



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

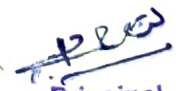
Course Outcome:

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	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>) 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>) Basic Reference: <i>Electricity and Magnetism By K.K.Tewari (S. Chand & Company Ltd)</i>	1	15
Unit-2	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>) 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>) Pendulum: Compound Pendulum and Oscillations, Bar pendulum Basic Reference: <i>A Text Book on Oscillations, Wave and Acoustics by M. Ghosh & D. Bhattacharya (S. Chand & Company LTD.)</i>	1	15
Unit-3	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>) Network Theorems: Thevenin's Theorem (18.6), Maximum Power Theorem (18.8) 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 capacitance (17.7) (1) De Sauty's A.C Bridge (2) Schering Bridge (<i>Related Examples & Problems</i>) Basic Reference: <i>Electricity and Magnetism by K.K. Tewari (S. Chand & Company Ltd)</i>	1	15



Unit-4	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) (Related Examples & Problems) 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) (Related Examples & Problems) 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>	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

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**B. Sc. PHYSICS - SEMESTER – II (PRACTICAL COURSE)****PROGRAMME CODE: SCIUG101**

(Effective from June 2023 Under NEP – 2020)

TYPE OF COURSE	CREDIT	COURSE CODE
Major Discipline Core Course (MJDSCP)	2(Group A)	SC23MJDSC P PHY201
Major Discipline Core Course (MJDSCP)	2 (Group B)	SC23MJDSC P PHY202
Minor Discipline Core Course (MIDSCP)	2	SC23MIDSC P PHY203
Inter-Discipline Core Course (MDSCP)	2	SC23MDSC P PHY204

Teaching Hours

Teaching Hours per Week : 08 Hours for 4 Credit practical (120 Hours per Semester)

Teaching Hours per Week : 04 Hours for 2 Credit practical (60 Hours per Semester)

Course Objectives:

- Course Objectives:**
- To gain practical knowledge by applying the experimental method to correlate with the Physics theory.
 - To provide hands on experience with equipment such as, spectrometer, Pendulum, Flywheel and electronic circuits.
 - To learn the usage of electrical and optical systems of various measurements.
 - To impart practical knowledge by performing experiments based on the principles of theory courses.
 - To provide training how to analyze the experimental data and graphical analysis.
 - To develop intellectual communication skills and discuss the basic principles of scientific concepts in the group.

LABORATORY EXPERIMENTS Group A**MAJOR COURSE (2 Credit)**

COURSE CODE: SC23MJDSC P PHY201(A)

1. Bar Pendulum: Determination of 'K' and 'g'
2. Melde's Experiment. T/L^2 constant
3. Find out Refractive index of the prism using spectrometer.
4. To determine the ratio of magnetic moments of two magnets by using Vibrational Magnetometer.
5. To determine the magnetic moment of a given Bar magnet using Deflection Magnetometer in Gauss A and B position.
6. Determine wavelength of LASER Light.
7. Numerical Analysis: Jacobi interaction Method.
8. Plotting of a Graph and Error estimation on graphical plot. Linear and nonlinear graph, Logarithmic Graph Polar Graph
9. To Find the vertical distance between two points using Sextant.
10. Determine Modulus of Rigidity (Moment of Inertia) of Disk using Torsional pendulum
11. Numerical: Gauss Backward Interpolation Formula
12. Determination of angular acceleration (α) and find MI of a Fly wheel using Formula
13. To Determine the value of Cauchy's Constants of material of Prism

LABORATORY EXPERIMENTS Group B

MAJOR COURSE (2 Credit)
COURSE CODE: SC23MJDSC P PHY201(B)



1. Determination of self-inductance 'L' of Inductor.
2. Study of Parallel Resonance with variable frequency and Fix capacity
3. P-N Junction diode as Full Wave Rectifier Without filter. Calculation of Percentage of Regulation.
4. P-N Junction diode as Full Wave Rectifier (i) With Series Inductor Filter, (iii) With Shunt Capacitor Filter. Calculation of Percentage of Regulation.
5. Study of Characteristics of Tunnel Diode.
6. Study of Series Resonance with Capacitor variation and Fix Frequency
7. Study of Parallel Resonance with variable capacitor and Fix Frequency
8. Decay of Potential across Condenser
9. LDR Characteristics: obtain IV Characteristics of given LDR and calculate its resistor. (For three different light level)
10. To find the value of an unknown Inductor by using Owen's Bridge circuits
11. Measurement of Boltzmann constant using Diode.
12. PN Junction IV characteristics and Load Line analysis.
13. Study of Step Down Transformer. To determine Turn Ratio, % of Efficiency, Energy loss due to copper loss for a given transformer.

Course Outcome

By the end of the course, the students will be able to understand.

- The basic principles of Physics related to their courses in the practical way.
- The operational details of spectrometer, electronic circuits etc.
- The experimental design aspects to determine various properties of like gravity, quality factor, Refractive index, determination of Cauchy's Constants, analysis of spectra, Analysis of error, determine value of unknown frequency etc.
- The process to analyze the observations and infer the outcome of the experiments.
- How to analyze the experimental data and graphical analysis.


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