Course Code	**:**	**PHIR11**
Course Title	**:**	Physics –I (Theory)
Credits	**:**	**4(2L +1T+2P)**
Prerequisites	:	**-**
Course Type	**:**	**EPR**

Course Learning Objectives:

- To develop the understanding of fundamentals of Physics essential for engineering and technology.
- To introduce engineering relevance of Quantum mechanics, Electromagnetic theory, Crystal Physics, Optics, Theory of relativity, Lasers and Nuclear technology.

Course Content

UNIT-I

QUANTUM MECHANICS: Basics of quantum mechanics, De-Broglie's hypothesis, Uncertainty principle, Probability and Wave function, Postulates of quantum mechanics, Time-dependent and Time-independent Schrodinger wave equation, Particle in a box.

ELECTRO MAGNETIC THEORY: Maxwell's equations in vacuum and medium, Electromagnetic Waves, Propagation Energy and Poynting Vector.

UNIT-II

SOLID STATE PHYSICS: Space Lattice, unit cell and translation vectors; Miller indices, Simple and close-packed crystal structures with examples, Origin of energy bands, Kronig Penney Model (qualitative), E-K diagram, Brillouin Zones, Concept of effective mass and holes, Classification into metals, Semiconductors and insulators, Liquid crystals, Hall effect.

UNIT-III

SPECIAL THEORY OF RELATIVITY: The Michelson-Morley experiment, relativistic transformations, length contraction, time dilation, variation of mass with velocity, mass-energy equivalence.

NUCLEAR TECHNOLOGY: Interaction of radiation with matter, Nuclear reactors, Moderators, Reactor criticality & Neutron cross-section

UNIT-IV

ENGINEERING OPTICS: Basics of Interference, Diffraction and Polarization. Lasers and characteristics, Einstein's coefficients, He-Ne laser, semiconductor lasers, Applications of Lasers, Optical fibres; Numerical aperture, Classification of optical fibres, fibre Losses, fibre manufacturing, Applications of optical fibre in industry and communication.

Reference Books

1. D.J. Griffiths, Introduction to Electrodynamics, PHI Learning Publishers, New Delhi, 2012
2. H.D Young and R.A Freedman, University Physics with Modern Pearsons publications, 2012.
3. S.O.Pillai, Solid state Physics, New age International publishers, 2012
4. A. Beiser, Concepts of Modern Physics, McGraw-Hill, 2008.
5. John Lilley, Nuclear Physics, Principles and applications, Wiley, 2016

Course Outcomes:

- Students will be able to understand the basics of quantum mechanics and electromagnetic theory for technological applications.
- Students will be able to solve engineering problems on solid state materials and nuclear reactors
- Students will get knowledge of latest developments in Lasers and fibre optics and their applications in technology.

Course Code	**:**	**PHIR12**
Course Title	**:**	**B. Tech. Physics-II (CE, ME &PR)**
Credits	**:**	**4(2L +1T+2P)**
Prerequisites	**:**	**-**
Course Type	**:**	**EPR**

Course Learning Objectives

- To understand mechanical properties of materials, Physics of Magnetic Materials and Superconductors, Thermal Physics and Physics of Nanotechnology.
- To develop the approach to handle engineering problems on various materials.
- To prepare the students to take up the future engineering challenges related to materials.

Course Content

UNIT-I

MECHANICAL PROPERTIES OF MATERIALS: Phase diagram, Gibbs phase rule, Binary phase diagram its types, solid solution: Hume Rothery Rules, Concepts of stress and strain, Stress-Strain diagrams; Tensile test; Elastic deformation, Plastic deformation. Impact Testing & toughness behavior. Hardness of materials, Imperfections and dislocations

UNIT-II

THERMAL PHYSICS: Seebeck effect, Peltier effect, Thomson effect, Kelvin relationships, Wiedemann-Franz law, Thermal equilibrium, Entropy, The laws of thermodynamics, Thermal conductivity of bulk materials, Phonons: lattice vibration heat transfer, specific heat of solids, classical, Einstein and Debye Model, Ideal quantum gases: Maxwell-Boltazmann, Bose–Einstein, Fermi-Dirac statistics, Carnot efficiency.

UNIT-III

MAGNETIC MATERIALS AND SUPERCONDUCTORS: Orbital diamagnetism, Magnetic moments, orbital diamagnetism, Classical theory of Paramagnetism, Ferromagnetism, molecular field theory and domains, applications of magnetic materials, Type I and II Superconductors, London equation, Applications of superconductivity.

UNIT-IV

NANOTECHNOLOGY: Classifications of nanomaterials (3D, 2D, 1D and 0D) and their density of states, nanocomposites, carbon nanotubes (CNTs), graphene, nanoclusters, structural, thermal and mechanical properties of nanomaterials, bottom up and bottom down synthesis processes, basic characterization techniques for nanomaterials, Applications of nanotechnology.

Reference Books

1. Schroeder, Daniel V. "An introduction to thermal physics, 1999
2. Garg, Bansal. Thermal physics, Tata McGraw-Hill Education, 2013
3. Wole Soboyejo, Mechanical Properties of Engineered Materials, Marcel Dekker, 2003
4. D. K. Bhattacharya, Engineering Physics, Oxford University Press, 2015
5. Charles P. Poole, Jr and Frank J. Owens, Introduction to Nanotechnology, John Wiley & Sons,2006

Course Outcomes

- Students will be able to solve the practical problems related to the technological applications of materials.
- Students will be able to design and develop materials for industrial applications

Course Code	**:**	**PHIR14**
Course Title	**:**	**Physics –II (CS & IT)**
Credits	**:**	**4(2L +1T+2P)**
Prerequisites	:	**-**
Course Type	**:**	**IR**

Course Learning Objectives

- To understand the basics of quantum computing
- To understand the fundamental concepts of optoelectronic devices for information technology
- To understand the behavior of emerging magnetic materials for data storage devices and nanomaterials

Course Content

UNIT-I

PHYSICS OF QUANTUM COMPUTING: Quantum theory- simple concepts, Wave function and its physical significance, applications of Schrödinger wave equations, concept of spin, qubits and quantum computing

UNIT –II

OPTOELECTRONIC DEVICES: Optoelectronic processes and systems, Photoconductive devices, Photoemissive devices, Photovoltaic devices, Photodetectors, Light Emitting Diode, Liquid Crystal Display, Plasma display panel.

UNIT- III

MAGNETIC MATERIALS AND DEVICES: Molecular field theory and domains, basic ideas of Magnetoresistance, types and applications of Magnetoresistance, spintronics, fundamental concepts of magnetic data storage: writing and read head sensors.

UNIT-IV

NANOTECHNOLOGY: Classification of nanomaterials (3D, 2D, 1D and 0D) and their density of states, nanocomposites, carbon nanotubes (CNTs), graphene, nanoclusters, structural, thermal and mechanical properties of nanomaterials, bottom up and bottom down synthesis processes, basic characterization techniques for nanomaterials, Applications of nanotechnology.

Reference Books

1. Alastair I. M. Rae, Quantum Mechanics, Taylor and Francis, 2011
2. S. O. Kasap, Principles of Electronic Materials and Devices, McGraw Hill, 2006.
3. John Wilson and John Hawkes, Optoelectronics: an introduction, Prentice Hall, 1997.
4. S. L. Gupta, V. Kumar, A Hand Book of Electronics, Pragati Prakashan, 2012.
5. Katsuaki Sato and Eiji Saitoh (Editors), Fundamentals of Magnetoresistance Effects, John Wiley publication, 2016
6. Charles P. Poole, Jr, Frank J. Owens, Introduction to Nanotechnology, Wiley, 2016

Course Outcomes

- Students will understand quantum computing for information technology.
- Students will be able to use the Physics of optoelectronic devices, fiber optics in engineering applications
- Students will be able to develop new magnetic materials and devices used for data storage

Course Code	**:**	**PHIR13**
Course Title	**:**	**PHYSICS – II (EE & ECE)**
Credits	**:**	**4(2L+1T+2P)**
Prerequisites	**:**	**-**
Course Type	**:**	**EPR**

Course Learning Objectives

- To gain knowledge of the electronic, dielectric and magnetic properties of materials.
- To understand theories relevant to the engineering principles of materials and devices.
- To solve problems related to semiconductor device operation in technology.

Course Content

UNIT-I

ELECTRONIC PROPERTIES OF MATERIALS: Drude and Sommerfeld's Free Electron theory of Metals, Concept of Fermi level, Fermi-Dirac distribution function, Charge carrier densities.

NANOTECHNOLOGY: Classifications of nanomaterials (3D, 2D, 1D and 0D) and their density of states, Quantum confinement, Manifestation of quantum confinement on optical, electrical and mechanical properties, basic characterization techniques for nanomaterials, Applications of nanotechnology.

UNIT-II

DIELECTRIC PROPERTIES OF MATERIALS: Polarization, Bound Charges, Electric displacement, susceptibility, dielectric coefficient, permittivity & various relations between these, Dielectrics in ac fields, Dielectric loss factor, effect of temperature and frequency on dielectric constant and dielectrics loss factor (qualitative description), Applications of dielectrics.

UNIT-III

SEMICONDUCTING PROPERTIES OF MATERIALS: Direct and indirect Band gap semiconductors, Elemental and compound semiconductors, Equilibrium and extrinsic carrier concentration, carrier transport, Drift and Diffusion current, mobility, Excess carrier generation and recombination, tunnel diode, solar cell, LEDs

UNIT-IV

MAGNETIC MATERIALS AND SUPERCONDUCTORS: Orbital diamagnetism, Atomic magnetic moments, orbital diamagnetism, Classical theory of Paramagnetism, Ferromagnetism, molecular field theory and domains, applications of magnetic materials, Type I and II Superconductors, London equation, Applications of superconductivity.

Reference Books

1. Arthur Beiser, Tata McGraw Hill, Concept of Modern Physics, publication, 2003
2. Charles Kittel, John Wiley, Introduction to Solid State Physics, publication, 2013
3. Ben G. Streetman, Prentice-Hall of India, Solid State Electronic Devices, 2012
4. Jaspreet Singh, John Wiley, Semiconductor Devices-Basic Principles, publication 2008
5. D. K. Bhattacharya, Oxford University Press, Engineering Physics, 2015

Course Outcomes

- Students will understand the physics underlying the electronic and magnetic behavior of materials.
- Students will be able to estimate materials properties and engineer these.
- Students will understand the operation mechanism of basic components of various electrical and electronic devices.

B.Tech 7th Semester
PHT-471T: LASERS

L	T	P		Credit	:	3.5
				Sessional	:	50
3	1	-		Theory	:	50
				Total	:	100

Unit-I

Quantum behavior of light, concept of spontaneous and stimulated emission, Derivation of Einstein relations, Population Inversion, Pumping methods, condition for light amplification, Two, three and four level laser systems, quantum efficiency, laser rate equations and Threshold condition. Components of laser devices, Laser action, Temporal and spatial coherence. Optical cavities: gain and losses in optical cavities, Laser resonators, their characteristics, design and construction.

Unit-II

Design and operating characteristics of solid state (Nd: YAG and glass laser), Tunable dye lasers, gaseous (CO_2 and Argon laser), semiconductor lasers and Free-Electron Laser (FEL). Mode locking, Types of mode Locking, Q- Switching.

Applications of Lasers in Mechanical, Electronics, Nuclear energy, Medical, Optical data storage devices, Holography, Environmental studies, Communications.

Note: EIGHT questions are to be set – **Four** from unit-I, **Four** from Unit-II and the candidates will be required to attempt **FIVE QUESTIONS** selecting at least TWO from each unit.

Books Suggested:

1. Ajay Ghatak: Optics, McMillan India.
2. W.T. Silfvast : Laser Fundamentals, Foundation Books.
3. B.B. Laud: Lasers and Non-linear Optics, Wiley Eastern Limited.
4. Svelto Lasers, Pergmon.
5. Thyagarajan & Ghatak: Laser Theory and applications.
6. Yariv : Quantum Electronics

B.Tech 7th Semester
PHT-472T: ULTRA SONIC

		Credit	:	3.5
L	T	Sessional	:	50
3	1	Theory	:	50
		Total	:	100

Unit-I

Physics of ultrasonics-wave motion, velocity of propagation, characteristic impedance, reflection, attenuation and transmission through layers, Particle and radiation pressure.

Generation of Ultrasonics: Ultrasonics transducers-piezoelectric and magnetostrictive transducer, equivalent circuits, impedance matching, high and low power devices.

Unit-II

Ultrasonic based bio-instrumentation:

Instrumentation and application; Ultrasonic sensing using plus echo and Doppler techniques. Industrial processing units, Ultrasonic instrumentation in measurement and control: Flaw detection diagnostic, therapeutic and ultrasonic instrumentation.

Note: EIGHT questions are to be set – **Four** from unit-I, **Four** from Unit-II and the candidates will be required to attempt **FIVE QUESTIONS** selecting at least TWO from each unit.

Books Suggested:

1. Ultrasonic Engineering : J.R.Fredrick
2. Physical Principal of Ultrasonic Diagnosis : P.N.T. Wells