Government General Degree College, Chapra

Department of Physics (Sem-IV)

Lesson Plan 2024-2025, Undergraduate Course in Physics (NEP-2020)

Semester	Tentative dates of University Exam	Name of the faculty	Course code	Allotted topic/text	Sub-topic/Lesson plan (No. Of Lecture)
Sem- IV	Follow the latest notification by KU	**Dr. Shaikh Safikul Alam (SSA)**	**PHY-M-T-4** (WAVE OPTICS and ELECTROMAGNETIC THEORY)	**Superposition of Two Waves**	Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. (6 Lectures)
				Wave Optics	Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. (2 Lectures)
				Interference	Division of amplitude and wave front. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. (8 Lectures)
				Interferometer	Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. (4 Lectures)
			PHS-M-P-4 (WAVE OPTICS and ELECTROMAGNETIC THEORY)		1. To determine the frequency of an electric tuning fork by Melde's experiment and verify X2 -T law. 2. Familiarization with: Schuster's focusing; determination of angle of prism and to determine refractive index of the Material of a prism using sodium source. 3. To draw the deviation - wavelength of the material of a prism and to find the

					wavelength of an unknown line from its deviation. 4. To determine wavelength of (1) Na source and (2) spectral lines of suitable source using plane diffraction grating.
			PHY-M-T-5 THERMAL PHYSICS	**Introduction to Thermodynamics** **Second Law of Thermodynamics** **Entropy**	Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroeth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. (8 Lectures) Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. (10 Lectures) Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature-Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero. (7 Lectures)
			PHY-M-P-5: THERMAL PHYSICS		1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method. 2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus. 3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method. 4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
			PHY- MI-T-4: ELECTRICIT	**Electrostatics**	Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem-Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. (8 Lectures) Electric potential as line integral of electric field, potential due to appoint charge, electric

			Y AND MAGNETISM		dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. (6 Lectures)
				Magnetism	Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. (8 Lectures) Magnetostatics: Biot-Savart's law and its applications-straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia, para, and ferromagnetic materials. (10 Lectures)
				Maxwell's equations and Electromagnetic wave propagation	Faraday's Law of electromagnetic induction. Lenz's Law. Self-Inductance and Mutual Inductance. Inductance of single coil, Mutual Inductance of two coils. Energy stored in magnetic field. (6 Lectures) Equation of continuity of current, Displacement current, Maxwell's equations, Pointing vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization. (7 Lectures)
		Subhendu Das (SD)	**PHY-M-T-4** (WAVE OPTICS and ELECTROMAGNETIC THEORY)	**Diffraction**	Kirchhoff s Integral Theorem, Fresnel-Kirchhoff s Integral formula and its application to rectangular slit. (4 Lectures)
				Fraunhofer diffraction	Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. (4 Lectures)
				Fresnel Diffraction	Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. (4 Lectures)
				Maxwell Equations	Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and

					Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field, Energy Density. (8 Lectures)
			PHS-M-P-4 (WAVE OPTICS and ELECTRO MAGNETIC THEORY)		1. To determine the dispersive power of the material of a prism using mercury source. 2. To determine wavelength of sodium light using Fresnel Bi-prism. 3. To determine wavelength of sodium light using Newton's Rings. 4. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
			PHY-M-T-5 THERMAL PHYSICS	**Thermodynamic Potentials** **Maxwell's Thermodynamic Relations** **Kinetic Theory of Gases Distribution of Velocities**	Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations. (7 Lectures) Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp- Cv, (3) Tds Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process. (7 Lectures) Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases. (7 Lectures)
			PHY-M-P-5 THERMAL PHYSICS		To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT). To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method,

			PHY- MI-P-4: ELECTRICITY AND MAGNETISM		1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses. 2. Ballistic Galvanometen (i) Measurement of charge and current sensitivity, (ii) Measurement of CDR, (iii) Determine a high resistance by Leakage Method, (iv) To determine Self Inductance of a Coil by Rayleigh's Method. 3.To compare capacitances using De'Sauty's bridge. 4.Measurement of field strength Bandits variation in a Solenoid (Determined B/dx) 5.To study the Characteristics of a Series RC Circuit.
		Dr. Supriya Mandal (SM)	**PHY-M-T-4** (WAVE OPTICS and ELECTROMAGNETIC THEORY)	**EM Wave Propagation in Unbounded Media** **EM Wave in Bounded Media** **Polarization of Electromagnetic Waves**	Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. (6 Lectures) Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. (6 Lectures) Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Bi-quartz polarimeter. (8 Lectures)
			PHY-M-P-4 (WAVE OPTICS and ELECTROMAGNETIC THEORY)		1. To determine dispersive power and resolving power of a plane diffraction grating. 2. To verify the law of Malus for plane polarized light. 3. To determine the specific rotation of sugar solution using Polarimeter. 4. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
				Molecular Collisions	Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion

			PHY-M-T-5 THERMAL PHYSICS	**Real Gases: Behaviour of Real Gases**	and its Significance. (4 Lectures) Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule- Thomson Cooling. (10 Lectures)
			PHY-M-P-5 THERMAL PHYSICS		Determination of the boiling point of a liquid by Platinum resistance thermometer Determination of the melting point of a solid with a thermocouple. Measurement of the coefficient of linear expansion of a solid using an optical lever.
			PHY- MI-P-4: ELECTRICITY AND MAGNETISM		6.To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor 7.To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q 8.To determine a Low Resistance by Carey Foster's Bridge. 9.To verify the Thevenin and Norton theorems 10.To verify the Superposition, and Maximum Power Transfer Theorems