Davangere University

Shivagangothri, Davangere- 577007

SYLLABUS and COURSE STRUCTURE

of

PHYSICS

as per the Choice Based Credit System (CBCS) designed in accordance with of State Education Policy (SEP-2024)

Syllabus of III and IV Semester

Bachelor of Science (B. Sc. Physics)

Dr. U.S. MAHABALESHWAR
M.Sc., M.Phil., Ph.D.
Professor & Dean, Science & Technology
Davangere University, Shivagangotri,
Davangere-577 007, Karnataka, India

w.e.f.

Academic Year 2024-25 and onwards

Registrar
Davangere University
Shivagangotri, Davangere.

Chairman
Board of Studies
Department of Physics
Davangere University
Shivagangotri, Davangere-07

Programme Outcomes:

By the end of the program the students will be able to:

1. Acquire in depth knowledge of almost all basic branches of physics such as mechanics, properties of matter, relativity, electricity and magnetism, wave motion, optics, thermal physics, electronics, classical mechanics, quantum mechanics, spectroscopy, nuclear physics, condensed matter physics and also advanced areas like nanoscience, energy science, astrophysics, instrumentation.

2. Communicate effectively physics concepts with examples related to day to day life. Acquire ability of recognizing and distinguishing various aspects of physics found in real life.

3. Learn, perform and design experiments in the laboratory to demonstrate the concepts, principles, laws of physics, theories learnt in the class rooms.

4. Acquire the ability of critical thinking and logical reasoning in physics problems and their solutions. Develop ability to analyze physics problem including simple to thought provoking problems and apply the acquired knowledge to solve.

5. Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.

6. Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.

7. Apply the professional ethics and norms in respective discipline.

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Davangere University

Bachelor of Science (B. Sc.)

Curriculum Structure for Undergraduate Programme for 2024-25

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.
	24SEPPHYP-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.
	24SEPPHYP-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.
	24SEPPHYP-III	Practical - III	**MC-P**	04	40	10	**50**	02	3 Hrs.
	24SEPPHYOE-IIIA 24SEPPHYOE-IIIB (Open Elective Optional – I*)	A) Energy Sources B) Physics for All	**OEL/ OP-I**	02	40	10	**50**	02	2 Hrs.
	Total			**10**	**160**	**40**	**200**	**07**	---
Semester-IV									
4	24SEPPHYT-IV	Wave Optics and Electromagnetism	**MC-T**	04	80	20	**100**	03	3 Hrs.
	24SEPPHYP-IV	Practical - IV	**MC-P**	04	40	10	**50**	02	3 Hrs.
	24SEPPHYOE-IVA 24SEPPHYOE-IVB (Open Elective Optional – II*)	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**	---
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.
	24SEPPHYP-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.
	24SEPPHYP-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; **OEL/Op:** *Open 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.
	24SEPPHYP-III	Practical - III	MC-P	04	40	10	50	02	3 Hrs.
2	24SEPPHYOE-IIIA 24SEPPHYOE-IIIB	Open 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:

a) To understand the basic ideas of nature of light, geometrical optics, lenses and optical photography.

b) To understand the basic ideas of Electrostatics, Gauss's law, Capacitors.

c) To understand the basic ideas of Electric current, effects of electric current and Thermoelectricity.

d) 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:

a) Explain basic ideas of Geometrical Optics, Optical photography.

b) Explain the basic concepts of Electrostatics, Gauss's law and Capacitors.

c) Explain the basic ideas of Electric current, effects of electric current and thermoelectricity.

d) 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. **7 hours**

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. **4 hours**

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. **6 hours**

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. **4 hours**

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. **5 hours**

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. **6 hours**

Chapter 13: AC Bridge Networks:

Wheatstone's bridge (Qualitative), Maxwell's bridge and De-Sauty's bridge - derivation of expressions, Problems. **3 hours**

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. Murugeshan	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. Murugeshan	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

24SEPPHYOE-IIIA: ENERGY SOURCES (Open 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

24SEPPHYOE-IIIB: PHYSICS FOR ALL (Open 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.

24SEPPHYOE-IIIB: PHYSICS FOR ALL (Open 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.
	24SEPPHYP-IV	Practical - IV	**MC-P**	04	40	10	**50**	02	3 Hrs.
	24SEPPHYOE-IVA 24SEPPHYOE-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:

a) To understand basic ideas of Huygen's Wave theory, interference of light and Interferometry.

b) To understand concepts and applications of Diffraction of light and Polarisation of light.

c) To understand concepts and ideas about Magnetic effect of electric current, Electromagnetic induction, Ac circuits and Magnetic properties of materials.

d) 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:

a) Explain ideas pertaining to Huygen's Ware theory, Interference of light and interferometry.

b) Explain concept and ideas about Diffraction and Polarisation of light.

c) Explain the ideas about magnetic effect of electric current, Electromagnetic induction, AC Circuits and Magnetic properties of materials.

d) 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

Chapter11: 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. Murugeshan	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. Murugeshan	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 Iac 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

24SEPPHYOE-IVA: Electronic Instrumentation and Sensors (Open Elective)

TOTAL HOURS -32

Course Learning Objectives:

a) To understand basic ideas about Electronic Instrumentation and Sensors.

b) 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:

a) Explain basic ideas about Electronic Instrumentation and sensors.

b) Explain basic ideas pertaining to types of electronic Sensors, their advantages, limitations and drawbacks.

24SEPPHYOE-IVA: Electronic Instrumentation and Sensors (Open 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, μC, 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

24SEPPHYOE-IVB: Elements of Nanoscience (Open 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.

24SEPPHYOE-IVB: Elements of Nanoscience (Open 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

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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 **Max. Marks: 80**

Instructions to candidates:

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

SECTION-A

1. Answer **all** the following questions: **(2×10=20)**

a)
b)
c)
d)
e)
f)
g)
h)
i)
j)

SECTION-B

Answer any **SIX** of the following: **(5×6=30)**

2. From Unit-I
3. From Unit-I
4. From Unit-II
5. From Unit-II
6. From Unit-III
7. From Unit-III
8. From Unit-IV
9. From Unit-IV

SECTION -C

Answer **Any Three** of the following: **(10×3=30)**

10. From Unit-I
11. From Unit-II
12. From Unit-III
13. From Unit-IV

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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

I. Answer **all** the following questions: **(2×5=10)**

1.
2.
3.
4.
5.

SECTION-B

II. Answer any **SIX** of the following: **(5×6=30)**

6. From Unit-I
7. From Unit-I
8. From Unit-II
9. From Unit-II
10. From Unit-III
11. From Unit-III
12. From Unit-IV
13. From Unit-IV

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