

Sl. No.	Course/Paper Code	Title of the Paper	Subject Category	Teaching Hours/Week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
1	2	3	4	5	6	7	8	9	10
Semester-I									
1	24SEPPHYT-I	Mechanics and Properties of Matter	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-I	Practical I	MC-P	04	40	10	50	02	3 Hrs.
	Total			08	120	30	150	05	---
Semester-II									
2	24SEPPHYT-II	Thermal Physics, Waves and Sound	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-II	Practical - II	MC-P	04	40	10	50	02	3 Hrs.
	Total			08	120	30	150	05	---
Semester-III									
3	24SEPPHYT-III	Geometrical Optics and Electricity	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-III	Practical - III	MC-P	04	40	10	50	02	3 Hrs.
	24SEPPHYE-III A	A) Energy Sources B) Physics for All	OEL/ OP-I	02	40	10	50	02	2 Hrs.
	24SEPPHYE-III B (Elective/ Optional – I*)								
	Total			10	160	40	200	07	---
Semester-IV									
4	24SEPPHYT-IV	Wave Optics and Electromagnetism	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-IV	Practical - IV	MC-P	04	40	10	50	02	3 Hrs.
	24SEPPHYE-IV A	A) Electronic Instrumentation and Sensors B) Elements of Nanoscience	OEL/ OP-II	02	40	10	50	02	2 Hrs.
	24SEPPHYE-IV B (Optional – II*)								
	Total			10	160	40	200	07	---
Semester-V									
5	24SEPPHYT-V	Classical Mechanics, Quantum Mechanics and Statistical Mechanics	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHYT-VI	Methods of Mathematical Physics, Relativity and Astrophysics	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-V	Practical - V	MC-P	04	40	10	50	02	3 Hrs.
	Total			12	200	50	250	08	---
Semester-VI									
6	24SEPPHYT-VII	Atomic and Molecular Physics and Nuclear Physics	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHYT-VIII	Condensed Matter Physics and Electronics	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-VI	Practical - VI	MC-P	04	40	10	50	02	3 Hrs.
	24SEPPHYPr	Project	MC-Pr	04	50	--	50	04	3 Hrs.
	Total			16	250	50	250	12	---
	Grand total			64	1010	240	1250	44	49

MC: Major Course; MC-T: Major Course Theory; MC-P: Major Course Practical; MC-Pr: Project; EL/Op: Elective/Optional; AEDP: Apprenticeship Embedded Degree Programme. [*In Semester-III and Semester-IV open elective papers are offered. There shall be 02 elective papers offered during each semester (Semester-III and Semester-IV) by every major subject offering Department, where a student shall choose/select/opt 01 elective paper out of two to study in each semester (Semester-III and Semester-IV)].

SEMESTER-III
Curriculum Structure

Sl. No.	Course/Paper Code	Title of the Paper	Subject Category	Teaching Hours/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
1	2	3	4	5	6	7	8	9	10
Semester-III									
1	24SEPPHYT-III	Geometrical Optics and Electricity	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-III	Practical - III	MC-P	04	40	10	50	02	3 Hrs.
2	24SEPPHYE-III A 24SEPPHYE-III B	Elective A) Energy Sources B) Physics for All	OEL/ OP-I	02	40	10	50	02	2 Hrs.
Total				10	160	40	200	07	---

24SEPPHYT-III: GEOMETRICAL OPTICS AND ELECTRICITY

TOTAL HOURS -56

Course Learning Objectives:

- To understand the basic ideas of nature of light, geometrical optics, lenses and optical photography.
- To understand the basic ideas of Electrostatics, Gauss's law, Capacitors.
- To understand the basic ideas of Electric current, effects of electric current and Thermoelectricity.
- To understand basic ideas of transient currents, Network analysis and theorems, AC bridge networks.

Course Outcome:

On successful completion of the course, the student will be able to:

- Explain basic ideas of Geometrical Optics, Optical photography.
- Explain the basic concepts of Electrostatics, Gauss's law and Capacitors.
- Explain the basic ideas of Electric current, effects of electric current and thermoelectricity.
- Explain basic ideas of transient currents, Network analysis and theorems; AC bridge networks.

SEMESTER-III

24SEPPHYT-III: GEOMETRICAL OPTICS AND ELECTRICITY

TOTAL HOURS: 56

Unit – 1	14 hours
Chapter 1: Theories on the Nature of Light: Newton's corpuscular theory, Huygens' wave theory, Maxwell's electromagnetic theory-mention of successes, failures, limitations, and drawbacks of each theory, Quantum Optics — Qualitative description. 2 hours	
Chapter 2: Geometrical Optics: Fermat's principle of least time -Definition and Explanation, Rectilinear propagation of light, Laws of reflection, Laws of refraction at plane surfaces -Derivation based on Fermat's principle, Problems. 3 hours	
Chapter 3: Lenses: Types of lenses, review of basic terms connected with lenses, Principal foci and focal plane Focal length, Radius of curvature, Optic centre, Aperture, Magnification, Power. Lens maker's formula, lens formula and associated sign conventions (Qualitative), Derivation of formula for focal length of two thin lenses separated by a distance. Lens aberrations — Brief description of Spherical aberration, Coma, Astigmatism, Curvature of field, Distortion, Methods of correction, Chromatic aberration: Expression for longitudinal and lateral chromatic aberration, Expression for condition of achromatism of two thin lenses separated by a distance. Eye piece- Huygens' and Ramsden's eyepiece Construction and working, Problems. 7 hours	
Chapter 4: Optical Photography: Basic Optical Camera, Qualitative description of- Aperture, Shutter speed, White balance, Focal length, ISO, Exposure and Resolution. 2 hours	
Unit -2	14 Hours
Chapter 5: Electrostatics: Review of basic properties of electric charges, Coulomb's law, Concepts of electric field and potential, Lines of force, Potential energy, Electrical flux (Explanation with mention of relevant expressions for each) Electric dipole — Expression for potential and field (Special cases), Problems 3 Hours	
Chapter 6: Gauss's Law and Applications: Gauss's law - Statement and proof, Differential form of Gauss's law, Poisson's equation and Laplace equation. Applications: Electric field due to a uniformly charged sphere, Field of a charged conductor, Force on the surface of a charged conductor, Problems 4 Hours	

Chapter 7: Capacitors:	
Review of capacitance of a conductor and principle of a capacitor, Types of capacitors: Guard ring, Mica, Electrolytic, variable air column gang capacitor, Derivation of capacitance of a parallel plate capacitor (with and without dielectric). Expressions for capacitances in series and parallel, expression for energy stored in a charged capacitor (Qualitative).	
Derivation of expression for loss of energy on sharing of charges between two capacitors, Role of dielectrics in capacitors: Dielectric constant, Dielectric breakdown, Polarization, Experimental determination of Dielectric constant by charging and discharging of a capacitor. Applications of capacitors, Problems.	
hours	7
Unit -3	
14 Hours	
Chapter 8: Electric Current:	
Electric current and current density: Expression for current density, equation of continuity, Ohm's law in terms of current density (qualitative).	
Electrical Conductivity - Variation with temperature (Derivation), Resistivity, Distinction between alternating and direct current, Problems.	
hours	4
Chapter 9: Effects of Electric Current:	
Heating effect of electric current - Joule heating (qualitative, with mention of expressions)	
Chemical effects of electric current - Electrolysis explanation Qualitative description of: Lead-acid cell, Daniel cell, Li-ion cell. Mechanical effect-Lorentz force (Qualitative)	
Magnetic effect of electrical current -Biot-Savart's law (qualitative).	
Expressions for magnetic field (B) due to: A straight conductor carrying current, A circular coil carrying current on its axis (Qualitative), Helmholtz tangent Galvanometer-construction and theory. Problems.	
hours	6
Chapter 10: Thermoelectricity:	
Seebeck effect, Derivation of expression for neutral temperature and inversion temperature. Thermoelectric series, Laws of thermoelectricity, Peltier effect and Thomson effect (Qualitative), Problems.	
hours	4
Unit – 4	
14 Hours	
Chapter 11: Circuit Elements and Transient Current:	
Basic passive circuit elements — Resistors, Inductors, Capacitors-and their features.	
Transient current- derivation of growth and decay of current in LR, charge in CR and in LCR circuits Problems.	
hours	5
Chapter 12: Network Analysis and Theorems:	
Review of Kirchoff's Current Law and Voltage Law. Statement, proof and illustrations of Thevenin's theorem, Norton's theorem, superposition theorem, Maximum power transfer theorem, Problems.	
hours	6
Chapter 13: AC Bridge Networks:	
Wheatstone's bridge (Qualitative), Maxwell's bridge and De-Sauty's bridge - derivation of expressions, Problems.	
hours	3

References Books:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1	A Text Book of Optics for Students of Physics (28th Revised Edition)	Dr. N. Subrahmanyam, Brij Lal, Dr. M.N. Avadhanulu	S. Chand	2006
2	Optics and Spectroscopy	R. Murugesan	S. Chand	2010
3	Fundamentals of Optics	Francis Jenkins, Harvey White	McGraw Hill Education	2001
4	Optics (7e)	Ghatak	McGraw Hill	2019
5	Optics (Fifth Edition)	Eugene Hecht, A.G. Ganesan	Pearson IN	2019
6	Principles of Physics (Extended Edition - Twelfth Edition)	Halliday & Resnick	WILEY	2023
7	Concepts of Physics (Volumes 1 & 2)	H. C. Verma	Bharati Bhawan (P & D)	2025
8	University Physics with Modern Physics (Fifteenth Edition)	Hugh D. Young, Roger A. Freedman	Pearson	2021
9	Berkeley Physics Course: Electricity and Magnetism	E. M. Purcell	McGraw Hill	2013
10	Electricity and Magnetism (10e)	R. Murugesan	S. Chand	2019
11	Electricity & Magnetism (Fourth Revised Edition, Reprint)	D. C. Tayal	Himalaya Publishing House	2024
12	Electricity and Magnetism	Dr. K. K. Tewari	S. Chand & Co.	2007
13	Electricity and Magnetism (Sixth Edition, Reprint)	Sehgal, Chopra, Sehgal	Sultan Chand & Sons	2004
14	Text Book of Electricity and Magnetism	Ashutosh Kapil	Pearl Books	2020
15	Introduction to Electrodynamics (Fourth Edition)	David J. Griffiths	Cambridge University Press	2021
16	Electronic Devices and Circuit Theory (Eleventh Edition)	Boylestad, Nashelsky	Pearson	2015
17	Basic Electrical Engineering with Lab Exercises (Second Edition)	D.C. Kulshreshtha	McGraw Hill	2019
18	Engineering Physics for Undergraduate Students (Eighth Revised Edition)	R.K. Gaur, S.L. Gupta	Dhanpat Rai Publications	2017
19	Photography - The New Basic Principles, Techniques and Practice	Graham Diprose, Jeff Robse	Thomas & Hudson	2012
20	The Photographer's Handbook	Michael Freeman	Lillex	2017
21	Digital Photography: An Introduction (Fully Updated 5th Edition)	Tom Ang	DK	2018

Practical Content

List of Experiments to be performed in the Laboratory (Minimum of 8 Experiments)

1.	Determination of focal length of combination of lenses separated by distance by shift and magnification methods.
2.	Study of exposure variations with changes in aperture and shutter speed - using mobile camera (PRO mode).
3.	Verification of laws of capacitors in series and parallel by De Sauty's bridge.
4.	Variation of C of an air gang capacitor by Ohm's law (DC and AC measurements).
5.	Variation of R with temperature by Ohm's law or meter bridge.
6.	Black box - identification of R, L and C and determination of their values by Ohm's law.
7.	Determination of B_H using HTG.
8.	Variation of thermo emf with temperature by I-V measurements.
9.	Capacitance by charging and discharging.
10.	Verification of Thevenin's theorem.
11.	Verification of Norton's theorem.
12.	Verification of Superposition theorem.
13.	Verification of Maximum Power Transfer theorem.
14.	Determination of L by Maxwell's bridge.

References Books:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1.	B. Sc. Practical Physics	Harnam Singh, Dr. A.S. Hemne	S. Chand & Co.	2000
2.	Physics through Experiments	B. Saraf	Vikas Publications	1995
3.	B. Sc. Practical Physics	C. L. Arora	S. Chand & Co.	2020
4.	Basic Electrical Engineering (with lab exercises) — Second Edition	D. C. Kulshreshtha	McGraw Hill	2019

24SEPPHYE-IIIA: ENERGY SOURCES (Elective)

TOTAL HOURS -32

Course Learning Objectives:

- a) To understand basic ideas about forms of energy, energy scarcity and renewable & non-renewable energy.
- b) To understand basic ideas about Conservable & Non-Conservable energy sources, Polluting and eco-friendly energy and future energy.

Course outcome:

On successful completion of the course, the student will be able to:

- a) Explain basic ideas about types of energy, energy scarcity and renewable/non-renewable energy.
- b) Explain basic concepts and ideas Pertaining to Conservable & Non-conservable energy, Polluting and non-polluting energy and future energy systems.

Unit – 1	8 Hours
Forms of Energy and Requirements Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Requirements of energy in various areas of human activity. Energy Scarcity Qualitative account of energy scarcity in different areas. Overview of Indian & world energy scenario with latest statistics- consumption & necessity.	
Unit – 2	8 Hours
Renewable and Non-renewable Energy Renewable energy -Ocean Thermal Energy conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy, tidal energy, hydroelectricity. Non-renewable energy -Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations.	
Unit -3	8 Hours
Conservable and Non-Conservable Energy Need for energy conservation and problems associated with it. Need for energy audit. Conservable energy sources, non-conservable energy sources-with emphasis on the Indian scenario.	
Unit -4	8 Hours
Polluting and Eco-friendly Energy Pollution, global warming, climate change. Major pollutants. Eco-friendly energy-solar energy, solar cooker, solar water heaters and solar green houses. Energy for the Future Concept of green energy-idea of carbon-credits. Green energy systems — wind, solar, tidal, hydel, etc.	

Reference Books:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1.	Fundamentals of renewable energy sources	N. S. Rathore, Chethan B Khobragade, Bhawana Asnoni	Himanshu Publications	2010
2.	Energy technologies- non conventional renewable and conventional	S. Rao, Dr. D. B. Paruleha	Khanna publishers	1994
3.	Fundamentals of renewable	G. N. Tiwari, M. K. Ghosal	Springer	2007

	energy sources			
4.	Renewable energy sources and emerging technologies	D. P. Kothari, Rakesh Ranjan, S. K. Singal	PHI learning	2011
5.	Fuel Cells- Principles and applications	B. Vishwanathan, M. Aulice scibion	University Press	2006
6.	Fuel Cells- A beginner's guide	Dr. Abhik chatterjeo	Ukiyoto Publishing	2023
7.	Non-conventional energy sources	G.D Rai	Khanna Publishers	1988
8.	Renewable Energy, Power for a sustainable future	Godfrey Boyle	Oxford University Press, in association with The Open University.	2004
9.	Solar Energy: Resource	Dr. P Jayakumar	Resource Assessment Handbook	2009

24SEPPHYE-IIIB: PHYSICS FOR ALL (Elective)

TOTAL HOURS -32

Course Learning objectives:

- a) To understand basic ideas about fundamental nature of Physics, branches of Physics, applications of Physics-in the human body and at home.
- b) To understand basic ideas about Physics in Agriculture, Industry and Entertainment.

Course Outcome:

On successful completion of the course, the student will be able to:

- a) Explain basic ideas about fundamental nature of Physics, branches of Physics and applications of Physics-in human body functions and at home.
- b) Explain basic ideas about applications of Physics in Agriculture, Industry and Entertainment.

24SEPPHYE-IIIB: PHYSICS FOR ALL (Elective)**TOTAL HOURS -32**

Unit – 1	8 Hours
Basic Nature of Physics Significance of Physics - matter and energy, — fundamental nature of Physics. Branches of physics — optical, thermal, electrical, magnetic, acoustic, nuclear, etc. Scope for wide applications of physics.	
Unit – 2	8 Hours
Physics in the Human Body Role of thermodynamics, fluid dynamics, electrical concepts, mechanical and optical concepts in the functioning of various organs and systems. Physics at Home Physics in the kitchen, physics in ventilation, Smoke detectors, physics in home electrical systems.	
Unit -3	8 Hours
Physics in Agriculture Role of light, gravity, capillarity in growth of plants. Irrigation systems — fluid dynamics and hydrostatics in them. Radioactivity usage in agriculture. Physics in Industry: Role of thermal, electrical, optical, magnetic, and nuclear physics in industrial machinery and procedures.	
Unit -4	8 Hours
Physics in Entertainment Physics in acoustics — design of halls, electro-optical displays, lighting systems, photography, holography, etc.	

Reference Books:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1.	The Physics of Everyday things	James Kakalies	Robinson	2018
2.	Physics in Everyday Life	Shashwat Goswami, Vedang sati	Kindle Edition	2016
3.	The Science of Everyday Life	Marty Jopson	Audible Studios	2015
4.	Physics at Every Step	Yakov Perelman	Prodinnova	2019
5.	The trouble with physics	Lee smolin	Penguin UK	2008
6.	For the love of physics	Walter Lewin	Taxmann Publications	2012

SEMESTER-IV

Curriculum Structure

Sl. No.	Course/Paper Code	Title of the Paper	Subject Category	Teaching Hours/ week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Examination Duration
Semester-IV									
4	24SEPPHYT-IV	Wave Optics and Electromagnetism	MC-T	04	80	20	100	03	3 Hrs.
	24SEPPHY-P-IV	Practical - IV	MC-P	04	40	10	50	02	3 Hrs.
	24SEPPHYE-IVA 24SEPPHYE-IVB	Open Elective A) Electronic Instrumentation and Sensors B) Elements of Nanoscience	OEL/ OP-II	02	40	10	50	02	2 Hrs.
	Total			10	160	40	200	07	---

24SEPPHYT-IV: WAVE OPTICS AND ELECTROMAGNETISM

TOTAL HOURS -56

Course Learning Objectives:

- To understand basic ideas of Huygen's Wave theory, interference of light and Interferometry.
- To understand concepts and applications of Diffraction of light and Polarisation of light.
- To understand concepts and ideas about Magnetic effect of electric current, Electromagnetic induction, Ac circuits and Magnetic properties of materials.
- To understand basic ideas of Maxwells electromagnetic equations, Electromagnetic waves and Communication with electromagnetic waves

Course Outcome:

On successful completion of the course, the student will be able to:

- Explain ideas pertaining to Huygen's Ware theory, Interference of light and interferometry.
- Explain concept and ideas about Diffraction and Polarisation of light.
- Explain the ideas about magnetic effect of electric current, Electromagnetic induction, AC Circuits and Magnetic properties of materials.
- Explain concepts pertaining to Maxwell's electromagnetic equations, Electromagnetic waves and communication using electromagnetic waves.

SEMESTER-IV

24SEPPHYT-IV: WAVE OPTICS AND ELECTROMAGNETISM

TOTAL HOURS: 56

Unit – 1	14 hours
Chapter 1: Huygens' Wave Theory: Review of Huygens' Wave Theory - Principle and construction of wavefront and its types. Derivation of laws of reflection, refraction based on wave optics, Problems.	3 hours
Chapter 2: Interference of Light (Division of Wavefront Method): Review of basic ideas of interference, superposition of light waves, redistribution of energy in interference, expression for resultant amplitude (Qualitative). Conditions for constructive and destructive interference (Qualitative), Young's double slit experiment- derivation of expression for position of bright and dark fringes, fringe width. Fresnel's Biprism - derivation of expressions for β and d , Problems.	4 hours
Chapter 3: Interference of Light (Division of Amplitude Method): Thin film interference (reflected system) - derivation of expression for path difference. Transmitted system (qualitative), Air wedge - derivation for β . Newton's Rings - derivation for radius of curvature of plano-convex lens. Colours of thin films and interference filters (qualitative), Problems.	4 hours
Chapter 4: Interferometry: Michelson's interferometer - construction, working, types of fringes. Applications - determination of wavelength, thickness of transparent sheet, refractive index of gases. Interferometry -Applications. Lasers interferometry-discovery of gravitational waves. Problems.	3 hours
Unit – 2	14 hours
Chapter 5: Fresnel Diffraction: Review of basic ideas of diffraction — Fresnel's half period zones (qualitative), Zone plate - derivation of expression for focal length, comparison with convex lens. Distinction between interference and diffraction, Problems.	3 hours
Chapter 6: Fraunhofer Diffraction: Introduction, comparison of Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at single slit, derivation for width of central maximum, typical diffraction pattern (Graph). Plane transmission diffraction grating - derivation of expression for maxima and minima (oblique incidence), normal incidence (qualitative). Comparison between prism and grating spectra. Resolving power, limit of resolution, Rayleigh's criterion and resolving power of telescope, microscope and diffraction grating (qualitative), Problems.	5 hours

Chapter 7: Polarization: Basic ideas, types of polarization. Production of plane polarized light by reflection - Brewster's law. Plane polarized light by refraction, scattering, selective absorption and double refraction. Calcite crystal: Theory of double refraction-Huygens' explanation; positive and negative crystals. Retarders – quarter wave plate, half wave plate (qualitative). Production and detection of elliptically polarized and circularly polarized light. Optical activity Fresnel's theory (derivation). Laurent's half shade polarimeter (qualitative description), Problems.	
6 hours	
Unit – 3	
14 hours	
Chapter 8: Magnetic Effect of Electric Current: Review of magnetic effect of electric current-Oersted's discovery. Definition of magnetic field (B), ϕ_B and its expression, magnetic flux (Φ_B). Ampere's circuital law -statement and proof. Applications of Ampere's law - B due to a straight conductor carrying current and B along the axis of a solenoid (derivation), Problems.	
3 hours	
Chapter 9: Electromagnetic Induction: Review of Faraday's experiments, Faraday's laws of electromagnetism and Lenz's law. Inductors - self-inductance. Derivation of expression for L due to a solenoid. Derivation of energy stored in a solenoid. Mutual inductance -derivation of M between two coaxial solenoids. expression for M with multiple secondary coils and Eddy currents (qualitative), Problems.	
4 hours	
Chapter 10: Alternating Current Circuits: Review of AC - expressions for average value, RMS value; concepts of reactance, impedance, admittance (qualitative), j-operator and its use in AC circuits. Response of pure R , C and L to AC using j-operators. Analysis of series LCR circuit using j-operator - Electrical resonance. Expression for quality factor, parallel resonance and their relevant expressions (qualitative). Power in AC circuits-series LCR circuit, wattless current, Problems.	
4 hours	
Chapter 11: Magnetic Properties of Materials: Review of three magnetic vectors -Magnetisation (M), Magnetic induction (B), Magnetising force or intensity (H) with mention of relevant expressions. Relation between B , H and M . Magnetic susceptibility (χ_m) and permeability (μ). Diamagnetic, paramagnetic and ferromagnetic materials and their features. Explanation of magnetism based on electron theory. B-H hysteresis curve- description, retentivity, coercivity, hysteresis loss (qualitative) and uses, Problems.	
3 hours	
Unit – 4	
14 hours	
Chapter 12: Maxwell's Electromagnetic Equations: Introduction, displacement current, equation of continuity, Maxwell's electromagnetic equations-derivation using Gauss theorem, Stokes' theorem, Faraday's law and continuity equation. Significance of Maxwell's equations. Problems.	
4 hours	

Chapter 13: Electromagnetic Waves:

Introduction, derivation of velocity of electromagnetic waves from Maxwell's equations in free space and in dielectrics. Poynting's theorem and Poynting vector, Skin effect and Skin depth - (qualitative), Problems.

4 hours**Chapter 14: Communication Using Electromagnetic Waves:**

Radio Communication-Basic model of radio transmission and reception. derivation of expressions for amplitude modulation and frequency modulation. Phase modulation (qualitative). Television – broadcast, reception (using block diagram), bandwidth and different bands (qualitative). Mobile communication (qualitative). Qualitative description of optical, radio, IR, X-ray, and γ -ray astronomy, Problems.

6 hours**Reference Books:**

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1	A Text Book of Optics for Students of Physics (28th Revised Edition)	Dr. N. Subrahmanyam, Brij Lal, Dr. M.N. Avadhanulu	S. Chand	2006
2	Optics and Spectroscopy	R. Murugesan	S. Chand	2010
3	Fundamentals of Optics	Francis Jenkins, Harvey White	McGraw Hill Education	2001
4	Optics (7e)	Ghatak	McGraw Hill	2019
5	Optics (Fifth Edition)	Eugene Hecht, A.G. Ganesan	Pearson IN	2019
6	Principles of Physics (Extended Edition - Twelfth Edition)	Halliday & Resnick	WILEY	2023
7	Concepts of Physics (Volumes 1 & 2)	H. C. Verma	Bharati Bawan (P & D)	2025
8	University Physics with Modern Physics (Fifteenth Edition)	Hugh D. Young, Roger A. Freedman	Pearson	2021
9	Berkeley Physics Course: Electricity and Magnetism	E. M. Purcell	McGraw Hill	2013
10	Electricity and Magnetism (10e)	R. Murugesan	S. Chand	2019
11	Electricity & Magnetism (Fourth Revised Edition, Reprint)	D. C. Tayal	Himalaya Publishing House	2024
12	Electricity and Magnetism	Dr. K. K. Tewari	S. Chand & Co.	2007
13	Electricity and Magnetism (Sixth Edition, Reprint)	Sehgal, Chopra, Sehgal	Sultan Chand & Sons	2004

14	Text Book of Electricity and Magnetism	Ashutosh Kapil	Pearl Books	2020
15	Introduction to Electrodynamics (Fourth Edition)	David J. Griffiths	Cambridge University Press	2021
16	Electronic Devices and Circuit Theory (Eleventh Edition)	Boylestad, Nashelsky	Pearson	2015
17	Basic Electrical Engineering with Lab Exercises (Second Edition)	D.C. Kulshreshtha	McGraw Hill	2019
18	Engineering Physics for Undergraduate Students (Eighth Revised Edition)	R.K. Gaur, S.L. Gupta	Dhanpat Rai Publications	2017

Practical Content

List of Experiments to be performed in the Laboratory (Minimum of 8 Experiments)

Sl. No.	List of Experiments
1.	Radius of a plano-convex lens by Lens Maker's formula.
2.	Determination of wavelength of sodium vapor light using Biprism.
3.	Determination of thickness of paper/thin wire using air wedge.
4.	Determination of radius of curvature of plano-convex lens using Newton's rings.
5.	Determination of wavelength by minimum deviation method using diffraction grating.
6.	Determination of wavelength by normal incidence method using diffraction grating.
7.	Determination of dispersive power and resolving power using diffraction grating.
8.	Determination of specific rotation of sugar solution using diffraction grating.
9.	Study of variation of magnetic field along the axis of a circular coil.
10.	Measurement of self-inductance of coil by V_{ac} and I_{ac} measurements.
12.	Study of series resonance by LCR circuit.
13.	Study of parallel resonance by LCR circuit.
14.	Determination of amplitude modulation coefficient.

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1	B. Sc. Practical Physics	Harnam Singh, Dr. P.S. Hemne	S. Chand & co.	2000
2	Physics through Experiments	B. Saraf	Vikas Publication	1995
3	B. Sc. Practical Physics	C. L. Arora	S. Chand & co.	2020

24SEPPHYE-IVA: Electronic Instrumentation and Sensors (Elective)

TOTAL HOURS -32

Course Learning Objectives:

- To understand basic ideas about Electronic Instrumentation and Sensors.
- To understand basic ideas about types of Electronic Sensors, their advantages, limitations and drawbacks.

Course outcome:

On successful completion of the course, the student will be able to:

- Explain basic ideas about Electronic Instrumentation and sensors.
- Explain basic ideas pertaining to types of electronic Sensors, their advantages, limitations and drawbacks.

24SEPPHYE-IVA: Electronic Instrumentation and Sensors (Elective)

TOTAL HOURS -32

Unit – 1	8 Hours
Requirements for Sensors: Necessity of different types of sensors — thermal, optical, pressure, chemical, mechanical, etc.	
Unit – 2	8 Hours
Conventional Sensors and their Drawbacks: Thermometers, pressure gauges, light meters, specific gravity meters, pH gauges, weighing machines, etc. Their drawbacks. Advantages of Electronic Sensors and Instrumentation: Compactness, energy efficiency, reliability, economy, etc.	
Unit -3	8 Hours
Basic Electronic Component Sensors Diode, transistors, LDR, etc. — basic sensors. Advanced Electronic Component Sensors IC, μ C, LCD, LED, etc. — based sensors and instrumentation.	
Unit -4	8 Hours
Limitations and Drawbacks of Electronic Instrumentation and Sensors Thermal limitations, atmospheric condition limitations, X-ray/radiation hazard based limitations, e-waste problems.	

Reference Books:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1	Electronic Instrumentation	H. S. Kalsi	Mc Graw Hill Education	2017
2	Sensors and instrumentation	Mayar Srivastava, Jaspree Srivatsa , Monica Mehrotra	S. Kataria and Sons	2024
3	Sensors and Transducers	D. Patranabis	PHI learning	2003

24SEPPHYE-IVB: Elements of Nanoscience (Elective)

Course Learning Objectives:

- a) To understand basic ideas about Origin of Nano Science, Special properties of Nanomaterials, Fullerenes and Nanotubes.
- b) To understand basic ideas about Nanomaterials, Nano Science related-technologies, Problems and drawbacks of Nanoscience.

Course outcome:

On successful completion of the course, the student will be able to:

- a) Explain basic ideas about Origins of Nano Science, special properties at Nanoscale, Fullerenes and Nanotubes.
- b) Explain basic ideas about Nanomaterials, Nano Science related technologies, Problems and drawbacks of Nanoscience.

24SEPPHYE-IVB: Elements of Nanoscience (Elective)**TOTAL HOURS -32**

Unit – I	8 hours
Origins of Nanoscience: Richard Feynman's Talk - "There's plenty of room at the bottom". Coining of the word "nanotechnology" by Norio Taniguchi and Heinrich Rohrer. Definition of nanoscience, distinction between nanoscience and nanotechnology, modern synthesis of nanostructures – top-down and bottom-up approaches. Evidence of nanomaterials - ancient civilization.	
Unit – II	8 Hours
Special Properties at the Nano scale Large increase in surface area at Nano scale – illustration on forming a 1 cm sphere with corresponding 1 nm particles. Physical, chemical, electrical, magnetic, thermal differences in properties of bulk materials and Nano scale materials. Role of STEM in Nano science.	
Unit -III	8 Hours
Fullerenes and Nanotubes: C60 Bucky ball, C-nanotubes, C-dots – synthesis, properties and applications. Drug delivery, Nano informatics, Nano computers.	
Unit – IV	8 Hours
Nano Science-Related Technologies: Nano electronics, nano diagnostics, nano biotechnology, smart materials, constructional nanomaterial's. Problems and Drawbacks of Nano science High cost of development, Environmental risks, Health risks, Security and privacy issues, Economic disruption, Unknown long-term effects.	

Reference Books:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1.	Introduction to Nanoscience and nanotechnology	Charles P poole, Frank J Owens	Wiley-Interscience	2003
2.	Nanotechnology-Principles and practices	Sulabha K Saraf	Springer Nature	2014
3.	Nanoscience concepts and fundamentals	Diptonil Banerjee, Nirmalya Sankar Das	Consortium eLearning Network Pvt. Ltd.	2019
4.	Text book of nanoscience and nanotechnology	T. Pradeep	McGraw Hill Education	2017
5.	Concise concepts of nanoscience and nanotechnology	Narendra Kumar, Santha kumbhat	Scientific Publishers India	2018
6.	Introduction to nanoscience and nanotechnology	P Venugopal Reddy, M Lakshmi	BSP Books	2023
7.	Introduction to Nanoscience and Nanotechnology	Chris Bines	Wiley	2021

THEORY EXAMINATION QUESTION PAPER PATTERN FOR MAJOR SUBJECTS
(Semesters I –VI)

B. Sc. Semester-I-IV Degree Examination; 2025-26
(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: SCIENCE COURSES

Paper – _____ : _____
Paper Code: _____

Time: 3 Hours
80

Max. Marks:

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

I. Answer all the following questions:

(2×10=20)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

SECTION-B

II. Answer any SIX of the following:

(5×6=30)

- 11.
- 12.
- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

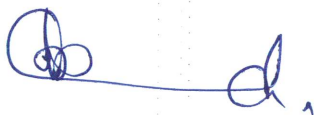
SECTION -C

III. Answer Any Three of the following:

(10×3=30)

- 19.
- 20.
- 21.
- 22.

From Unit-I
From Unit-II
From Unit-III
From Unit-IV



THEORY EXAMINATION QUESTION PAPER PATTERN FOR
ELECTIVE/OPTIONAL PAPERS

(Semesters III & IV)

B.Sc. Semester-I/II/III/IV/V Degree Examination; 2025-26
(Semester Scheme; New Syllabus: 2024-25)

SUBJECT: SCIENCE COURSES

Paper – ELECTIVE/OPTIONAL III & IV _____: _____

Paper Code: _____

Time: 2 Hours

Max. Marks: 40

Instructions to candidates:

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

SECTION-A

Answer **all** the following questions:

(2×5=10)

- 1.
- 2.
- 3.
- 4.
- 5.

SECTION-B

Answer any **SIX** of the following:

(5×6=30)

- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

