lecture 41 - Rigid Body, Euler's Theorem
Lecture 42 - General motion of a rigid body
Lecture 43 - Moment of Inertia Tensor
Lecture 44 - Principal Moments
Lecture 45 - Langrangian of a rigid body
Lecture 46 - Motion of a free symmetric top
Lecture 47 - Angular velocity using Euler angles
Lecture 48 - Lagrangian of a heavy symmetric top
Lecture 49 - First integrals of a heavy symmetric top
Lecture 50 - Nutation and Precission of a heavy symmetric top
Lecture 51 - Sleeping Top
Lecture 52 - Rotating Frames. Euler Equations
Lecture 53 - Calculus of Variations
Lecture 54 - Method of Lagrange Multipliers
Lecture 55 - Calculus of Variations
Lecture 56 - Calculus of Variations
Lecture 57 - Cartesian Tensors
Lecture 58 - Hamiltonian Mechanics
Lecture 59 - Hamiltonian Mechanics
Lecture 60 - Hamiltonian Mechanics
Lecture 61 - Hamiltonian Mechanics
Lecture 62 - Hamiltonian Mechanics
Lecture 63 - Hamiltonian Mechanics
Lecture 64 - Examples of Generating Functions
Lecture 65 - Harmonic Oscillator (Canonical Transformations)
Lecture 66 - Invariance of Poisson Brackets
Lecture 67 - Normal modes of triatomic molecule using Mathematica

NPTEL Video Course - Physics - NOC:Fluid Dynamics for Astrophysics

Subject Co-ordinator - Prof. Prasad Subramanian

Co-ordinating Institute - IISER - Pune

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the course
Lecture 2 - Continuum hypothesis, distribution function and stress-viscosity relation
Lecture 3 - Continuum hypothesis, distribution function and stress-viscosity relation - Recap
Lecture 4 - Fluid Kinematics
Lecture 5 - Fluid Kinematics - Recap
Lecture 6 - Conservation laws: Mass conservation and incomprehensibility
Lecture 7 - Conservation laws: Momentum conservation and Euler equation
Lecture 8 - Conservation laws - Recap
Lecture 9 - Potential flows
Lecture 10 - Bernoulli constant, its applications and voracity equation
Lecture 11 - Recap - Potential flows, Bernoulli constant and its applications
Lecture 12 - Voracity dynamics -- Kelvin's voracity theorem and Magus effect
Lecture 13 - Navier-Stokes equation
Lecture 14 - Navier-Stokes equation (Continued....) and energy equation
Lecture 15 - Energy equation in a conservative form
Lecture 16 - Boundary conditions in Navier-Stokes equation, d'Alembert's paradox
Lecture 17 - Poiseuille flow, deriving viscosity from microscopics
Lecture 18 - Dimensionless numbers -- Mach number, Reynolds number
Lecture 19 - DimDimensionless numbers (Continued...) -- plasma beta, magnetic Reynolds number, Alfven Mach nu
Lecture 20 - Reynolds number and dynamic similarity
Lecture 21 - Reynolds number recap, Low Re flows, and drag on a sphere (Stokes law)
Lecture 22 - High Re flows -- turbulent drag law, vortex shedding and drag crisis
Lecture 23 - Lift on a body, introduction to compressible flows
Lecture 24 - Compressible flows -- derivation of sound speed and dispersion relation
Lecture 25 - Subsonic and supersonic flows
Lecture 26 - Propagation of sonic information, shock tube problem and piston problem
Lecture 27 - Criterion for neglect of compressibility, method of characteristics
Lecture 28 - Shock thickness
Lecture 29 - Shock thickness recap, shock jump conditions

Lecture 30 - Shock jump conditions (Continued...), transonic 1D flows, converging/diverging channels
Lecture 31 - Coverging/diverging channels, de Laval nozzle and its application to astrophysical jets
Lecture 32 - Spherically symmetric transonic flows
Lecture 33 - Spherically symmetric transonic flows (Continued...)
Lecture 34 - Solar wind : Parker's solution
Lecture 35 - Solar wind : Modifications in Parker's solution
Lecture 36 - Spherical accretion onto a compact object : Eddington luminosity and accretion rate
Lecture 37 - Spherical accretion onto a compact object : Solutions for flow properties
Lecture 38 - Spherical accretion (Continued...), disk accretion--Roche lobe overflow
Lecture 39 - Disk accretion : Mass conservation and vertical hydrostatic equilibrium
Lecture 40 - Disk accretion : Removal of angular momentum, Shakura-Sunyaev viscosity parameter
Lecture 41 - Disk accretion : Viscous dissipation and the energy equation, two-temperature criterion
Lecture 42 - Particle acceleration in astrophysical settings : Shocks and non-thermal energy distribution
Lecture 43 - Particle acceleration in astrophysical settings : Diffusive shock acceleration
Lecture 44 - Spherical blast waves : Bomb explosion and supernova explosion
Lecture 45 - Spherical blast waves : Sedov-Taylor solution
Lecture 46 - Spherical blast waves : Sedov-Taylor solution (Continued....)
Lecture 47 - Magnetohydrodynamics (MHD) : Introduction
Lecture 48 - Magnetohydrodynamics (MHD) : The induction equation
Lecture 49 - Magnetohydrodynamics (MHD) : Currents in MHD, momentum equation and magnetic stress tensor
Lecture 50 - Magnetohydrodynamics (MHD) : Magnetic stresses and magnetic buoyancy
Lecture 51 - Magnetohydrodynamics (MHD) : Plasma beta, force-free fields and potential configurations
Lecture 52 - Magnetohydrodynamics (MHD) : Magnetic flux-freezing
Lecture 53 - Magnetohydrodynamics (MHD) : Magnetic flux-freezing (Continued....), magnetic dynamos
Lecture 54 - Magnetohydrodynamics (MHD) : Dynamo theory
Lecture 55 - Magnetohydrodynamics (MHD) : Waves in MHD - Alfven waves
Lecture 56 - Magnetohydrodynamics (MHD) : Waves in MHD - Alfven waves and magnetosonic waves
Lecture 57 - Magnetohydrodynamics (MHD) : Waves in MHD - Magnetosonic waves
Lecture 58 - Magnetohydrodynamics (MHD) : Shocks in MHD
Lecture 59 - Magnetohydrodynamics (MHD) : Shocks in MHD - Shock jump conditions
Lecture 60 - Non-ideal MHD : Introduction to magnetic reconnection
Lecture 61 - Non-ideal MHD : Magnetic reconnection - The Sweet-Parker model
Lecture 62 - Non-ideal MHD : Magnetic reconnection - The Petscheck model
Lecture 63 - Sun's atmosphere : Solar corona and the coronal heating problem
Lecture 64 - Solar eruptions : Coronal Mass Ejections (CMEs) and solar flares

NPTEL Video Course - Physics - NOC:Quantum Transport

Subject Co-ordinator - Prof. Madhu Thalakulam

Co-ordinating Institute - IISER - Thiruvananthapuram

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Classical and Semi-classical Transport: Overview
Lecture 3 - Quantum Transport Regimes
Lecture 4 - Band-bending and Metal semiconductor Interfaces
Lecture 5 - Semiconductor Heterostructures
Lecture 6 - 2DEG and Electrostatic Gating
Lecture 7 - Device Fabrication - Photolithography
Lecture 8 - Device Fabrication - Electron-beam Lithography
Lecture 9 - Quantum hall Effect - Overview
Lecture 10 - Quantum Hall Effect: Quantization of electron orbitals, Landau levels and Flux quantization
Lecture 11 - Quantum Hall Effect: Lanau level, filling factor and Shubnikov-de-Haas effect
Lecture 12 - Quantum Hall Effect: Edge states and Resistance Quantization
Lecture 13 - Weak Localization
Lecture 14 - Aharonov-Bohm Effect
Lecture 15 - Ballistic 1D transport-Quantum Point contacts
Lecture 16 - Ballistic 1D transport-Current from transmission
Lecture 17 - Ballistic 1D transport-Where is the power dissipation?
Lecture 18 - 0D Transport - Single Electron Tunneling
Lecture 19 - Single Electron Transistors, Coulomb Blockade
Lecture 20 - Quantum Dots, Shell filling, Artificial Atoms
Lecture 21 - Transport on Double Quantum Dots - I
Lecture 22 - Transport on Double Quantum Dots - II
Lecture 23 - Superconductivity-Introduction
Lecture 24 - Superconducting tunnel junctions-Josephson effect - 1
Lecture 25 - Superconducting tunnel junctions-Josephson effect - 2
Lecture 26 - Charge sensing with quantum point contacts
Lecture 27 - Charge sengin with single electron transistors
Lecture 28 - Real-time charge sensing
Lecture 29 - Quantum Electrical Metrology - I

Lecture 30 - Quantum Electrical Metrology - II
Lecture 31 - Qubits - Overview
Lecture 32 - Superconducting qubits
Lecture 33 - Quantum dot qubits

NPTEL Video Course - Physics - NOC:Statistical Mechanics (2021)

Subject Co-ordinator - Prof. Dipanjan Chakraborty

Co-ordinating Institute - IISER - Mohali

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Thermodynamics
Lecture 2 - Laws of Thermodynamics
Lecture 3 - Second Law of Thermodynamics and Heat Engines
Lecture 4 - Entropy, Clausius Inequality, Thermodynamic Processes and Systems
Lecture 5 - Extensivity of Entropy and Internal Energy, Gibbs Duhem relation
Lecture 6 - Exact and Inexact differentials, Legendre Transformation
Lecture 7 - Free Energy in Thermodynamics
Lecture 8 - Maxwell's relations - Part I
Lecture 9 - Maxwell's relations - Part II
Lecture 10 - Maxwell's relations - Part III
Lecture 11 - Response Functions and manipulating Partial Derivatives
Lecture 12 - Working With Thermodynamics
Lecture 13 - Joule Expansion and Joule Thomson Effect
Lecture 14 - Stability of Thermodynamic Potentials
Lecture 15 - Consequences of Stability of Thermodynamic Potentials
Lecture 16 - Conditions of Equilibrium and Gibbs Phase Rule
Lecture 17 - Introduction to Probability
Lecture 18 - Discrete and Continuous Distributions
Lecture 19 - Central Limit Theorem and Statistical Entropy
Lecture 20 - Classical Probability Density and Liouville Equation
Lecture 21 - Classical Probability Density, Ergodicity and Microcanonical Ensemble
Lecture 22 - Microcanonical Ensemble
Lecture 23 - Examples of Microcanonical Ensemble - Two Level System
Lecture 24 - Examples of Microcanonical Ensemble - Magnetic System and Ideal Gas - Part I
Lecture 25 - Examples of Microcanonical Ensemble - Magnetic System and Ideal Gas - Part II
Lecture 26 - Examples of Microcanonical Ensemble - Ultra-Relativistic Gas
Lecture 27 - Microcanonical Ultrarelativistic Gas and Quantum Solid
Lecture 28 - Microcanonical Excluded Volume
Lecture 29 - Canonical Ensemble

Lecture 30 - Canonical Ensemble Paramagnet
Lecture 31 - Canonical Ensemble Ideal Gas
Lecture 32 - Canonical Ensemble Einstein Solid
Lecture 33 - Grand Canonical Ensemble
Lecture 34 - Grand Canonical Ensemble Ideal Gas - Part I
Lecture 35 - Grand Canonical Ensemble Ideal Gas - Part II
Lecture 36 - MicroCanonical to Canonical - Part I
Lecture 37 - MicroCanonical to Canonical - Part II
Lecture 38 - Interacting System - Part I
Lecture 39 - Interacting System - Part II
Lecture 40 - Van-Der Waals Equation of State
Lecture 41 - Quantum Statistical Mechanics Density Matrix
Lecture 42 - Density Matrix in different Ensembles
Lecture 43 - Free Particle Quantum Canonical Partition Function Free
Lecture 44 - Single Particle Quantum Partition Function Harmonic Oscillator - Part I
Lecture 45 - Single Particle Quantum Partition Function Harmonic Oscillator - Part II
Lecture 46 - Wigner Transformation
Lecture 47 - N-Particle partition function
Lecture 48 - Canonical Formulation of Ideal Gas
Lecture 49 - Grand Canonical Formulation of Ideal Gas
Lecture 50 - High Temperature Expansion
Lecture 51 - Degenerate Fermi Gas
Lecture 52 - Ideal Fermi Gas close to T=0, Chemical Potential and Specific Heat
Lecture 53 - Relativistic Fermi Gas at T=0
Lecture 54 - Ideal Bose Gas
Lecture 55 - Bose-Einstein Condensation
Lecture 56 - Pressure of an Ideal Bose Gas
Lecture 57 - Specific Heat of an Ideal Bose Gas - Part 1
Lecture 58 - Specific Heat of an Ideal Bose Gas - Part 2
Lecture 59 - Bose-Einstein Condensation in a Harmonically Trapped Bose Gas
Lecture 60 - Specific Heat of a Harmonically Trapped Bose Gas
Lecture 61 - General Treatment of a Bose gas - Part 1
Lecture 62 - General Treatment of a Bose gas - Part 2
Lecture 63 - Discontinuity in the Specific Heat of a Bose Gas - Part 1
Lecture 64 - Discontinuity in the Specific Heat of a Bose Gas - Part 2
Lecture 65 - Ultra Relativistic Bose Gas Stefan Boltzmann Law

NPTEL Video Course - Physics - NOC:Solid State Physics (2021)

Subject Co-ordinator - Prof. Nirmal Ganguli

Co-ordinating Institute - IISER - Bhopal

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - What is solid?
Lecture 2 - Bravais lattice
Lecture 3 - Indexing of crystal planes
Lecture 4 - Simple crystal structures
Lecture 5 - Diffraction of waves by crystals
Lecture 6 - Fourier analysis of diffraction
Lecture 7 - Diffraction condition
Lecture 8 - Laue equations and Ewald construction
Lecture 9 - Introduction to Brillouin zone
Lecture 10 - Brillouin zones for bcc and fcc lattice
Lecture 11 - Fourier analysis of the basis and structure factor
Lecture 12 - Atomic form factor
Lecture 13 - Van der Waals attraction
Lecture 14 - Repulsive interaction
Lecture 15 - Equilibrium lattice constant and cohesive energy
Lecture 16 - Ionic crystals
Lecture 17 - Evaluation of the Madelungconstant
Lecture 18 - Covalent crystals: Linearcombination of atomic orbitals
Lecture 19 - Electron tunneling in covalentbonds
Lecture 20 - Metallic bonds
Lecture 21 - The Drude theory of metals
Lecture 22 - Hall effect and magnetoresistance
Lecture 23 - AC electrical conductivity
Lecture 24 - Thermal conductivity
Lecture 25 - Introduction to Sommerfeld theory - I
Lecture 26 - Introduction to Sommerfeld theory - II
Lecture 27 - Electronic states at finite temperature
Lecture 28 - Fermi-Dirac distribution
Lecture 29 - Thermal properties of the free electron gas

Lecture 30 - The Sommerfeld theory for conduction in metals
Lecture 31 - Thermal conductivity
Lecture 32 - One dimensional chain of atoms
Lecture 33 - One dimensional chain of atoms
Lecture 34 - Periodic boundary condition
Lecture 35 - Energy levels in periodic array of quantum wells
Lecture 36 - Tunneling of electrons
Lecture 37 - Reflection and transmission amplitudes and coefficients
Lecture 38 - Transfer matrix for a rectangular barrier
Lecture 39 - Electron tunneling through a periodic potential
Lecture 40 - The tight-binding approximation
Lecture 41 - Tridiagonal matrices and continued fraction
Lecture 42 - Plane-wave basis for nearly free electrons
Lecture 43 - Nearly free electron approximation
Lecture 44 - Dynamical aspects of electrons in band theory
Lecture 45 - Semiconductor crystals
Lecture 46 - Effective mass
Lecture 47 - Carrier concentration
Lecture 48 - Mobility, impurity conductivity, and Fermi surface
Lecture 49 - Vibration of crystals with monatomic basis
Lecture 50 - Analyzing the dispersion relation
Lecture 51 - Phonons with diatomic basis
Lecture 52 - Quantization of elastic waves
Lecture 53 - Phonon heat capacity
Lecture 54 - Phonon density of states
Lecture 55 - Introduction to diamagnetism
Lecture 56 - Issues with the classical theory of diamagnetism
Lecture 57 - Quantum theory of diamagnetism
Lecture 58 - The quantum theory of paramagnetism
Lecture 59 - Rare earth atoms, Hund's rule
Lecture 60 - Crystal field splitting
Lecture 61 - Quenching of orbital angular momentum
Lecture 62 - Paramagnetic susceptibility of conduction electrons
Lecture 63 - Ferromagnetism
Lecture 64 - Antiferromagnetism and ferrimagnetism
Lecture 65 - Introduction to superconductivity
Lecture 66 - Thermodynamics of superconducting transition,London equation
Lecture 67 - BCS theory of superconductivity
Lecture 68 - Flux quantization in a superconducting ring

Lecture 69 - Single particle tunneling and Josephson effect
Lecture 70 - AC Josephson effect and microscopic quantum interference

NPTEL Video Course - Physics - NOC:Introduction to Quantum Field Theory (Theory of Scalar Fields)

Subject Co-ordinator - Prof. Anurag Tripathi

Co-ordinating Institute - IIT - Hyderabad

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Quantum Filed Theory
Lecture 2 - Quantizing Schrodinger Field
Lecture 3 - Quantizing Schrodinger Field (Continued...)
Lecture 4 - Symmetry and normalization of the states
Lecture 5 - A multiparticle system of Bosons
Lecture 6 - Klein-Gordon Equation
Lecture 7 - Quantization of Klein-Gordon Theory
Lecture 8 - Quantization of Klein-Gordon Theory (Continued...)
Lecture 9 - Quantization of Klein-Gordon Theory (Continued...)
Lecture 10 - Quantization of Klein-Gordon Theory (Continued...)
Lecture 11 - Quantization of Klein-Gordon Theory (Continued...)
Lecture 12 - Qunatization of Klein-Gordon Theory (Continued...)
Lecture 13 - Quantization of Klein-Gordon Theory (Continued...)
Lecture 14 - Feynman propagator - 2
Lecture 15 - Feynman propagator - 3
Lecture 16 - Symmetries
Lecture 17 - Lorentz transformations
Lecture 18 - Lorentz transformations (Continued...)
Lecture 19 - Lorentz Group
Lecture 20 - Groups and Generators
Lecture 21 - SU(3) Generators
Lecture 22 - Representation of groups. Poincare group
Lecture 23 - Poincare Algebra
Lecture 24 - Symmetries in Classical Field Theories
Lecture 25 - Symmetries (Continued...)
Lecture 26 - Symmetries (Continued...)
Lecture 27 - Symmetries (Continued...)
Lecture 28 - Noether's theorem: The Proof
Lecture 29 - Noether's theorem (Continued...)

Lecture 30 - Momentum in KG Theory
Lecture 31 - Noether Currents corresponding to Lorentz symmetry
Lecture 32 - Conserved currents and charges due to Lorentz symmetry
Lecture 33 - Conserved charges as symmetry generators
Lecture 34 - Consequences of symmetry
Lecture 35 - A boring world: Scattering in a free theory
Lecture 36 - Phi-4 Theory
Lecture 37 - Phi-4 Theory: Manipulating the ground state
Lecture 38 - Phi-4 Theory: Interaction picture - 1
Lecture 39 - Phi-4 Theory: Interaction picture - 2
Lecture 40 - Phi-4 Theory: Interaction picture (Continued...)
Lecture 41 - Phi-4 Theory: Interaction picture (Continued...)
Lecture 42 - Wick's Theorem
Lecture 43 - Wick's Theorem (Continued...)
Lecture 44 - Feynman Diagrams
Lecture 45 - Feynman Diagrams (Continued...)
Lecture 46 - Momentum space Feynman rules for G(x1,..xN)
Lecture 47 - Feynman rules for G(p1,p2,,,,pN)
Lecture 48 - Feynman rules for G(p1,p2,,,,pN) (Continued...)
Lecture 49 - Cancellation of Bubble diagrams
Lecture 50 - Examples of Feynman Diagrams
Lecture 51 - Survery

NPTEL Video Course - Physics - NOC:Introduction to Quantum Field Theory (Theory of Scalar Fields) - Part 2

Subject Co-ordinator - Prof. Anurag Tripathi

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Scattering Matrix
Lecture 2 - Scattering Matrix (Continued...)
Lecture 3 - Scattering Matrix (Continued...)
Lecture 4 - Creating single particle states - 1
Lecture 5 - Creating single particle states - 2
Lecture 6 - Annihilating single particle states
Lecture 7 - Creating Multiparticle States
Lecture 8 - LSZ reduction
Lecture 9 - LSZ reduction (Continued...)
Lecture 10 - S matrix
Lecture 11 - S matrix (Continued...)
Lecture 12 - S matrix (Continued...)
Lecture 13 - Pole and residue of the propagator
Lecture 14 - Kallen-Lehmann spectral representation
Lecture 15 - Kallen-Lehmann spectral representation (Continued...)
Lecture 16 - High Energy Experiment Setup - 1
Lecture 17 - High Energy Experiment Setup - 2
Lecture 18 - Scattering cross-section
Lecture 19 - Differential cross-section
Lecture 20 - 2-2 scattering cross-section
Lecture 21 - Loop diagrams - 1
Lecture 22 - Wick rotated Green's functions
Lecture 23 - UV divergences - Part 1
Lecture 24 - UV divergences - Part 2
Lecture 25 - UV divergences - Part 3
Lecture 26 - Explicit evalutation of Feynman integrals
Lecture 27 - Few more Feynman integrals
Lecture 28 - UV Singularity structure in dimensional regularization
Lecture 29 - Renormalization - Part 1

Lecture 30 - Renormalization - Part 2
Lecture 31 - Renormalization - Part 3
Lecture 32 - Renormalization - Part 4
Lecture 33 - Renormalization - Part 5
Lecture 34 - Renormalization Group Equation - 1
Lecture 35 - Renormalization Group Equation - 2
Lecture 36 - Renormalization Group Equation - 3
Lecture 37 - Solution of Callan Symanzik Equation
Lecture 38 - UV and IR fixed points and Asymptotic Freedom
Lecture 39 - Behaviour near fixed point

NPTEL Video Course - Physics - NOC:Radio Astronomy

Subject Co-ordinator - Prof. Abhirup Datta

Co-ordinating Institute - IIT - Indore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Radio Astronomy
Lecture 2 - Review of Electromagnetism - Part 1
Lecture 3 - Review of Electromagnetism - Part 2
Lecture 4 - Radio Astronomy - Tutorial 1
Lecture 5 - Milestones in Radio Astronomy
Lecture 6 - Radio Astronomy Fundamentals - Part 1
Lecture 7 - Radio Astronomy Fundamentals - Part 2
Lecture 8 - Radiative Transfer - Tutorial 1
Lecture 9 - Fundamentals of Antenna
Lecture 10 - Fundamental of Antenna Theory - Part 1
Lecture 11 - Fundamental of Antenna Theory - Part 2
Lecture 12 - Fundamental of Antenna Theory - Part 3
Lecture 13 - Signal Processing and Receivers
Lecture 14 - Signal Proceeding and Receivers - Part 2
Lecture 15 - Radio Telescopes
Lecture 16 - Single Dish Observations
Lecture 17 - Demonstration of Antenna Design and Simulation - Part 1
Lecture 18 - Demonstration Of Antenna Design and Simulation - Part 2
Lecture 19 - What Have we Learnt so Far? - A Review
Lecture 20 - Demonstration of Antenna Design and Simulation - Part 3
Lecture 21 - Co-ordinate System
Lecture 22 - Radio Interferometers
Lecture 23 - Example Questions
Lecture 24 - Python Crash Course
Lecture 25 - Few Concepts with the help of python as a computational tool
Lecture 26 - Live session
Lecture 27 - Example Questions
Lecture 28 - Radio Interferometry and Aperture Synthesis
Lecture 29 - Introduction to CASA

Lecture 30 - Examples
Lecture 31
Lecture 32
Lecture 33 - Revision
Lecture 34 - Revision

NPTEL Video Course - Physics - NOC:Foundations of Quantum Theory: Non-Relativistic Approach

Subject Co-ordinator - Prof. Sandeep Kumar Goyal, Prof. Kinjalk Lochan

Co-ordinating Institute - IISER - Mohali

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Axiomatic Approach to Quantum Mechanics - Part 1
Lecture 2 - Axiomatic Approach to Quantum Mechanics - Part 2
Lecture 3 - Linear Vector Space
Lecture 4 - Linear Operators - Part 1
Lecture 5 - Linear Operators - Part 2
Lecture 6 - Qubits: Introduction
Lecture 7 - Qubits: State Tomography
Lecture 8 - Qubits: Density Operators - Part 1
Lecture 9 - Qubits: Density Operators - Part 2
Lecture 10 - Qubits: Unitary Transformation
Lecture 11 - Qubits: Bloch Sphere
Lecture 12 - Composite Systems: Pure States, Schmidt Decomposition, Operators Acting on Composite Systems - P
Lecture 13 - Composite Systems: Pure States, Schmidt Decomposition, Operators Acting on Composite Systems - P
Lecture 14 - Composite Systems: Density Operators
Lecture 15 - Quantum Maps: Positive Maps
Lecture 16 - Quantum Maps: Completely Positive Maps - Part 1
Lecture 17 - Quantum Maps: Completely Positive Maps - Part 2
Lecture 18 - Measurements: Introduction
Lecture 19 - Measurements: POVM
Lecture 20 - Measurements: Optical Scheme for POVM
Lecture 21 - Measurements: State Discrimination
Lecture 22 - Measurements: Weak Measurements
Lecture 23 - Entanglement: Introduction
Lecture 24 - Entanglement Measures
Lecture 25 - EPR Paradox and Bohrâ s Argument, Bohmâ s Argument and Merminâ s Argument - Part 1
Lecture 26 - EPR Paradox and Bohrâ s Argument, Bohmâ s Argument and Merminâ s Argument - Part 2
Lecture 27 - Hidden Variable Theory, Bell model, Bell Inequality, Bell CHSH Inequality
Lecture 28 - Open Quantum Systems: Introduction - Part 1
Lecture 29 - Open Quantum Systems: Introduction - Part 2

Lecture 30 - Open Quantum Systems: Introduction - Part 3
Lecture 31 - Open Quantum Systems: Optical Master Equation, Thermalization
Lecture 32 - Open Quantum Systems: Solving Master Equaitons
Lecture 33 - Open Quantum Systems: Quantum Trajectory Aproach
Lecture 34 - Open Quanutm Systems: Decoherence

NPTEL Video Course - Physics - NOC:Foundations of Quantum Theory: Relativistic Approach

Subject Co-ordinator - Prof. Kinjalk Lochan

Co-ordinating Institute - IISER Mohali

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Perturbation theory 1.1
Lecture 2 - Perturbation theory 1.2
Lecture 3 - Perturbation theory 1.3
Lecture 4 - Perturbation theory 1.4
Lecture 5 - Time dependent perturbation theory 1.1
Lecture 6 - Time dependent perturbation theory 1.2
Lecture 7 - Time dependent perturbation theory 1.3
Lecture 8 - Special Relativity 1.1
Lecture 9 - Special Relativity 1.2
Lecture 10 - Special Relativity 1.3
Lecture 11 - Relativistic Quantum Mechanics 1.1
Lecture 12 - Relativistic Quantum Mechanics 1.2
Lecture 13 - Relativistic Quantum Mechanics 1.3
Lecture 14 - Relativistic Quantum Mechanics 1.4
Lecture 15 - Quantum Field Theory 1.1
Lecture 16 - Quantum Field Theory 1.2
Lecture 17 - Quantum Field Theory 1.3
Lecture 18 - Quantum Field Theory 1.4
Lecture 19 - Quantum Field Theory 2.1
Lecture 20 - Quantum Field Theory 2.2
Lecture 21 - Quantum Field Theory 2.3
Lecture 22 - Spinor Field quantization 1.1
Lecture 23 - Spinor Field quantization 1.2
Lecture 24 - Spinor Field quantization 1.3
Lecture 25 - Spinor Field quantization 1.4
Lecture 26 - Electromagnetic Field Quantization 1.1
Lecture 27 - Electromagnetic Field Quantization 1.2
Lecture 28 - Electromagnetic Field Quantization 1.3
Lecture 29 - Quantum Fields expectation

Lecture 30 - Quantum Field Coherent State
Lecture 31 - Thermal Fields 1.1
Lecture 32 - Thermal Fields 1.2
Lecture 33 - Matter-Field interaction 1.1
Lecture 34 - Matter-Field interaction 1.2
Lecture 35 - Matter-Field interaction 1.3
Lecture 36 - Atom-Field Coupling
Lecture 37 - Excitation of atom through field interaction
Lecture 38 - Spontaneous and Stimulated emission
Lecture 39 - Lindblad Master Equation
Lecture 40 - Relativistic corrections in transitions
Lecture 41 - Change in atomic characteriscs via field interaction
Lecture 42 - Shift in eigen energies via field interaction

NPTEL Video Course - Physics - NOC:Introduction to General Relativity

Subject Co-ordinator - Prof. Shubho R. Roy, Prof. Arpan Bhattacharyya

Co-ordinating Institute - IIT Hyderabad and IIT Gandhinagar

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Newton's Gravitation - Part I
Lecture 2 - Newton's Gravitation - Part II
Lecture 3 - Newton's Gravitation - Part III
Lecture 4 - Newton's Gravitation - Part IV
Lecture 5 - Newton's Gravitation - Tutorial 1
Lecture 6 - Newton's Gravitation - Tutorial 2
Lecture 7 - Special Relativity Review
Lecture 8 - Minkowski Spacetime
Lecture 9 - Lorentz Group - Part I
Lecture 10 - Lorentz Group - Part II
Lecture 11 - Topology of Lorentz Group
Lecture 12 - Lorentz Group: Tutorial
Lecture 13 - Relativistic index/component notation
Lecture 14 - Tensor analysis - I
Lecture 15 - Tensor analysis - II
Lecture 16 - Tensor analysis - III
Lecture 17 - Introduction to differential forms
Lecture 18 - Exterior Calculus
Lecture 19 - Differential Forms: Tutorial
Lecture 20 - Free Point Particle - I
Lecture 21 - Free Point Particle - II
Lecture 22 - Point Particle with interactions
Lecture 23 - Tensor Fields
Lecture 24 - Point Particle with interactions: Tutorial
Lecture 25 - Covariant equations for Fluid mechanics - I
Lecture 26 - Covariant equations for Fluid mechanics - II
Lecture 27 - Stress-Energy-Momentum Tensor: Tutorial
Lecture 28 - Electrodynamics in Lorentz covariant form - I
Lecture 29 - Electrodynamics in Lorentz covariant form - II

Lecture 30 - Electrodynamics in Lorentz covariant form: Tutorial
Lecture 31 - Alternative route to Maxwell's equations from Electrostatics - I
Lecture 32 - Alternative route to Maxwell's equations from Electrostatics - II
Lecture 33 - Towards a Lorentz covariant formulation for Newton's gravitation - I
Lecture 34 - Towards a Lorentz covariant formulation for Newton's gravitation - II
Lecture 35 - Consistent coupling of gravity to matter - I
Lecture 36 - Consistent coupling of gravity to matter - II
Lecture 37 - Covariance vs Invariance principles
Lecture 38 - Mathematical Preliminaries-I : Basics of Point-Set Topology - 1
Lecture 39 - Mathematical Preliminaries-I : Basics of Point-Set Topology - 2
Lecture 40 - Mathematical Preliminaries-I : Basics of Differential Geometry - 1
Lecture 41 - Mathematical Preliminaries-I : Basics of Differential Geometry - 2
Lecture 42 - Mathematical Preliminaries-I : Calculus on manifolds - 1
Lecture 43 - Mathematical Preliminaries-I : Calculus on manifolds - 2
Lecture 44 - Mathematical Preliminaries-II : Riemannian manifolds
Lecture 45 - Mathematical Preliminaries-II : Riemannian Geometry
Lecture 46 - Mathematical Preliminaries-II : Riemannian Geometry
Lecture 47 - Mathematical Preliminaries-II : Riemannian Geometry
Lecture 48 - Mathematical Preliminaries-II : Riemannian Geometry
Lecture 49 - Geodesic Deviation and the Riemann Curvature tensor
Lecture 50 - Principle of Minimal Coupling
Lecture 51 - Einstein Field Equations - I
Lecture 52 - Einstein Field Equations - II
Lecture 53 - Weak field limit: Linearized GR
Lecture 54 - Gravitational Waves
Lecture 55 - Gravitational Radiation
Lecture 56 - Schwarzschild Solution - I
Lecture 57 - Schwarzschild Solution - II
Lecture 58 - Schwarzschild Solution - III
Lecture 59 - Timelike geodesics in Schwarzschild geometry
Lecture 60 - Precession of perihelion of planets
Lecture 61 - Lightlike geodesics in Schwarzschild geometry
Lecture 62 - Gravitational Deflection and Retardation of light
Lecture 63 - Cosmology-I : Kinematics - Part 1
Lecture 64 - Cosmology-I : Kinematics - Part 2
Lecture 65 - Cosmology-II : Dynamics - Part 1
Lecture 66 - Cosmology-II : Dynamics - Part 2
Lecture 67 - Cosmology-II : Dynamics - Part 3
Lecture 68 - Cosmology-II : Dynamics - Part 4

NPTEL Video Course - Physics - NOC:Fiber Optics

Subject Co-ordinator - Prof. Vipul Rastogi

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Need for Optical Communication
Lecture 3 - Salient Features of Optical Fiber - I
Lecture 4 - Salient Features of Optical Fiber - II
Lecture 5 - Optical Fiber Fabrication
Lecture 6 - Transmission Characteristics - I
Lecture 7 - Transmission Characteristics - II
Lecture 8 - Transmission Characteristics - III
Lecture 9 - Propagation in Infinitely Extended Dielectric
Lecture 10 - EM Waves in Dielectrics
Lecture 11 - Electromagnetic Analysis of Waveguides - I
Lecture 12 - Electromagnetic Analysis of Waveguides - II
Lecture 13 - Electromagnetic Analysis of Waveguides - III
Lecture 14 - Electromagnetic Analysis of Waveguides - IV
Lecture 15 - Electromagnetic Analysis of Waveguides - V
Lecture 16 - Electromagnetic Analysis of Waveguides - VI
Lecture 17 - Electromagnetic Analysis of Waveguides - VII
Lecture 18 - Electromagnetic Analysis of Waveguides - VIII
Lecture 19 - Optical Fiber Waveguide - I
Lecture 20 - Optical Fiber Waveguide - II
Lecture 21 - Optical Fiber Waveguide - III
Lecture 22 - Optical Fiber Waveguide - IV
Lecture 23 - Optical Fiber Waveguide - V
Lecture 24 - Splice Loss
Lecture 25 - Waveguide Dispersion - I
Lecture 26 - Waveguide Dispersion - II
Lecture 27 - Recap
Lecture 28 - Optical Fiber Components and Devices - I
Lecture 29 - Optical Fiber Components and Devices - II

Lecture 30 - Optical Fiber Components and Devices - III
Lecture 31 - Optical Fiber Components and Devices - IV
Lecture 32 - Optical Fiber Components and Devices - V
Lecture 33 - Optical Sources and Detectors - I
Lecture 34 - Optical Sources and Detectors - II
Lecture 35 - Optical Sources and Detectors - III
Lecture 36 - Optical Sources and Detectors - IV
Lecture 37 - Optical Sources and Detectors - V
Lecture 38 - System Design Aspects
Lecture 39 - Optical Fiber Measurements
Lecture 40 - Summary and Recent Advances

NPTEL Video Course - Physics - NOC:Solar Photovoltaics Fundamentals, Technology and Applications

Subject Co-ordinator - Prof. Soumitra SataPathi

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Energy and its Sources
Lecture 2 - Introduction to Solar Energy
Lecture 3 - Introduction of Quantum Mechanics in Solar Photovoltaics - I
Lecture 4 - Introduction of Quantum Mechanics in Solar Photovoltaics - II
Lecture 5 - Introduction of Quantum Mechanics in Solar Photovoltaics - III
Lecture 6 - Band Theory
Lecture 7 - Energy Band Diagram
Lecture 8 - Charge Carrier Dynamics in Semiconductor
Lecture 9 - P-N junction model and Diode working principle
Lecture 10 - Current-Voltage Characteristics of Solar Cell
Lecture 11 - Equivalent Circuits of Solar Cells, Fill Factor
Lecture 12 - Fabrication Process of Semiconductor Grade Silicon
Lecture 13 - Fabrication Process of Single crystalline Silicon
Lecture 14 - Thin Film deposition Techniques
Lecture 15 - Thin Film Solar Cells
Lecture 16 - Photo Physics of Dye Sensitized Solar Cells
Lecture 17 - Fabrication of Dye Sensitized Solar Cells
Lecture 18 - Design of Novel dyes
Lecture 19 - Design of Electrolytes
Lecture 20 - Quantum Dot Solar Cells
Lecture 21 - Fabrication of Organic Solar Cells
Lecture 22 - Physics of Bulk Hetero Junction (BHJ) Solar Cells
Lecture 23 - Photo Physics of Organic Solar Cells
Lecture 24 - Morphology Optimization of Organic Solar Cells
Lecture 25 - Perovskite Solar Cells
Lecture 26 - Fabrication of Perovskite Solar Cells
Lecture 27 - Photo Physics of Perovskite Solar Cells
Lecture 28 - Stability in Perovskite Solar Cells
Lecture 29 - Morphology Optimization of Perovskite Solar Cells

Lecture 30 - Perovskite Single Crystal Solar Cells
Lecture 31 - Photophysics in Perovskite Single Crystal Solar Cells
Lecture 32 - Applicationss of Perovskite Single Crystal Solar Cells
Lecture 33 - Organic Nano Particles Based Solar Cells
Lecture 34 - Morphology Optimization in Organic Nanoparticle Based Solar Cells
Lecture 35 - Multijunction Tandem Solar Cells
Lecture 36 - Introduction to Characterization Techniques
Lecture 37 - Vacuum Technology in Solar Photovoltaics
Lecture 38 - Introduction of Pressure Gauges
Lecture 39 - Electron Microscopy in Solar Photovoltaics
Lecture 40 - Impedance Spectroscopy

NPTEL Video Course - Physics - NOC:Introduction to Atmospheric and Space Sciences

Subject Co-ordinator - Prof. M V Sunil Krishna

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - An Introduction to the Earth's Atmosphere and Source of Energy - The Sun
Lecture 2 - Primary Source of Energy on the Earth - The Sun
Lecture 3 - Evolution of the Earth's Atmosphere
Lecture 4 - Earth's Second Atmosphere and Rise of Oxygen
Lecture 5 - Atmosphere of Other Planets in Solar System
Lecture 6 - Structure of Earth's Atmosphere
Lecture 7 - Vertical Structure of Atmosphere
Lecture 8 - Characterization of Atmosphere Based on Electrical Properties
Lecture 9 - Coupling of Solar Radiation with the Earth's Atmosphere
Lecture 10 - Forces and Their Classifications
Lecture 11 - Forces - Gravitational Force
Lecture 12 - Forces - Viscous Force
Lecture 13 - Forces - Coriolis Force
Lecture 14 - Coriolis Force and Curvature Effect
Lecture 15 - Hydrostatic Equation
Lecture 16 - Hypsometric Equation
Lecture 17 - Atmospheric Thermodynamics
Lecture 18 - Thermodynamics - Dry Air
Lecture 19 - Thermodynamics - Moist Air
Lecture 20 - Geopotential and Scale Height
Lecture 21 - Specific Heats
Lecture 22 - Air Parcel and Potential Temperature
Lecture 23 - Moisture Parameters
Lecture 24 - Saturation Mixing Ratio and Relative Humidity
Lecture 25 - Pseudo-Adiabatic Processes
Lecture 26 - Convection of Air
Lecture 27 - Atmospheric Stability and Cloud Formation
Lecture 28 - Cloud Formation
Lecture 29 - Cloud Formation and Lifting

Lecture 30 - Cloud Morphology
Lecture 31 - Secondary Cloud Classification and Fog
Lecture 32 - Atmospheric Stability
Lecture 33 - Atmospheric Stability Conditions
Lecture 34 - Stable Unstable and Neutral Atmosphere
Lecture 35 - Cloud Seeding and Precipitation
Lecture 36 - Measuring Precipitation
Lecture 37 - Droplet Growth and Curvature Effect
Lecture 38 - Droplet Growth and Solute Effect
Lecture 39 - Radial Growth of Droplets by Diffusion
Lecture 40 - Radial Growth of Droplets by Diffusion (Continued...)
Lecture 41 - Ionospheric Layers and Photochemistry
Lecture 42 - Ionization Processes
Lecture 43 - Ionospheric Chemical Reactions and Layers
Lecture 44 - Chapman's Theory of Layer Production
Lecture 45 - Chapman's Theory of Layer Production (Continued...)
Lecture 46 - Chapman's Alpha Layer
Lecture 47 - Hydrogen in Ionosphere
Lecture 48 - Debye's Shielding
Lecture 49 - Debye's Shielding and Debye's Potential
Lecture 50 - Debye's Potential (Continued...)
Lecture 51 - Particle Motion in Uniform Electric Field
Lecture 52 - Particle Motion in Uniform Magnetic Field
Lecture 53 - Particle Motion in Uniform Magnetic Field and Guiding Center
Lecture 54 - Particle Motion in Uniform Electric and Magnetic Fields
Lecture 55 - Gradient Magnetic Field
Lecture 56 - Gradient Drift and Curvature Drift
Lecture 57 - Vacuum Drift and Planetary Ring Current
Lecture 58 - Magnetic Mirroring
Lecture 59 - Magnetic Mirroring and Loss Cone
Lecture 60 - Airglow and Aurora

NPTEL Video Course - Physics - NOC:Optical Sensors

Subject Co-ordinator - Prof. Sachin Kumar Srivastava

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Sensor Fabrication and Characterization
Lecture 3 - Basic Optics for Optical Sensing - I
Lecture 4 - Basic Optics for Optical Sensing - II
Lecture 5 - Basic Optics for Optical Sensing - III
Lecture 6 - Basic Optics for Optical Sensing - IV
Lecture 7 - Basic Optics for Optical Sensing - V
Lecture 8 - Basic Optics for Optical Sensing - VI
Lecture 9 - Basic Optics for Optical Sensing - VII
Lecture 10 - Plasmons - I
Lecture 11 - Plasmons - II
Lecture 12 - Plasmons - III
Lecture 13 - Plasmons - IV
Lecture 14 - Plasmons - V
Lecture 15 - Plasmons - VI
Lecture 16 - Multiple Optical Sensors of Different Mechanisms
Lecture 17 - Interference based Sensors
Lecture 18 - Interference, Diffraction and Optical Fiber Sensors
Lecture 19 - Review of Biomaterial Optics
Lecture 20 - Terahertz Based Detection and Circular Dichroism

NPTEL Video Course - Physics - NOC:Advanced Atmospheric Physics

Subject Co-ordinator - Prof. M V Sunil Krishna

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Atmospheric Forces and Dynamics - Part 1
Lecture 2 - Atmospheric Forces and Dynamics - Part 2
Lecture 3 - Total Derivative (Introduction)
Lecture 4 - Total Derivative of a Vector in a Rotating Frame of Reference
Lecture 5 - Momentum Equations and its Vectorial Form in Spherical Polar Coordinates - Part 1
Lecture 6 - Momentum Equations and its Vectorial Form in Spherical Polar Coordinates - Part 2
Lecture 7 - Momentum Equations and its Vectorial Form in Spherical Polar Coordinates - Part 3
Lecture 8 - Total Derivative and Lagrangian
Lecture 9 - Continuity Equation: Eulerian
Lecture 10 - Energy Equations - Part 1
Lecture 11 - Energy Equations - Part 2
Lecture 12 - Scaling analysis - Part 1
Lecture 13 - Scaling analysis - Part 2
Lecture 14 - Scaling Analysis of Governing Equations - Part 1
Lecture 15 - Scaling Analysis of Governing Equations - Part 2
Lecture 16 - Scaling Analysis - Part 3, A Tutorial
Lecture 17 - Scaling Analysis - Part 4, A Tutorial
Lecture 18 - Introduction of Atmospheric Waves - Part 1
Lecture 19 - Introduction of Atmospheric Waves - Part 2
Lecture 20 - Problems based on Total Derivative - Part 1
Lecture 21 - Problems based on Total Derivative - Part 2
Lecture 22 - Shallow Water Gravity Waves - Part 1
Lecture 23 - Shallow Water Gravity Waves - Part 2
Lecture 24 - Acoustic Waves
Lecture 25 - Internal Gravity Waves - Part 1
Lecture 26 - Internal Gravity Waves - Part 2
Lecture 27 - Internal Gravity Waves - Part 3
Lecture 28 - Pressure as a vertical coordinate - Part 1
Lecture 29 - Pressure as a vertical coordinate - Part 2

Lecture 30 - Pressure as a vertical coordinate - Part 3
Lecture 31 - General circulation and global winds
Lecture 32 - Introduction to different types of Fronts
Lecture 33 - Geostrophic winds
Lecture 34 - Natural coordinate and Inertial flows
Lecture 35 - Cyclostrophic winds and Rossby number
Lecture 36 - Gradient winds
Lecture 37 - Thermal winds
Lecture 38 - Problems on thermal winds
Lecture 39 - Ionosphere introduction (Basics)- Part 1
Lecture 40 - Ionosphere introduction (Different layers) - Part 2
Lecture 41 - Ionosphere introduction (Photochemistry) - Part 3
Lecture 42 - Ionosphere introduction (Recombination) - Part 4
Lecture 43 - Composite F layer - Part 1
Lecture 44 - Composite F layer - Part 2
Lecture 45 - Composite F layer H/He ions - Part 3
Lecture 46 - The Sun - Earth Energetics and Aurora
Lecture 47 - Airglows and Aurora
Lecture 48 - Sun's magnetic field, Formation of Aurora, and Solar cycle
Lecture 49 - Sun's internal structure, Prominences
Lecture 50 - Solar wind - Magnetosphere interactions
Lecture 51 - Solar wind interactions with different planets
Lecture 52 - Solar wind properties and its interaction with different planets
Lecture 53 - Static Model of Corona
Lecture 54 - Parker's Theory of Solar Wind Acceleration - Part 1
Lecture 55 - Parker's Theory of Solar Wind Acceleration - Part 2
Lecture 56 - Parker's Theory of Solar Wind Acceleration - Part 3
Lecture 57 - Parker's Theory of Solar Wind Acceleration - Part 4
Lecture 58 - Introduction to Space Weather - Part 1
Lecture 59 - Introduction to Space Weather - Part 2
Lecture 60 - Introduction to Space Weather - Part 3

NPTEL Video Course - Physics - NOC:Nuclear Astrophysics

Subject Co-ordinator - Prof. Anil Kumar Gourishetty

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Historical Background, Observational Astronomy, Properties of Sun and of Stars
Lecture 2 - Properties of Galaxies and Universe
Lecture 3 - Background of elemental abundance curve
Lecture 4 - Evidences of Nucleosynthesis - I
Lecture 5 - Evidences of Nucleosynthesis - II
Lecture 6 - Evidences of Nucleosynthesis - III and Mass gaps
Lecture 7 - H-R Diagram
Lecture 8 - M-L relation, Hubbleâ s Law and Echo of Big Bang
Lecture 9 - Thermonuclear reactions and Reaction cross-section
Lecture 10 - Reaction rate
Lecture 11 - Reaction rate and Neutron induced reactions
Lecture 12 - Gamma induced reactions and Inverse reactions
Lecture 13 - Inverse reactions
Lecture 14 - Inverse reactions and Mean life time of a nuclei
Lecture 15 - Mean life time of a nuclei and Time dependent abundance evolution
Lecture 16 - Non-resonant charged particle induced reactions
Lecture 17 - Astrophysical S-factor and Non-resonant charged particle induced reactions
Lecture 18 - Gamow peak and Electron screening effect
Lecture 19 - Resonant reactions
Lecture 20 - Resonant reactions
Lecture 21 - Neutron induced non-resonant reactions
Lecture 22 - Burning stages of stars and Hydrogen burning
Lecture 23 - pp chain
Lecture 24 - pp chain and CN cycle
Lecture 25 - CNO cycle, Shell model and Gamma decay
Lecture 26 - Formation of 12C
Lecture 27 - Survival of 12C
Lecture 28 - Carbon, Neon, Oxygen and Silicon burning
Lecture 29 - Nucleosynthesis beyond Iron

Lecture 30 - s-, r- and p-process
Lecture 31 - Charged particle and Neutron beams
Lecture 32 - Accelerators and Targets
Lecture 33 - Backing materials and Target preparation
Lecture 34 - Contaminants and Radiation sources
Lecture 35 - Detectors - I
Lecture 36 - Detectors - II
Lecture 37 - Activity method
Lecture 38 - Kinematics - I
Lecture 39 - Kinematics - II
Lecture 40 - Time of flight method and Indirect methods

NPTEL Video Course - Physics - NOC:Applied Optics

Subject Co-ordinator - Prof. Akhilesh Kumar Mishra

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Overview
Lecture 2 - Introduction to Geometrical Optics
Lecture 3 - Ray Theory, Fermat's Principle
Lecture 4 - Refraction from Single Interface
Lecture 5 - Refraction from double interface
Lecture 6 - Matrix method in paraxial optics - I
Lecture 7 - Matrix Method in Paraxial Optics - II
Lecture 8 - Thick and Thin Lenses, Unit Planes
Lecture 9 - Nodal Planes, System of Thin Lenses
Lecture 10 - Problems on Geometrical Optics
Lecture 11 - Concept of Wavefront, Huygens Principle - I
Lecture 12 - Concept of Wavefront, Huygens Principle - II
Lecture 13 - Superposition of Waves
Lecture 14 - Introduction to Polarization, Linear and Circular Polarization
Lecture 15 - Elliptical Polarization
Lecture 16 - Interference of Light Waves, Interference of Polarized Light - I
Lecture 17 - Interference of Light Waves, Interference of Polarized Light - II
Lecture 18 - Young's Double Slit Experiment - I
Lecture 19 - Young's Double Slit Experiment - II
Lecture 20 - Interference with White Light, Displacement of Fringes, Fresnel's Biprism
Lecture 21 - Interference by Division of Amplitude
Lecture 22 - Thin Parallel Films, Wedge Shaped Films
Lecture 23 - Newton's Rings
Lecture 24 - Michelson Interferometer and Its Applications - I
Lecture 25 - Michelson Interferometer and Its Applications - II
Lecture 26 - Multiple Beam Interference
Lecture 27 - Fabry-Perot Interferometer and Etalon - I
Lecture 28 - Fabry-Perot Interferometer and Etalon - II
Lecture 29 - Concept of Coherence - I

Lecture 30 - Concept of Coherence - II
Lecture 31 - Introduction to Diffraction
Lecture 32 - Fraunhofer Diffraction
Lecture 33 - Single Slit Diffraction
Lecture 34 - Double Slit Diffraction
Lecture 35 - Multiple Slit Diffraction
Lecture 36 - Diffraction at a Rectangular Aperture
Lecture 37 - Diffraction at a Circular Aperture
Lecture 38 - Diffraction Grating
Lecture 39 - Grating Spectrum and Resolving Power
Lecture 40 - Fresnel Diffraction
Lecture 41 - Fresnel Half Period Zones
Lecture 42 - Vibration Curve
Lecture 43 - Circular Obstacle, Zone Plates
Lecture 44 - Rectangular Aperture
Lecture 45 - Diffraction of a Plane Wave by a Long Narrow Slit
Lecture 46 - Brewster's Law, Malus' Law
Lecture 47 - Phenomenon of Double Refraction
Lecture 48 - Normal and Oblique Incidence
Lecture 49 - Production of Polarized Light
Lecture 50 - Quarter and Half Wave Plates
Lecture 51 - Analysis of Polarized Light and Optical Activity
Lecture 52 - Plane Wave Propagation in Anisotropic Media - I
Lecture 53 - Plane Wave Propagation in Anisotropic Media - II
Lecture 54 - Antireflecting Coating
Lecture 55 - Basic Concepts of Holography - I
Lecture 56 - Basic Concepts of Holography - II
Lecture 57 - Basic Concepts and Ray Optics Consideration of Optical Fiber
Lecture 58 - Introduction to Lasers - I
Lecture 59 - Introduction to Lasers - II
Lecture 60 - Trifle

NPTEL Video Course - Physics - NOC:Newtonian Mechanics With Examples

Subject Co-ordinator - Prof. Shiladitya Sengupta

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Scalars vectors, and tensors - basic definitions
Lecture 2 - Scalars, vectors and tensors - most general definition
Lecture 3 - Elementary vector algebra - I (unit vector, dot product)
Lecture 4 - Elementary vector algebra - II (cross product, triple product)
Lecture 5 - Review of Newtonâ s laws of motion - tools for analysis
Lecture 6 - Newtonâ s laws of motion - third and second law
Lecture 7 - Newtonâ s laws of motion - first law
Lecture 8 - Solving mechanics problems - how to draw free body diagram correctly
Lecture 9 - Mechanical equilibrium (statics) using force and torque balance
Lecture 10 - Mechanical equilibrium (statics) using force and torque balance - more examples
Lecture 11 - Mechanical equilibrium of rope like structures, nature of tension force
Lecture 12 - Massless, flexible suspension cable in mechanical equilibrium
Lecture 13 - Massive flexible suspension cable in mechanical equilibrium
Lecture 14 - Mechanical equilibrium of truss (framework) - nature of internal forces
Lecture 15 - Mechanical equilibrium of truss (framework) - examples
Lecture 16 - Mechanical equilibrium of truss - uniqueness of solution, beam with distributed load
Lecture 17 - Mechanical equilibrium of truss - more on beam with distributed load
Lecture 18 - Mechanical equilibrium - more examples, principle of virtual work, constrained motion
Lecture 19 - Mechanical equilibrium: constraints, degrees of freedom, work done by constrained force
Lecture 20 - d'Alembert - Lagrange principle of virtual work - statement and examples
Lecture 21 - Equivalence of principles of force, torque balance and virtual work, stability analysis
Lecture 22 - Mechanical equilibrium: stability analysis, energy diagram technique
Lecture 23 - Friction between solids - Amonton-Coulomb laws, common misconceptions
Lecture 24 - Friction between solids - worked out examples
Lecture 25 - Friction between solid and fluid - drag force
Lecture 26 - Friction examples - projectile motion with drag force, tying a rope
Lecture 27 - Work-energy theorem in one dimension, importance of conservation laws
Lecture 28 - Work-energy theorem in higher dimensions, conservative forces
Lecture 29 - Momentum balance principle, critical review: projectile motion in real-life

Lecture 30 - Projectile motion - effect of lift and thrust force by examples
Lecture 31 - More on rocket motion - comparing effect of thrust in deep space and at lift off
Lecture 32 - Collisions in daily life - application of energy and momentum balance principles
Lecture 33 - Collision at micro-meter, atomic and sub-atomic scales - Brownian motion, Compton effect
Lecture 34 - Concepts necessary for translation and rotation of rigid bodies - centre of mass
Lecture 35 - Centre of mass of composite objects
Lecture 36 - Concepts necessary for translation and rotation of rigid bodies - moment of inertia
Lecture 37 - More on moment of inertia - 3D objects, composite objects, engineering applications
Lecture 38 - Symmetry of mass distribution - product of inertia
Lecture 39 - Determining the principal axes of rotation and moment of inertia about them
Lecture 40 - Example of finding principal axes, introduction to rotation, the angular velocity vector
Lecture 41 - Rotation of rigid bodies - the angular momentum vector
Lecture 42 - Rotation of rigid bodies - torque
Lecture 43 - Translation and rotation of rigid bodies - computing rules
Lecture 44 - Translation and rotation of rigid bodies - examples (rolling, collision with rotation)

NPTEL Video Course - Physics - NOC:Plasma Physics and Applications

Subject Co-ordinator - Prof. M.V. Sunil Krishna

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Plasma - I
Lecture 2 - Introduction to Plasma - II
Lecture 3 - Plasma Oscillations
Lecture 4 - Debye Shielding
Lecture 5 - Debye Potential - I
Lecture 6 - Debye Potential - II
Lecture 7 - Debye Length and Plasma Criteria
Lecture 8 - More Aspects of Debye Shielding
Lecture 9 - Numerical Problems on Debye Shielding - I
Lecture 10 - Plasma as a Gas and Distribution of Velocities
Lecture 11 - Numerical Problems on Debye Shielding - II
Lecture 12 - Single-Particle Motion in Uniform Electric Field
Lecture 13 - Single-Particle Motion in Uniform Magnetic Field - I
Lecture 14 - Single-Particle Motion in Uniform Magnetic Field - II
Lecture 15 - Single-Particle Motion in Uniform Magnetic Field - III
Lecture 16 - Single-Particle Motion Under Uniform Magnetic field - IV
Lecture 17 - Motion in Perpendicular Electric and Magnetic fields - I
Lecture 18 - Motion in Perpendicular Electric and Magnetic fields - II
Lecture 19 - Gradient Drift
Lecture 20 - Gradient and Curvature Drifts
Lecture 21 - Vacuum Drift
Lecture 22 - Numerical Problems on Drifts
Lecture 23 - Magnetic Mirroring - I
Lecture 24 - Magnetic Mirroring - II
Lecture 25 - Magnetic Mirroring - III
Lecture 26 - Magnetic Mirroring - IV
Lecture 27 - Motion in Time Varying Magnetic Field - I
Lecture 28 - Motion in Time Varying Magnetic Field - II
Lecture 29 - Motion in Time Varying Electric field - I

Lecture 30 - Motion in Time Varying Electric field - II
Lecture 31 - Plasma as a Fluid: Equation of Continuity
Lecture 32 - Plasma as a Fluid: Fluid Equation - I
Lecture 33 - Plasma as a Fluid: Fluid Equation - II
Lecture 34 - Plasma as a fluid: Governing Equations
Lecture 35 - MHD Approximation - I
Lecture 36 - MHD Approximation - II
Lecture 37 - Plasma as a fluid: Electric and Magnetic Properties - I
Lecture 38 - Plasma as a fluid: Electric and Magnetic Properties - II
Lecture 39 - Plasma as a fluid: Fluid Drift - I
Lecture 40 - Plasma as a fluid: Fluid Drift - II
Lecture 41 - Magnetic Pressure
Lecture 42 - Wave in Plasma: Perturbation Theory
Lecture 43 - Wave in Plasma: Plasma Oscillation
Lecture 44 - Wave in Plasma: Dispersion Relation
Lecture 45 - Ion Acoustic Wave - I
Lecture 46 - Ion Acoustic Wave - II
Lecture 47 - Ion Acoustic Wave - III
Lecture 48 - Invalidity of Plasma Approximation - I
Lecture 49 - Invalidity of Plasma Approximation - II
Lecture 50 - Electromagnetic Waves in Plasma
Lecture 51 - Collisions and Diffusion in Plasma - I
Lecture 52 - Collisions and Diffusion in Plasma - II
Lecture 53 - Ambipolar Diffusion - I
Lecture 54 - Ambipolar Diffusion - II
Lecture 55 - Diffusion Equation
Lecture 56 - Diffusion in Presence of B - I
Lecture 57 - Diffusion in Presence of B - II
Lecture 58 - Instabilities in Plasma
Lecture 59 - Laser Produced Plasma and Pulsed Laser Deposited (PLD) Thin Film - I
Lecture 60 - Laser Produced Plasma and Pulsed Laser Deposited (PLD) Thin Film - II
Lecture 61 - Surface Modification of Metallic Components by Plasma Nitriding - I
Lecture 62 - Surface Modification of Metallic Components by Plasma Nitriding - II

NPTEL Video Course - Physics - Relativistic Quantum Mechanics

Subject Co-ordinator - Prof. Apoorva D Patel

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, The Klein-Gordon equation
Lecture 2 - Particles and antiparticles, Two component framework
Lecture 3 - Coupling to electromagnetism, Solution of the Coulomb problem
Lecture 4 - Bohr-Sommerfeld semiclassical solution of the Coulomb problem, The Dirac equation and the Cliffor
Lecture 5 - Dirac matrices, Covariant form of the Dirac equation, Equations of motion, Spin, Free particle so
Lecture 6 - Electromagnetic interactions, Gyromagnetic ratio
Lecture 7 - The Hydrogen atom problem, Symmetries, Parity, Separation of variables
Lecture 8 - The Frobenius method solution, Energy levels and wavefunctions
Lecture 9 - Non-relativistic reduction, The Foldy-Wouthuysen transformation
Lecture 10 - Interpretation of relativistic corrections, Reflection from a potential barrier
Lecture 11 - The Klein paradox, Pair creation process and examples
Lecture 12 - Zitterbewegung, Hole theory and antiparticles
Lecture 13 - Charge conjugation symmetry, Chirality, Projection operators, The Weyl equation
Lecture 14 - Weyl and Majorana representations of the Dirac equation, Unitary and antiunitary symmetries
Lecture 15 - Time reversal symmetry, The PCT invariance
Lecture 16 - Arrow of time and particle-antiparticle asymmetry, Band theory for graphene
Lecture 17 - Dirac equation structure of low energy graphene states, Relativistic signatures in graphene prop
Lecture 18 - Groups and symmetries, The Lorentz and Poincare groups
Lecture 19 - Group representations, generators and algebra, Translations, rotations and boosts
Lecture 20 - The spinor representation of SL(2,C), The spin-statistics theorem
Lecture 21 - Finite dimensional representations of the Lorentz group, Euclidean and Galilean groups
Lecture 22 - Classification of one particle states, The little group, Mass, spin and helicity
Lecture 23 - Massive and massless one particle states
Lecture 24 - P and T transformations, Lorentz covariance of spinors
Lecture 25 - Lorentz group classification of Dirac operators, Orthogonality and completeness of Dirac spinors
Lecture 26 - Propagator theory, Non-relativistic case and causality
Lecture 27 - Relativistic case, Particle and antiparticle contributions, Feynman prescription and the propaga
Lecture 28 - Interactions and formal perturbative theory, The S-matrix and Feynman diagrams
Lecture 29 - Trace theorems for products of Dirac matrices

Lecture 30 - Photons and the gauge symmetry
Lecture 31 - Abelian local gauge symmetry, The covariant derivative and invariants
Lecture 32 - Charge quantisation, Photon propagator, Current conservation and polarisations
Lecture 33 - Feynman rules for Quantum Electrodynamics, Nature of perturbative expansion
Lecture 34 - Dyson's analysis of the perturbation series, Singularities of the S-matrix, Elementary QED proce
Lecture 35 - The T-matrix, Coulomb scattering
Lecture 36 - Mott cross-section, Compton scattering
Lecture 37 - Klein-Nishina result for cross-section
Lecture 38 - Photon polarisation sums, Pair production through annihilation
Lecture 39 - Unpolarised and polarised cross-sections
Lecture 40 - Helicity properties, Bound state formation
Lecture 41 - Bound state decay, Non-relativistic potentials
Lecture 42 - Lagrangian formulation of QED, Divergences in Green's functions, Superficially divergent 1-loop
Lecture 43 - Infrared divergences due to massless particles, Renormalisation and finite physical results
Lecture 44 - Symmetry constraints on Green's functions, Furry's theorem, Ward-Takahashi identity, Spontaneous
Lecture 45 - Status of QED, Organisation of perturbative expansion, Precision tests

NPTEL Video Course - Physics - NOC:Control System Design

Subject Co-ordinator - Prof. G R Jayanth

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Linear Systems
Lecture 3 - Homogeneous linear time invariant ordinary differential equations
Lecture 4 - In-homogeneous linear time invariant ordinary differential equations
Lecture 5 - Fourier transforms - Part 1
Lecture 6 - Fourier transforms - Part 2
Lecture 7 - Laplace transforms - Part 1
Lecture 8 - Laplace transforms - Part 2
Lecture 9 - Introduction to feedback control - Part 1
Lecture 10 - Introduction to feedback control - Part 2
Lecture 11 - Nyquist stability theory - Part 1
Lecture 12 - Nyquist stability theory - Part 2
Lecture 13 - Nyquist stability theory - Part 3
Lecture 14 - Bode plots
Lecture 15 - Steps for performing control design - Part 1
Lecture 16 - Steps for performing control design - Part 2
Lecture 17 - General controllers - Part 1
Lecture 18 - General controllers - Part 2
Lecture 19 - General controllers - Part 3
Lecture 20 - Bode plot-based control design - Part 1
Lecture 21 - Bode plot-based control design - Part 2
Lecture 22 - Introduction to root-locus
Lecture 23 - Control system design using root-locus
Lecture 24 - Control of systems with some known parameters - Part 1
Lecture 25 - Control of systems with some known parameters - Part 2
Lecture 26 - Limitations of 1-degree of freedom control
Lecture 27 - Introduction to 2-degree of freedom control
Lecture 28 - 2-Degree of freedom robust control design for plants with gain uncertainty - Part 1
Lecture 29 - 2-Degree of freedom robust control design for plants with uncertain gain - Part 2

Lecture 30 - 2-Degree of freedom robust control design for plants with uncertain pole
Lecture 31 - 2-Degree of freedom robust control design for plants with multiple uncertainties in their struct
Lecture 32 - Issues connected with 2-Degree of freedom control design using root-locus
Lecture 33 - Introduction to Nichols plot
Lecture 34 - Feedback control design using Nichols plot
Lecture 35 - Robust control design using Quantitative feedback theory - Part 1
Lecture 36 - Robust control design using Quantitative feedback theory - Part 2
Lecture 37 - Tutorial on QFT Toolbox software - Part 1
Lecture 38 - Tutorial on QFT Toolbox software - Part 2
Lecture 39 - Tutorial on QFT Toolbox software - Part 3
Lecture 40 - Fundamental properties of the loop gain - Part 1
Lecture 41 - Fundamental properties of the loop gain - Part 2
Lecture 42 - Ideal Bode Characteristic - Part 1
Lecture 43 - Ideal Bode Characteristic - Part 2
Lecture 44 - Introduction to nonminimum phase systems
Lecture 45 - Fundamental properties of nonminimum phase systems - Part 1
Lecture 46 - Fundamental properties of nonminimum phase systems - Part 2
Lecture 47 - Fundamental properties of unstable systems
Lecture 48 - Consequences of actuator bandwidth limitations while controlling unstable systems
Lecture 49 - Describing functions - Part 1
Lecture 50 - Describing functions - Part 2

NPTEL Video Course - Physics - NOC:Bonds and Bands in Solids

Subject Co-ordinator - S. Ramashesha

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Born-Oppenheimer approximation
Lecture 2 - Self-consistent field (SCF) method
Lecture 3 - Simple MO Theory of Hydrogen Molecule
Lecture 4 - Blochâ s theorem
Lecture 5 - Tight binding approximation
Lecture 6 - Energy band theory - 1
Lecture 7 - Energy band theory - 2
Lecture 8 - Density of states
Lecture 9 - Energy band theory - 3
Lecture 10 - Energy band theory - 4
Lecture 11 - Drudeâ s classical free electron model - 1
Lecture 12 - Drudeâ s classical free electron model - 2
Lecture 13 - Drudeâ s classical free electron model - 3
Lecture 14 - Drudeâ s classical free electron model - 4
Lecture 15 - Sommerfeldâ s quantum free electron model
Lecture 16 - Specific heat of Fermi gas
Lecture 17 - Energy dispersion relation in a periodic potential - 1
Lecture 18 - Energy dispersion relation in a periodic potential - 2
Lecture 19 - Brief overview of space groups and constant energy surface in 2D
Lecture 20 - Energy band and effective mass
Lecture 21 - Effective mass
Lecture 22 - kâ p perturbation method
Lecture 23 - Revisiting Blochâ s theorem and tight binding functions
Lecture 24 - Symmetries in crystal Hamiltonian - 1
Lecture 25 - Symmetries in crystal Hamiltonian - 2
Lecture 26 - Tight binding method - 1
Lecture 27 - Tight binding method - 2
Lecture 28 - Tight binding method - 3
Lecture 29 - Plane wave method

Lecture 30 - Pseudo potential method
Lecture 31 - Cellular method of energy band calculation
Lecture 32 - Muffin tin potential and APW functions
Lecture 33 - Augmented plane wave method of energy band calculation - 1
Lecture 34 - Augmented plane wave method of energy band calculation - 2
Lecture 35 - Greenâ s function method of energy band calculation - 1
Lecture 36 - Greenâ s function method of energy band calculation - 2
Lecture 37 - Cyclotron resonance technique
Lecture 38 - De Haas-van Alphen effect
Lecture 39 - De Haas-van Alphen effect conclusion.Introduction to point impurity effect on band structure
Lecture 40 - Point impurity in crystal
Lecture 41 - Friedel Oscillations
Lecture 42 - Lindhard dielectric constant
Lecture 43 - Dielectric anomaly. Crystal momentum
Lecture 44 - Spatial and time reversal symmetries in crystals
Lecture 45 - Time reversal symmetry (Continued...)
Lecture 46 - Spin orbit interaction
Lecture 47 - Disordered solids and transport in disordered solids
Lecture 48 - Optical properties of semiconductors
Lecture 49 - Excitonic states in semiconductors
Lecture 50 - Excitonic states in semiconductors (Continued...)
Lecture 51 - Molecular orbital calculation - I
Lecture 52 - Mott-Hubbard transition
Lecture 53 - Hubbard model
Lecture 54 - Electron repulsion and magnetic exchange
Lecture 55 - Beyond on-site electron repulsions;Pariser-Parr-Pople model
Lecture 56 - Electron-hole symmetry and Pairing theorem. Solitons
Lecture 57 - Density waves in 1-d systems and Lattice vibrations - I
Lecture 58 - Lattice vibrations - II
Lecture 59 - Lattice vibrations - III
Lecture 60 - Lattice vibrations - IV

NPTEL Video Course - Physics - NOC:Advanced NMR Techniques in Solution and Solid-State

Subject Co-ordinator - Prof. N. Suryaprakash

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to NMR
Lecture 2 - NMR concepts and spin physics - I
Lecture 3 - NMR concepts and spin physics - II
Lecture 4 - Internal interaction parameters and chemical shifts
Lecture 5 - Chemical shifts
Lecture 6 - Scalar couplings
Lecture 7 - Multiplicity patterns of coupled spins and analysis of 1H NMR spectrum
Lecture 8 - Multiplicity pattern and analysis of NMR spectra - II
Lecture 9 - Analysis of NMR spectra and their analysis
Lecture 10 - Heteronuclear NMR
Lecture 11 - Introduction to Fourier series
Lecture 12 - Complex form of Fourier series
Lecture 13 - Fourier theorems
Lecture 14 - Fourier transformation in NMR
Lecture 15 - Pople notation, construction of spin Hamiltonian
Lecture 16 - Quantum mechanical analysis of AX spectra
Lecture 17 - Quantum mechanical analysis of AB spin system
Lecture 18 - Quantum mechanical analysis of coupled spin systems
Lecture 19 - RF pulses and their phases
Lecture 20 - Receiver phase and phase cycling
Lecture 21 - Evolution of chemical shift
Lecture 22 - Evolution of J couplings: polarization transfer
Lecture 23 - selective saturation in homo and heteronuclear spin systems, coupled anddecoupled INEPT
Lecture 24 - INEPT and DEPT
Lecture 25 - Coherence transfer pathway
Lecture 26 - Examples of coherence pathway selection
Lecture 27 - Pulse field gradients - I
Lecture 28 - Pulse field gradients - II
Lecture 29 - Selective excitation, selective inversion

Lecture 30 - Relaxation phenomenon
Lecture 31 - T1 relaxation concepts and measurements
Lecture 32 - Spectral density function and relaxation mechanisms
Lecture 33 - T1 Relaxation mechanisms
Lecture 34 - T1 Relaxation mechanisms and T2 relaxation
Lecture 35 - Measurement of T1 and T2
Lecture 36 - Decoupling and NOE concepts
Lecture 37 - DQ and ZQ relaxation pathways
Lecture 38 - Positive and Negative NOE and spectral density functions
Lecture 39 - NOE and correlation time
Lecture 40 - Product operators
Lecture 41 - Product operator analysis
Lecture 42 - Productor operator analysis of pulse sequences
Lecture 43 - Product operators for two J coupled spins
Lecture 44 - Spin echo sequences
Lecture 45 - Introduction to 2D NMR
Lecture 46 - 2D NMR concepts, 2D experiments
Lecture 47 - 2D COSY experiment
Lecture 48 - 2D COSY and its variants
Lecture 49 - TOCSY Heteronuclear 2D experiments
Lecture 50 - coupled and decoupled HSQC, HMBC, INADEQUATE, 2D Jresolved
Lecture 51 - Introduction to multiple quantum NMR
Lecture 52 - DQ and ZQ of coupled spins
Lecture 53 - MQ and relative signs of couplings
Lecture 54 - MQ and spin system filtering
Lecture 55 - Introduction to solid state NMR
Lecture 56 - CSA and dipolar couplings
Lecture 57 - Magic Angle Spinning
Lecture 58 - WAHUHA and Cross Polarization
Lecture 59 - Cross Polarization
Lecture 60 - CP at high speeds, Side band suppression, TOSS

NPTEL Video Course - Physics - NOC:Particle Physics and the Standard Model

Subject Co-ordinator - Prof. Nirmal Raj

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the course
Lecture 2 - Field content and symmetries
Lecture 3 - Stability of particles vs symmetry
Lecture 4 - Parity
Lecture 5 - Parity violation
Lecture 6 - Charge conjugation
Lecture 7 - CP and CPT symmetries
Lecture 8 - CP violation in weak forces
Lecture 9 - CP violation and time reversal
Lecture 10 - Special lecture: Feynman diagrams
Lecture 11 - More Feynman diagrams
Lecture 12 - Spin and statistics
Lecture 13 - Spinors: Round 1
Lecture 14 - Introduction to group theory
Lecture 15 - Isospin
Lecture 16 - Consequences of isospin
Lecture 17 - Continuous groups
Lecture 18 - Introduction to quantum field theory
Lecture 19 - Action principle
Lecture 20 - Spin-0 fields: zero-point energy
Lecture 21 - Cosmological constant problem
Lecture 22 - Spin-1 fields
Lecture 23 - Proca Lagrangian
Lecture 24 - Maxwell Lagrangian
Lecture 25 - Spin-1/2 fields: Dirac Lagrangian
Lecture 26 - Lorentz group
Lecture 27 - Spinors: Round 2
Lecture 28 - Gauge invariance and QED
Lecture 29 - Non-abelian gauges

Lecture 30 - Asymptotic freedom
Lecture 31 - Standard Model field content
Lecture 32 - The Higgs field
Lecture 33 - Breaking symmetry: Round 1
Lecture 34 - Breaking symmetry: Round 2
Lecture 35 - Goldstoneâ s theorem
Lecture 36 - Higgs mechanism
Lecture 37 - CKM matrix
Lecture 38 - CKM parameterisation
Lecture 39 - Weak CP violation
Lecture 40 - FCNCs and PMNS matrix
Lecture 41 - Unitarity triangles
Lecture 42 - Neutrino oscillations
Lecture 43 - Oscillation length
Lecture 44 - Atmospheric neutrinos
Lecture 45 - Solar neutrinos and matter effects
Lecture 46 - Neutrino mass ordering
Lecture 47 - Neutrino experiments
Lecture 48 - Particle collider configurations
Lecture 49 - Cross section
Lecture 50 - Deriving 2-to-2 cross section
Lecture 51 - Centre-of-momentum frame cross section
Lecture 52 - Particle decay
Lecture 53 - Proton decay
Lecture 54 - Dimensionality of time and particle decay
Lecture 55 - Scattering without QFT
Lecture 56 - Forward-backward asymmetry
Lecture 57 - Deep inelastic scattering
Lecture 58 - Quark parton model, summary of course

NPTEL Video Course - Physics - NOC:Quantum Mechanics in the Relativistic Regime

Subject Co-ordinator - Prof. Sudhir Kumar Vempati

Co-ordinating Institute - IISc Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Recap of NRQM
Lecture 2 - Finite Step Potential: Schrodinger equation solution
Lecture 3 - Properties of wavefunction
Lecture 4 - Matrix Mechanics
Lecture 5 - Basics of STR
Lecture 6 - Natural Units
Lecture 7 - Relativistic effects in Quantum Mechanics
Lecture 8 - Building Relativistic Wave Theories
Lecture 9 - Solutions to the KG equation
Lecture 10 - Introduction to Relativistic Lagrangian
Lecture 11 - Scalar Quantum Electrodynamics (SQED)
Lecture 12 - Non-Relativistic Limit of the KG Equation: The Schrodinger Equation
Lecture 13 - Revisiting KG Equation's Negative Energy Solutions
Lecture 14 - Klein Paradox
Lecture 15 - Scalar Quantum Electrodynamics (SQED)
Lecture 16 - Dirac Theory
Lecture 17 - Dirac Equation and its solution
Lecture 18 - Dirac Spinors
Lecture 19 - Properties of Spinor
Lecture 20 - Group Theory
Lecture 21 - Rotation Groups and their Properties
Lecture 22 - Lie Group and Lorentz Boost
Lecture 23 - Group Representations - I
Lecture 24 - Group Representations - II
Lecture 25 - Symmetry and Isomorphism
Lecture 26 - Lorentz Group - I
Lecture 27 - Lorentz Group - II
Lecture 28 - Decomposition of Lorentz Group
Lecture 29 - Boost and Rotation Generators

Lecture 30 - Poincare Group
Lecture 31 - Representations of Poincare group
Lecture 32 - Solution of Dirac equation
Lecture 33 - Properties of Dirac Spinors and Probability Currents
Lecture 34 - Parity Violation and Axial Currents
Lecture 35 - Dirac interpretation for Negative Energy states
Lecture 36 - Dirac Hole Theory
Lecture 37 - Properties and Interpretations of Anti-Particle
Lecture 38 - Solutions of Massless Dirac Equation
Lecture 39 - Real Solutions of Dirac Equation
Lecture 40 - Properties of Majorana Fermions - I
Lecture 41 - Properties of Majorana Fermions - II
Lecture 42 - Examples of Majorana Fermions in different systems
Lecture 43 - Propagator Theory - I
Lecture 44 - Propagator Theory - II
Lecture 45 - Greenâ s Functions as Propagators
Lecture 46 - Solving for Greenâ s function
Lecture 47 - Photon Propagator
Lecture 48 - KG Propagator and its Properties
Lecture 49 - Scattering in SQED
Lecture 50 - Pion-Pion Scattering Channels
Lecture 51 - Pion-Pion Matrix Amplitude
Lecture 52 - Dirac Propagator and its Properties
Lecture 53 - Dyson equation and series
Lecture 54 - QED (Compton Scattering)
Lecture 55 - Dynamical Photon field processes
Lecture 56 - Employing trace theorems to calculate matrix element
Lecture 57 - Tree level QED processes
Lecture 58 - Pion mediated Processes
Lecture 59 - Loops and Renormalization
Lecture 60 - Bound states in RQM
Lecture 61 - Non-relativistic reduction of Dirac equation
Lecture 62 - Relativistic Corrections to H atom