

✓
B.Sc. (Physics Hons)

Thermal Physics II

January

Zeroth, Ist, IInd and IIIrd Law of Thermodynamics
Reversible and Irreversible process, Carnot thm,
Thermodynamic Temp, Clausius inequality.

Feb.

Entropy, T-S diagram, Test,
Increase of entropy and Applications

March

Unit II Thermodynamic Potentials and their
Applications, Magnetic work and cooling
by adiabatic demagnetization, Test

Approach to Absolute zero.

change of phase, Clausius-Clapeyron eq.

Phase diagram and triple point

Second order phase transitions

April, Numericals and Test -

Signature

Dr. Sanjeev Kumar

B.Sc Physics (Hons) Sem II
Phy 202 - Mechanics II

January

Unit I
Laws of Gravitation, Inertial and Gravitational mass, Potential Energy and field due to Spherical shell and solid sphere.
Self Energy, Motion of particle under central force
Angular Momentum Conservation: one body, two body problem.

Feb -

Energy Equation and Energy diagram Kepler's law and satellites, Non

Unit 2, Inertial and Non inertial Frame, G.T,
March

Centrifugal and Coriolis force, Michelson Morley Expt, Postulates of Special theory of relativity, L.T and Consequences, Mass Energy equivalence.

April

Relativistic Doppler Effect and kinematics.
Transformation of Energy and Momentum.

~~Anir~~

Dr. Sanjeev Kumar

Unit - I

Magnetic force between current elements and properties of magnetic field; curl and divergence of \vec{B} , vector potential, Magnetic flux; Test

Feb

Calculation of B for circular and solenoid currents
Torque on current loop magnetic dipole and force on moving isolated charge,

March

Def. of B , H , Magnetic susceptibility, BH curve and energy loss. Test

Unit-2 A conducting rod moving in uniform M.F.

Stationary loop with moving field source; Faraday Law: ~~$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$~~ $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$, Mutual induction

Reciprocity Thm. ($M_{12} = M_{21}$), Test

April

Self induction, Energy stored in M.F. Test.

~~There~~

Dr Sanjeev Kumar

Teacher: Anuj

Course: B.Sc. Non-medical Sem: 1

Subject: Paper II- PHY 102 : ELECTRICITY AND MAGNETISM

Session: 2023-24

Month	Lesson Plan
August	Mathematical Background : Scalars and Vectors, dot and cross product, Triple vector product, Scalar and Vector fields, Differentiation of a vector, Gradient of a scalar and its physical significance, Integration of a vector (line, surface and volume integral and their physical significance), Gauss's divergence theorem and Stocks theorem. Test and Assignment
September	Electrostatic Field : Derivation of field E from potential as gradient, derivation of Laplace and Poisson equations. Elecotric flux, Gauss's Law and its application to spherical shell, uniformly charged infinite plane and uniformity charged straight wire, mechanical force of charged surface, Energy per unit volume Test and Assignment
October	Magnetostatics : Magnetic Induction, magetic flux, solenoidal nature of Vector field of induction. Properties of B (i) $\nabla \cdot \mathbf{B} = 0$ (ii) $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$. Electronic theory of dia and para magnetism (Langevin's theory). Domain theory of ferromagnetism. Cycle of Magnetisation - Hysteresis (Energy dissipation, Hysteresis loss and importance of Hysteresis curve). Test and Assignment
November	Electromagnetic Theory : Maxwell equation and their derivations, Displacement Current. Vector and scalar potentials, boundary conditions at interface between two different media, Propagation of electromagnetic wave (Basic idea, no derivation). Poynting vector and Poynting theorem. Test and Assignment

Teacher: Anuj

Course: B.Sc. Non-medical Sem: 2

Subject: Paper II- PHY 202 : ELECTRO MAGNETIC INDUCTION AND ELECTRONIC DEVICES

Session: 2023-24

Month	Lesson Plan
January	<p>Electromagnetic Induction : Growth and decay of current in a circuit with (a) Capacitance and resistance (b) resistance and inductance (c) Capacitance and inductance (d) Capacitance resistance and inductance. AC circuit analysis using complex variables with (a) capacitance and resistance, (b) resistance and inductance (c) capacitance and inductance (d) capacitance, inductance and resistance Series and parallel resonant circuit. Quality factor (Sharpness of resonance).</p> <p>Test and Assignment</p>
February	<p>Semiconductor Diodes : Energy bands in solids. Intrinsic and extrinsic semiconductor, Hall effect, P-N junction diode and their V-I characteristics. Zener and avalanche breakdown. Resistance of a diode, Light Emitting diodes (LED). Photo conduction in semiconductors, photodiode, Solar Cell. Diode Rectifiers : P-N junction half wave and full wave rectifier. Types of filter circuits (L and - with theory). Zener diode as voltage regulator, simple regulated power supply</p> <p>Test and Assignment</p>
March	<p>Transistors : Junction Transistors, Bipolar transistors, working of NPN and PNP transistors, Transistor connections (C-B, C-E, C-C mode), constants of transistor. Transistor characteristic curves (excluding h parameter analysis), advantage of C-B configuration. C.R. O. (Principle, construction and working in detail). Transistor Amplifiers : Transistor biasing, methods of Transistor biasing and stabilization. D.C. load line. Common-base and common-emitter transistor biasing. Common-base, commonemitter amplifiers. Classification of amplifiers.</p> <p>Test and Assignment</p>

April	Resistance-capacitance (R-C) coupled amplifier (two stage; concept of band width, no derivation). Feed-back in amplifiers, advantage of negative feedback Emitter follower. Oscillators : Oscillators, Principle of Oscillation, Classification of Oscillator. Condition for self sustained oscillation : Barkhausen Criterion for oscillations. Tuned collector common emitter oscillator. Hartley oscillator. Colpitt's oscillator. Test and Assignment
-------	---

Teacher: Anuj
 Course: B.Sc. (H) Sem: 1
 Subject: Phy 101 Mathematical Physics-I
 Session: 2023-24

Month	Lesson Plan
August	Review of vector algebra- addition, subtraction and product of two vectors. Polar and axial vectors and their examples from physics. Triple and quadruple product (without frenet-Serret formulae). Test and Assignment
September	Scalar and vector fields, differentiation of a vector w.r.t. a scalar . Unit tangent vector and unit normal vector (without Frenet- Serret formulae). Directional derivatives, gradient, divergence, curl and Laplacian operations and their meaning. Idea of line, surface and volume integrals. Gauss, Stokes and Green's theorems Test and Assignment
October	Orthogonal curvilinear coordinates, Derivation of gradient, divergence, curl and Laplacian in Cartesian, spherical and cylindrical coordinate systems. Change of variables and Jacobian. Evaluation of line surface and volume integrals. Test and Assignment
November	Constrained maxima and minima. Method of Lagrange undetermined multipliers and its application to simple problems in physics. Variational principle Euler-Lagrange equation and its application to simple theorem. Test and Assignment

Teacher: Anuj
 Course: B.Sc. (H) Sem: 2
 Subject: Paper II- PHY 201 : Mathematical Physics-II
 Session: 2023-24

Month	Lesson Plan
January	Classification of differential equations: linear and nonlinear, homogeneous and non-homogenous equations, First order: Separable and exact equations. Integrating factor. Second Order: Homogeneous equations with constant coefficient's. Wronskian and general solution Statement of Existence and Uniqueness theorem for initial value problems. Test and Assignment
February	Solution of non-homogeneous equations by operator (D) method. Particular integral. Method of undetermined coefficients and variation of parameters Equations reducible to those with constant coefficient Test and Assignment
March	Fourier series, Dirichlet conditions (Statement only). Orthogonality of sine and cosine functions. Sine and cosine series. Distinctive features of Fourier expansions. Test and Assignment
April	Half-range expansions. Applications Square wave triangular wave, output of full wave rectifier and other simple functions Summary of infinite series. Test and Assignment

Teacher: Anuj
 Course: B.Sc. (H) Sem: 2
 Subject: Phy-206 Semester-II Linear and Digital Integrated Circuits & Instrumentation-II
 Session: 2023-24

Month	Lesson Plan
January	Sequential circuits: flip-flops – RS, JK , D, clocked, preset and clear operation, race-around

	conditions in JK Flip-flop, master slave JK flip-flop as building block of sequential circuits. Test and Assignment
February	Shift registers: Serial-in-serial-out, serial-in-parallel-out, parallel-in-parallel-out, parallel-in-paralleled-out (only upto 4 bits). Counters: Asynchronous counters, synchronous counter, decade counter. D/A and A/D conversion: D/A converter-resistive network, accuracy and resolution. A/D converter (only counter method) – accuracy and resolution. Test and Assignment
March	Timer: Simple applications of 555 timer circuits. Power supply: requirement of ideal voltage and current source, voltage source, half-wave and full-wave rectifier, bridge rectifier, L and C filters, some idea of ripple. Test and Assignment
April	Oscilloscope: Input attenuators, DC, AC and ground, horizontal and vertical deflecting system, time base generation and synchronization: measurement of positive, positive-negative wave shape, rise time and fall time; frequency, amplitude and phase of sinusoidal waves. Test and Assignment

Teacher: Anuj
Course: B.Sc. (H) Sem: 3
Subject: Phy-301 Semester-III Mathematical Physics III
Session: 2023-24

Month	Lesson Plan
August	Importance of complex numbers and their graphical representation. De Moivre's theorem. Roots of complex numbers. Euler's formula. Functions of complex variables. Examples. Cauchy-Riemann conditions. Analytic functions. Test and Assignment
September	Singularities. Differentiation and integration of a function of a complex variable. Cauchy's theorem. Cauchy's integral formula. Morera's theorem. Cauchy's inequality. Liouville's theorem. Fundamental theorem of algebra.

October	Multiple valued functions, simple ideas of branch points and Riemann surface. Power series of a complex variable, Taylor and Laurent series, Residue and residue theorem. Multiple valued functions Test and Assignment
November	Contour integration and its application to evaluation of integrals. Series Solution of Linear Second order Ordinary Differential Equations: Singular points of second order differential equations and their importance. Series methods (Frobenius) Legendre. Bessel, Hermite and Laguerre differential equations. Test and Assignment

Teacher: Anuj
Course: B.Sc. (H) Sem: 3
Subject: Phy-303 Semester-III Vibrations and Wave Optics-I
Session: 2023-24

Month	Lesson Plan
August	Free oscillations of system with one degree of freedom; Linearity and superposition principle. Superposition of (i) two and (ii) N collinear harmonic oscillations; beats System with two degrees of freedom (coupled oscillators). Normal coordinates and normal modes. Energy relation and energy transfer Test and Assignment
September	Normal modes of N coupled oscillators. Normal modes of stretched string, Energy of vibrating string. Plucked and struck strings waves. Wave equation. Traveling waves, Plane and spherical waves. Superposition of two harmonic waves. Standing waves on a string. Superposition of N harmonic waves. Pulses and wave packets. Test and Assignment
October	Introduction to different models, light waves, electromagnetic nature of light waves. Coherence and Interference: Interaction of independent light sources. Classification in terms of division of amplitude and division of wave front. Young's double slit experiment, Lloyd's mirror and Fresnel's biprism. Interference in thin films

	parallel and wedge-shaped films. Fringes of equal inclination (Haidinger fringes) and fringes of equal thickness (Fizeau fringes). Test and Assignment
November	Michelson's interferometer: Theory, form of fringes (mention only), applications, visibility of fringes. Theory of partial coherence. Coherence time and coherence length, i.e. temporal and spatial coherence. Fabry-Perot interferometer: Theory, Airy's formula, sharpness of fringes, finesse, visibility of fringes Test and Assignment

Teacher: Anuj Course: B.Sc. (H) Sem: 3 Subject: Phy-304 Semester-III Quantum Mechanics Session: 2023-24	
Month	Lesson Plan
August	Photoelectric effect. Compton effect. Reduced mass correction. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Two Slit experiment with electrons. Wave amplitude and wave functions, Probability. Uncertainty principle. Test and Assignment
September	Basic postulates and formalism: Schrodinger equation, wave function, eigenvalues, probabilistic interpretation, conditions for physical acceptability of wave functions. Free particle. Time independent Schrodinger equation, stationary states. Particle in one- dimensional box, quantization of energy. Franck-Hertz experiment. Test and Assignment
October	Scattering problem in one dimension : Reflection and transmission by a finite potential step. Stationary solutions, Attractive and repulsive potential barriers. Gamow theory of alpha decay. Quantum phenomenon of tunneling. Tunnel diode-qualitative description. Spectrum for a square well (mention upper bound-no calculation). Test and Assignment

November	Bound state problems: General features of a bound particle system. One-dimensional simple harmonic oscillator. Particle in a spherically symmetric potential rigid rotator. Orbital angular momentum and azimuthal quantum numbers and space quantization. Physical significance. Radial solutions and principal quantum number. Hydrogen atom. Test and Assignment
----------	--

Teacher: Anuj Course: B.Sc. (H) Sem: 4 Subject: Phy-401 Semester-IV Mathematical Physics IV Session: 2023-24	
Month	Lesson Plan
January	Gamma and Beta functions. Legendre, hermite and Laguerre Polynomials: Rodrigues formulae, generating functions, recurrence relations, orthogonality. Test and Assignment
February	Series expansion of a function in terms of a complete set of Legendre functions. Bessel functions : first and second kind, generating function, recurrence formulas, zeros of Bessel functions and orthogonality Fraunhofer, diffraction integral for circular aperture Test and Assignment
March	General solution of wave equation in 1 dimension. Transverse vibration of stretched string. Oscillation of hanging chain. Wave equation in 2 and 3 dimensions. Vibrations of rectangular and circular membrane. Test and Assignment
April	Derivation of the equation of heat conduction. Heat flow in one-two-and three- dimensional rectangular systems of finite boundaries, Temperature inside circular plate. Laplace equation in Cartesian, cylindrical and spherical coordinate systems. Problems of steady flow of heat in rectangular and circular plate. Gravitational potential of a ring Test and Assignment

Teacher: Anuj
 Course: B.Sc. (H) Sem: 4
 Subject: Phy-403 Semester-IV Vibration and Wave Optics-II
 Session: 2023-24

Month	Lesson Plan
January	Kirchhoff's integral theorem. Fresnel-Kirchhoff integral formula and its application to diffraction problems. Test and Assignment
February	Fraunhofer diffraction: Single slit, rectangular and circular aperture. Multiple slit. Plane diffraction grating. Resolving power and depressive power of a plane diffraction grating. Test and Assignment
March	Fresnel diffraction: Fresnel's integrals, Cornu's spiral, Fresnel diffraction pattern at a straight edge, a slit and a wire (qualitatively using Cornu's spiral). Test and Assignment
April	Holography : Principle of holography, recording and reconstruction method and its theory as interference between two plane waves. Test and Assignment

Teacher: Anuj
 Course: B.Sc. (H) Sem: 4
 Subject: Phy-404 Semester-IV Atomic and Nuclear Physics
 Session: 2023-24

Month	Lesson Plan
January	Atoms in electric and magnetic fields: Electron spin. Stern-Gerlach experiment. Orbital angular momentum, dipole moment and energy in magnetic field from classical viewpoint. Zeeman effect. Spin-orbit coupling. Fine structure. Total angular momentum Test and Assignment
February	Many-electron atoms: Pauli exclusion principle, Many particles in one- dimensional box,

	<p>Symmetric and antisymmetric wave functions. Atomic shell model and periodic table, Spectral notations for atomic states. Vector model. L-S and jj coupling Doublet Structure of alkali spectra. Empirical evidence of multiplets, Selection rules. Test and Assignment</p>
March	<p>Properties: mass, size, angular momentum, constituents, binding energy, stability. Models: Liquid drop model. Mass formula. Shell model, nuclear forces. Test and Assignment</p>
April	<p>Radioactivity : Law of radioactive decay. Theory of successive radioactive transformations. Radioactive series (mention the series-diagram not needed) Test and Assignment</p>