25PH101: Engineering Physics

w. e. f. Academic Year:	**2025-26**
Semester:	**1/2**
Category of the Course:	**Basic Science**
Prerequisite:	Basic concepts of high school physics.
Rationale:	Engineering Physics serves as a bridge between applied physics and engineering practices. It: • Equips students with the physical principles that underpin modern engineering applications. • Enhances analytical thinking by connecting theory with experiments. • Prepares learners for advanced studies in areas like nanotechnology, optics, quantum computing, and material science. • Addresses emerging technologies such as ultrasonics, lasers, fiber optics, and non-destructive testing, ensuring relevance to industrial needs.

Course Outcomes:

After Completion of the Course, Student will be able to:

	Course Outcome (CO)	**RBT Level (Cognitive Domain)**
CO1	Explain the fundamental concepts of acoustics and elasticity including damping, resonance, and mechanical properties of solids.	Understand
CO2	Apply the principles of laser and fiber optics to analyze optical systems and communication technologies.	Apply
CO3	Analyze quantum mechanical concepts such as wave-particle duality and Schrodinger's wave equation and compare classical and quantum computing.	Analyze
CO4	Evaluate the characteristics and structural properties of crystals using Miller indices and packing factors.	Evaluate
CO5	Differentiate between conductors, semiconductors, and superconductors using band theory, Hall effect, and explain their applications.	Analyze
CO6	Apply the concepts of nanomaterials synthesis and non-destructive testing techniques to assess material integrity and industrial use cases.	Apply

Teaching and Evaluation Scheme:

Teaching Scheme					Examination Scheme				
L	T	P	C	Hrs/Week	IE	Theory	CIA	Practical	Total Marks
3	-	2	4	5	40	60	30	20	150

IE: Internal Evaluation Theory: Theory Exam (End Semester)
CIA: Continuous Internal Assessment Practical: Practical Exam (End Semester)

Detailed Syllabus:

Topic		Hrs.	% of Weightage
UNIT: 1	**ACOUSTIC AND PROPERTIES OF MATTER**	**12**	**26**
ACOUSTIC: Introduction (Simple Damped Harmonic motion, Damping, Resonance, Force vibration and amplitude resonance), characteristics of musical sound, sound intensity and intensity level of sound, Sound absorption and reverberation, Sabine's formula (excluding derivation), acoustics of buildings, Properties of ultrasound, Generation of ultrasonics (Piezoelectric & magnetostriction oscillator), Applications of ultrasonics. **ELASTICITY**: Introduction (Stress, Strain, Hooke's law, Young's modulus, Rigidity modulus, Elastic behaviour of Material), determination of co-efficient of rigidity modulus of wire, Bending Moment of the beam, cantilever, determination of young's modulus of the materials, Applications.			
UNIT: 2	**OPTICS**	**11**	**24**
LASER: Introduction (Huygens' Principle, wave propagation, basic principle for understanding diffraction and interference-constructive & destructive), Characteristics of Laser, spontaneous and stimulated emission, population Inversion, Solid State (Nd-YaG) Laser, Gas (CO_2) laser, Applications of Lasers. **FIBRE OPTICS**: Introduction, basic principle and criteria, construction of Fibre Optics (FO), FO Communication system, Acceptance Angle and Numerical Aperture, Types of FO, Applications of FO.			
UNIT: 3	**MODERN PHYSICS**	**12**	**27**
INTRODUCTION OF QUANTUM MECHANICS & QUANTUM COMPUTING: Introduction (Black body Radiation-Planck's law, Wave-particle duality-de Broglie matter waves), Heisenberg's Uncertainty Principle and its applications, Basic Postulates and Formalism of QM: Energy, Momentum and Hamiltonian Operator, interpretation of Schrodinger's wave equation, Introduction of Quantum Computing, Classical Computing vs Quantum Computing, Applications of Quantum Computing. **CRYSTAL STRUCTURE**: Introduction of Crystal Structure, Space lattice, Basis, Unit cell, Lattice parameter, Bravais lattices, Crystal systems, Directions and planes in crystals, Miller indices, Relation between			

Interplanar spacing and cubic edge, atomic radius and packing fractions of SC, BCC, FCC, Applications			
UNIT: 4	**MATERIAL SCIENCE**	**10**	**23**
BAND THEORY OF SOLIDS: Introduction, Metals, Insulators and Semiconductors, Energy band gap, Hall effect and its importance, Superconductivity, Properties of superconductors, Types of superconductors (Type-I and Type-II), Applications of Superconductors. **NANOMATERIALS AND NDT:** Introduction, Synthesis of nano materials: Top-down and Bottom-up approach, Sol-gel method, **Applications:** Introduction to Non-Destructive Testing (NDT) & applications, Objectives of NDT and types of defects, Liquid Penetrant NDT method, Ultrasonic Inspection method, Eddy Current NDT method.			
	Total Hours	**45**	**100**

List of Practical:

Topic	Hrs
Measurement of Intensity Level (in dB) of various Sounds.	2
Elasticity of materials via Young's Modulus method.	2
Moment of Inertia of given body by using Torsional Pendulum.	2
Approximate the wavelength of LASER using diffraction grating.	2
Estimate the Numerical Aperture of Fiber Optics.	2
Simulation of nuclear radioactive decay.	4
Analyze the Miller Indices of crystal using x-rays diffraction pattern.	2
Verify de-Broglie Relation using x-rays diffraction pattern of crystal.	2
Measure the Threshold & Breakdown voltage of diodes (Si, Zener, LED).	4
Measure the value of Planck's constant using various LED.	2
Understanding the nano scale of Nanomaterials.	2
Energy Band gap Eg of Semiconductor.	2
Application of Solar Cell.	2
Total Hours	**30**

Reference Books:

1. Engineering Physics; G. Aruldhas, PHI Learning Private Ltd., New Delhi.
2. Engineering Physics, V. Rajendran, McGraw-Hill India
3. Engineering Physics; G. Vijayakumari, S.Chand.
4. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar, S. Chand
5. Applied Physics for Engineers, Neeraj Mehta, PHI Learning Private Ltd
6. Engineering Physics, Dattu Joshi, McGraw-Hill Education
7. Principles of Engineering Physics 1-2, Md Nazoor Khan, Simanchala Panigrahi, Cambridge University Press

8. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill Education
9. Quantum Computing Simplified: Demystifying Quantum Concepts for Beginners, Ronald K. Smith, The Great Publishers.
10. Applications and Principles of Quantum Computing, Alex Khang, IGI Global
11. Principles Of Quantum Computation and Information, Vol-I/II Basic Concepts, Basic Tools and Special Topics (Giuliano Benenti, Giulio Casati, World Scientific Publishing Co
12. Quantum Computing A Gentle Introduction, Eleanor G. Rieffel, Wolfgang H. Polak, The MIT Press
13. Quantum Computing from Bit to Qbit for Everyone (Quantum Field Theory Possible Applications)
14. https://archive.nptel.ac.in/courses/106/106/106106232/

Course Outcomes Mapping:

CO No.	Course Outcome (CO)	POs/PSOs Mapped	Cognitive Level (RBT)	Knowledge Category	Class Sessions (Lecture)
CO1	Explain the fundamental concepts of acoustics and elasticity including damping, resonance, and mechanical properties of solids.	PO1, PO2, PO4, PO10, PO12, PSO1	U	C	12
CO2	Aapply the principles of laser and fiber optics to analyze optical systems and communication technologies.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2	Ap	P	11
CO3	Analyze quantum mechanical concepts such as wave-particle duality and Schrodinger's wave equation and compare classical and quantum computing.	PO1, PO2, PO4, PO5, PO10, PO12, PSO1, PSO2	An	C	7
CO4	Evaluate the characteristics and structural properties of crystals using Miller indices and packing factors.	PO1, PO2, PO4, PO12, PSO1	E	C	5
CO5	Differentiate between conductors, semiconductors, and superconductors using band theory, Hall effect, and explain their applications.	PO1, PO2, PO4 PO5, PO12, PSO1, PSO2	An	C	4
CO6	Apply the concepts of nanomaterials synthesis and non-destructive testing techniques to	PO1, PO2, PO3, PO4, PO5, PO7,	Ap	P	6

	assess material integrity and industrial use cases.	PO10, PO12, PSO1, PSO2			

Mapping of COs with POs & PSOs:

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3		3						3		3	3	
CO2	3	3	2	3	3							3	3	3
CO3	3	3		3	3					3		3	3	3
CO4	3	3		3								3	3	
CO5	3	3		3	3							3	3	3
CO6	3	3	2	3	3		1			3		3	3	3

3: High, 2: Medium, 1: Low