HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS - SEMESTER – III

TYPE OF COURSE: <u>MAJOR</u> DISCIPLINE SPECIFIC COURSE

PROGRAMME CODE: SCIUG101   COURSE CODE:SC23MJDSCPHY301

COURSE NAME: THERMODYNAMICS, MODERN PHYSICS & SOLID STATE PHYSICS

(Effective from June 2024 Under NEP – 2020**)**

Total Credits: 04	THEORY	External Marks -50
Teaching Hours per Week: 04		
Teaching Hours per Semester: 60	MAJOR I	Internal Marks - 50

Course Objective:
- To understand the principles of Heat and Thermodynamics, Mathematical Theorems, Liquification of Gases
- Learns about Franck -Hertz Experiment, Bohr's Theory, Sommerfield Model
- To develope foundation in Atomic Spectra, Understand Spectroscopic terms Zeeman Effect, Paschan Back effect etc.
- To Learn Crystal Lattice and Crystal structure, the Seven crystal Systems.

Course Outcome:

After the successful completion of the course students will be able to
- Understand the principles of Heat and Thermodynamics, Mathematical Theorems, Liquification of Gases
- Learns about Franck -Hertz Experiment, Bohr's Theory, Sommerfield Model
- Learns the concepts Atomic Spectra, Understood Spectroscopic terms Zeeman Effect, Paschan Back effect
- Get sufficient knowledge of Crystal Lattice and Crystal structure, The Seven crystal Systems.

Syllabus

Unit No.	Content	Credit	Lect. Hrs 60
Unit-1	**Thermodynamics:** **Heat and Thermodynamics**: Characteristic functions, Enthalpy(11.1), The Helmholtz and Gibb's function(11.2), Two Mathematical Theorems(11.3), Maxwell's equation(11.4), The T-dS equations(11.5), Internal Energy equation(11.6), Heat capacity equation, The Thermal Expansivity (11.9), Compressibility(11.10), Joule-Kelvin effect (Porous plug Experiment) (12.1) Liquification of Gases by Joule-Kelvin Effect (12.2) (*Related Examples, Problems, MCQ & Short Questions*) **Basic Reference:** *Heat and Thermodynamics by Mark W. Zeemansky (5th Edition)*	1	15

Unit 2	**Modern Physics :**
	Atomic Spectra: Franck -Hertz Experiment(2.16), Critical Potentials (2.17), Shortcoming of Bohr's Theory(2.19) , Sommerfield extension of Bohr theory (2.20), Limitations of Sommerfield Model(2.21)
	           (*Related Examples, Problems, MCQ & Short Questions.*)
	Matter Waves and Schrodinger Equations :
	Formulation of Quantum Mechanics(1.19), Photon: The Quantization of field(1.20),: A Free Particle in One Dimension(2.1), Generalization to Three Dimension(2.2), The Operator correspondence and the Schrodinger equation for a particle subject to forces(2.3).
	           (*Related Examples, Problems, MCQ & Short Questions.*)
		1	15

	Basic Reference: 1. *Atomic and Molecular Physics by Raj Kumar (Campus Books)* 2. *A Text Book of Quantum Mechanics by Mathews and K.Venkatesan, Tata Mc-Graw Hill Publication*		
Unit -3	**ATOMIC PHYSICS:** **Atomic Spectra**: Orbital and Magnetic Dipole Moment (4.1), Larmor Precession (4.2), Space quantization(4.3), electron spin (4.4), Vector model of atom (4.5), Spectroscopic terms and their notations(4.6), Stern Gerlach Experiment(4.7), Pauli's Exclusion Principle(4.8). Zeeman Effect-Normal Zeeman Effect and anomalous Zeeman Effect(12.1), Explanation of Normal Zeeman Effect(12.2), Explanation of Anomalous Zeeman Effect(12.3), Paschan Back effect (12.4). Stark Effect of Hydrogen (13.1) (*Related Examples, Problems, MCQ & Short Questions.*) **Basic Reference**: Atomic & Molecular sprctra by Rajkumar Kedarnath Prakashan Meerut.	1	15
Unit-4	**SOLID STATE PHYSICS** **Crystal Structure:** Crystalline and Amorphous Solid(1.1) , Crystal Lattice and Crystal structure(1.2), Translational Symmetry, Space, Unit Cell and Primitive Cell(1.3), Symmetry Elements in Crystals(1.4-1.4.1 to 1.4.6), The Seven crystal Systems(1.5), Coordination Number(1.5.1), Some important crystal structure(1.6) , Simple Cubic Structure(1.6.1), Body Centered Cubic (BCC) Structure(1.6.2), Face Centered Cubic (FCC) Structure(1.6.3), Hexagonal closed packed structure (1.6.4), Sodium chloride structure (1.6.5), Cesium chloride structure (1.6.6), Diamond structure (1.6.7), Wigner-Seitz Cells (1.7), Miller Indices (1.8), The inter planar spacing of crystal planes (1.11). (*Related Examples, Problems, MCQ & Short Questions*) **Basic Reference:** Solid State Physics By Ajay Kumar Saxena (Macmillan India Limited)	1	15

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<tr><td colspan="4" align="center">: Further Reading – Other References:</td></tr>
<tr><td colspan="4">

(1) Heat and Thermodynamics by Zeemansky

(2) University Physics by Sears, Zeemankky and young (6th Edition Narosa Publishing)

(3) Heat and Thermodynamics by Richard H. Dittmon & Mark W. Zemansky (TMH)

(4) Heat and Thermodynamics by A.B. Gupta and H. P. Roy

(5) Thermodyna -mics and Statistical Physics by Singhal–Agarwal-Prakash Pragati Prakashan, Meerut.

(6) Spectroscopy Vol-1 by Walker & Straw

(7) Atomic Physics by J.B. Rajam (5th Edition – 1960) S. Chand & Co.

(8) Physics of Atoms and Molecules by B.H.Brandsden & C.J.Joachagh, Pearson Education.

(9) Modern Physics by Kenneth Krane, Jon wiley &sons

(10) Elements of Spectroscopy S L Gupta, V Kumar & R C Sharma (24th Edition) Pragati Prakashan,

(11) Molecular Structure and Spectroscopy G Aruldhas, Prentice Hall of India Private Limited

(12) Elements of Solid State Physics (2003) by J. P. Shrivastav, PHI

(13) Introduction to solid state Physics By C.Kittle (John Willey)

(14) Fundamen- tal of solid state Physics By Saxena, Gupta, Saxena (Pragati Prakashan)

(15)   Solid State Physics By Ajay Kumar Saxena (Macmillan India Limited)

(16)   Solid State Physics by S O Pillai

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HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
B. Sc. PHYSICS - SEMESTER – III
TYPE OF COURSE: <u>MAJOR</u> DISCIPLINE SPECIFIC COURSE

PROGRAMME CODE: SCIUG101   **COURSE CODE:SC23MJDSCPHY301A**
COURSE NAME: ELECTROMAGNETICS, OPTICS AND ELECTRONICS
(Effective from June 2024 Under NEP – 2020)

Total Credits: 04 Teaching Hours per Week: 04 Teaching Hours per Semester: 60	THEORY MAJOR II	External Marks - 50
		Internal Marks - 50

Course Objective:
- To Learns the basics concepts and the law of Electrostatics and Magnetostatics.
- To develop foundation in optics and Learn the concepts of diffraction, Single slit, Double Slit Fraunhoffer diffraction
- To learn the the knowledge of Resolving Power of Optical Instruments and the basic concepts of Polarization and Retarders.
- To develop sufficient knowledge about Farmat's principle.
- To understands and recalls the basic concepts of Basic Transistors
- To provide sufficient knowledge of Transistors Current Component, static (Input and Output) characteristics

Course Outcome:

After the successful completion of the course students will be able to
- Understands basics concepts of electrostatics and Magnetostatics.
- Learns the foundation of optics as well as the concepts of diffraction. Also Understands the concepts of Single slit, Double Slit Fraunhoffer diffraction
- Learns basic concepts of Polarization and Retarders.
- Get sufficient knowledge of Basic Transistors
- Learns the knowledge of various type of Transistors Current Component, static (Input and Output) characteristics

Syllabus

Unit No.	Content	Credit	Lect. Hrs 60
Unit-1	**ELECTROSTATICS AND MAGNETOSTATICS :** **Electrostatics in Dielectric**: Introduction to polar and non polar dielectrics, Gaseous Non Polar Dielectrics (2.11), Gaseous Polar Dielectrics (2.12), Non Polar Liquids (2.13), Solid Dielectrics Electrets(2.14), Methods of Electrostatics Images (3.11 i to v) *(Related Examples & Problems)* **Magnetostatics :** The Magnetic Potential (4.9-a & b) Magnetic Vector Potential due to small Current Loop(4.12), An Alternative method for finding the Vector Potential A and the field B due to Current Loop(4.13), Magnetization(4.15), Magnetic Field Vector (4.16),Magnetic susceptibility and Permeability (4.17), Boundary Conditions(4.18), Uniformly Magnetized Sphere in External Magnetic Field (4.19), A comparison of Static Electric and Magnetic Field (4.20) *(Related Examples & Problems)* **Basic Reference:** . Electromagnetics by B.B. Laud, New Age Publisher	1	15

Unit-2	**OPTICS :** **Diffraction:** Fraunhoffer Diffraction Introduction (18.1) Fraunhoffer Diffraction at a Single slit (18.2), Intensity distribution in diffraction pattern due to a single slit (18.2.1) Fraunhoffer diffraction at a double slit (18.4), Fraunhoffer diffraction at double slit (Calculus method)(18.4.1), Distinct between single slit and double slit diffraction pattern (18.4.2), Fraunhoffer diffraction at N slit(18.6 & 18.6.1), Plane Diffraction Gratting (18.7), Theory of plane transmission gratting (18.7.1), Dispersive power of Grating (18.7.7) *(Related Examples & Problem, MCQ, SQ)* **Resolving Power:** Resolving Power of Optical Instrument(19.5), Resolving Power of a telescope(19.7), Relation between magnifying power and resolving power of a telescope(19.7.1)., Resolving power of a plan transmission grating (19.12) *(Related Examples & Problem, MCQ, SQ)* **Basic Reference:** *Thermodynamics and Statistical Physics by Dr. J.P. Agarwal and Satya Prakash (Pragati Prakashan)*	1	15
Unit-3	**OPTICS:** **Fermat's Principle :** Fermat's principle (2.1), Fermat's principle of least time(2.2), law of reflection and law of refraction(2.3) **Polarization:** Introduction(20.1), Polarization by double refraction(20.5.5), Double refraction(20.8.3), Huygens' explanation of double refraction(20.9 & 20.9.1), Types of Polarized light(20.15),, Retarders or Wave plate (Quarter wave plate) (20.17.1), (Half wave plate)(20.17.2), Production of Elliptically polarized light(20.18), Detection of Elliptically polarized light(20.18.1). *(Related Examples & Problem, MCQ, SQ)* **Basic Reference:** *A text book of OPTICS by Dr. N.Subrahmanyam, Brijlal, Dr.M. N. Avadhanulu - S Chand*	1	15
Unit-4	**ELECTRONICS:** **Basic Transistors:** (Review of Construction of Transistor) Transistor Current Component(4.18), Detailed Transistor Leakage Currents (4.18-1) (Collector to Base and Collector to Emitter Leakage Current), C-B configuration static (Input and Output)characteristics)(4.09-1), Load Line(4.21), Operating Point(4.22) *(Related Examples, Problems, MCQ & Short Questions)* **Transistor Biasing and Stabilization:** Bias Stabilization (Operating Point stabilization) (8.7, 8.7.1 & 8.7.2), Stability factor (8.8), Stabilization by Collector Base Resistance (8.9) Stabilization by potential divider and Emitter resistor (8.10) *(Related Examples, Problems, MCQ & Short Questions)* **Basic Reference:** 1. Hand book of Electronics by Gupta & Kumar 30th Revised Edition, 2002 Pragati Prakashan	1	15

: Further Reading – Other References :

1. Electricity and Magnetism by Mahajan and Rangwala, THM
2. Electricity and Magnetism Berkeley Phy Vol.-II by Edward M Purcell, McGraw-Hill Publi
3. Electricity and Magnetism by D. C. Tayal, Himalaya Publishing House
4. A Text book of light by D.N.Vasudev – Atmaram & sons,New Delhi .
5. Fundamentals of Optics by F A Jenkine and H E White Tata McGraw Hill Book Co. Ltd.
6. Optics by Ajoy Ghatak Tata McGraw Hill Book Co. Ltd
7. Principles of Optics by B.K. Mathur
8. A Text book of light by D.N.Vasudev – Atmaram & sons,New Delhi .
9. Fundamentals of Optics by F A Jenkine and H E White Tata McGraw Hill Book Co. Ltd.
10. Optics by Ajoy Ghatak Tata McGraw Hill Book Co. Ltd
11. Principles of Optics by B.K. Mathur
12. Electronic Devices and Circuits by A. Mottershead prentice- Hall of India
13. Integrated Electronics by Milliman & Halkias
14. Basic Electronics and Linear Circuits by N. N. Bharagava, D.C.Kulshreshtha, S.C. Gupta.
15. Electronics and Radio Engineering by M L Gupta (9th Edition-2002) Dhanraj &Sons