

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS - SEMESTER – II

TYPE OF COURSE: MAJOR DISCIPLINE SPECIFIC COURSE

PROGRAMME CODE: SCIUG101 COURSE CODE:SC23MJDSCPHY201

COURSE NAME: Electrostatics, Classical Mechanics, Electricity and Optics

Effective from June 2023 Under NEP – 2020

Total Credits: 04	Theory	External Marks - 50
Teaching Hours per Week: 04		Internal Marks - 50
Teaching Hours per Semester: 60		

Course Objective:

- To Learn the basic concepts and the law of electrostatics and electrostatic energy.
- To Learn the concepts of Simple Harmonic Oscillations and combination of SHM.
- To Understand the concepts of Damped & Forced Oscillations and its applications
- To understand and recall the basic concepts of DC Circuits and its functioning, Network theorems and principles of Network analysis.
- To develop foundation in optics. To learn the knowledge of refraction through Lenses, Aberration and Interference
- To provide sufficient knowledge of Newton's ring experiments and determine wavelength

Course Outcome:

After the successful completion of the course students will be able to

- Understands basic concepts of electrostatics. Learns how to determine the charge of an electron.
- Learns the concepts of Simple Harmonic Oscillations and combination of SHM.
- Understands the concepts of Damped & Forced Oscillations and its applications
- Learns basic concepts of DC Circuits, its functioning and principles of Network analysis. Also apply theorems to construct and solve electrical circuits.
- Learns the knowledge of various types of Aberration and Interference
- Get sufficient knowledge of Newton's ring experiments and determine wavelength

: Syllabus :

Unit No.	Content	Credit	Lect. Hrs 60
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Unit-1	<p>Electrostatics: Gauss's law (4.21), Gauss's law in Differential form (4.22), Gauss's law and Coulomb's law (4.23), Important Examples on Gauss's Law (only List): when do Gauss's Law apply? (4.24) Force on the Surface of a charged Conductor (4.25), Electrostatics Energy in the medium surrounding the charged conductor (4.26), Millikan's Oil Drop Method for Determination of Electronic Charge (4.29) <i>(Related Examples & Problems)</i></p> <p>Steady Current: Metal Electrode in an Electrolyte (8.1), Battery on open circuit (8.2), Definition of EMF (8.3), Definition of Potential difference (8.4), Current and Current density (8.6), Conservation of charge i.e., Continuity Equation (8.8), Ohm's Law at a point (8.11), Wiedmann and Franz law (8.13), The Relaxation Time (8.14) <i>(Related Examples & Problems)</i></p> <p>Basic Reference: <i>Electricity and Magnetism By K.K.Tewari (S. Chand & Company Ltd)</i></p>	1	15
Unit-2	<p>Classical Mechanics: Simple Harmonic Oscillations: Composition of two simple Harmonic Motions along the same direction of the same frequency(2.8), Two simple Harmonic Motions act upon a particle simultaneously having no phase difference but they differ in frequency by very small amount(2.9), Composition of two simple Harmonic Motions acting upon a particle simultaneously at right angles to each other, same time period but different in phase(2.10), Lissajous figures(2.11), Experimental determination of Lissajous Figures(2.12b & c). <i>(Related Examples & Problems)</i></p> <p>Damped and Forced Oscillations: Motion Due to a constant force (3.2), The Force acts for short time and to find its effect (3.3), A Particle executing S.H.M. is acted upon by a harmonic force $F \sin pt$ of frequency $P/2\pi$ (3.4), Motion in a resisting medium (3.5) <i>(Related Examples & Problems)</i></p> <p>Pendulum: Compound Pendulum and Oscillations, Bar pendulum</p> <p>Basic Reference: <i>A Text Book on Oscillations, Wave and Acoustics by M. Ghosh & D. Bhattacharya (S. Chand & Company LTD.)</i></p>	1	15
Unit-3	<p>Electricity: D.C. Circuits: Simple R-L Circuit-Growth and decay of current Helmholtz equation (11.24), R-C Circuit (11.25), Measurement of High Resistance by method of leakage (11.26), Comparison of capacities by De-Sauty's Method (11.27), Ideal L-C. Circuit (11.28), Series L-C-R Circuit (change case only) (11.29) <i>(Related Examples & Problems)</i></p> <p>Network Theorems: Thevenin's Theorem (18.6), Maximum Power Theorem (18.8)</p> <p>A.C. Bridges.: AC Bridges (17.5) A.C. Bridges for the measurement of inductances (17.6) (1) Maxwell Bridge (2) Anderson Bridge A.C. Bridge for the measurement of <i>capacitance</i> (17.7) (1) De Sauty's A.C Bridge (2) Schering Bridge <i>(Related Examples & Problems)</i></p> <p>Basic Reference: <i>Electricity and Magnetism by K.K. Tewari (S. Chand & Company Ltd)</i></p>	1	15

Unit-4	<p>Optics: Refraction Through Lenses: Introduction of various shape of Lenses, Lenses(4.2), Lens equation(4.9), Smallest separation of object and real image in a Convex Lens(4.13), Deviation by a thin Lenses(4.15), Power of Lens(4.15), Equivalent Focal Length of two thin lenses Separated by a finite distance (4.17), Focal Length(4.17.1), Cardinal points(5.2) Aberrations: Introduction (5.1), The Achromatic Doublet (5.2.1), Monochromatic aberration (5.3), Spherical aberration (5.3.1) (<i>Related Examples & Problems</i>) Interference: Interference in Thin Films (8.15), Interference due to Reflected light (8.16), Interference due to Transmitted light (8.17), Newton's Rings (8.23), Determination of the Wavelength of Sodium Light using Newton's Rings (8.24), Refractive index of a liquid using Newton's Rings, Refractive index using Graph (8.25) (<i>Related Examples & Problems</i>) Basic Reference: 1) <i>A Textbook of OPTICS By N.Subhramanyam & Brijlal (S.Chand Co. Ltd.)</i> 2) <i>Optics by Ajay Ghatak (THM Edition) (For Aberration)</i></p>	1	15
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Other References – Further Readings

- Electricity and Magnetism by Mahajan and Rangavala
- Electricity and Magnetism by Berkley Physics Course Voll 2
- Waves and Oscillations By N. Subhramanyam & Brijlal (Vikas Publ. House Ltd, New Delhi)
- Introduction to Classical Mechanics by R.G. Takwale & P.S. Puranik (Tata McGraw-Hill Publishing Company Ltd.)
- Electrical Circuit Analysis by Sony and Gupta
- Network Analysis by G.K. Mittal. (Khanna Publications)
- Electricity and Magnetism by D. C. Tayal
- Principal of Optics by B.K Mathur (S. Chand & Company Ltd)
- Optics and Atomics Physics by D.P. Khandelval (Himalaya Publishing house)
- A Text book of Optics by N Subhramanyan and Brijlal