16HS102 ENGINEERING PHYSICS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

Technology is the experimental information for the physicist, where the theories can be tested. Recent technical developments have been the results of collaboration of physicists and engineers.

Study of engineering physics is a unique opportunity to learn the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.

The present course deals with various fields such as lasers, optical fibres, photonics, nano and funcational materials, make the students to enrich basic knowledge in various fields of physics and apply the same in engineering fields.

Course Outcomes:

Upon completion of the course, the student will be able to

CO1: Recognize the relevant applications of Ultrasonic waves by the grasp over their production and properties.

CO2: Analyze the characteristics of Laser for suitable applications in the field of industry, medicine and communication and to foster the knowledge on optical fibers to realize fiber optic communication and fiber optic sensors.

CO3: Apply the principles of quantum mechanics to learn the dynamics of free electrons in metals.

CO4: Evaluate efficiency of Solar cell and to understand the functioning of Photonic devices.

CO5: Demonstrate the knowledgeon fabrication and applications ofNanomaterialsand latest advanced materials.

SKILLS:

- ✓ *Determine the velocity of ultrasonics in a given liquid using interferometer.*
- ✓ *Study the wavelengths of light sources and lasers.*
- ✓ *Estimate the efficiency of a given solar cell.*
- ✓ *Learn about the type of the optical fibre and their ability to propagate light waves from its numerical aperture.*
- ✓ *Know voltage – current characteristics of a given light emitting diode.*

UNIT - 1 L-9

ULTRASONICS : Introduction – production of ultrasonic waves, piezoelectric method, properties of ultrasonic waves, types of ultrasonic waves, determination of velocity of ultrasonic waves in solids and liquids; SONAR - medical applications.
NDT: Introduction- types, visual inspection and liquid penetrate testing; Ultrasonic testing systems; X - ray radiography.

UNIT - 2 L-9

LASERS : Characteristics of laser light – spontaneous and stimulated emission of radiation, He-Ne laser, CO_2 laser, semiconductor laser and applications.
HOLOGRAPHY: Holography and applications.
FIBER OPTICS : Principle of optical fibre – acceptance angle, numerical aperture, types of fibres, dispersion and attenuation in optical fibres, optical fibre communication system and fibre optic sensors.

UNIT - 3 L-9

QUANTUM MECHANICS : Introduction- matter waves, Schroedinger's time independent wave equation, physical significance of the wave function, particle in one dimensional potential well and tunneling phenomenon.
FREE ELECTRON THEORY OF METALS : Introduction – classical free electron theory, electrical conductivity of metal, quantum free electron theory, Fermi - Dirac distribution function and its variation with temperature
PARTICLE ACCELERATORS: Introduction- cyclotron, synchrocyclotron, betatron and applications.

UNIT - 4 L-9

SOLAR ENERGY: Solar radiation, photovoltaic effect, solar cells, efficiency of solar cell and solar thermal energy conversion systems.
PHOTONICS: LED, LCD, photo conducting materials, photo detectors, photonic crystals, non- linear optical behaviour of materials and applications.

UNIT - 5 L-9

NANO MATERIALS: Introduction, fabrication of nano materials, ball milling, sol-gel, physical and chemical properties of nano materials and applications.
FUNCTIONAL MATERIALS: Smart materials, shape memory alloys, chromic materials (thermo, photo and electro), metallic glasses, advanced ceramics, composites, fiber reinforced plastics/ metals and biomaterials.

TEXT BOOKS:

1. V. Rajendran, "Engineering Physics", 7th edition, TMH Publications, 2014
2. D.K. Bhattacharya and P. Tandon, "Engineering Physics", Oxford University Press, 2015.

REFERENCE BOOKS :

1. M.R. Srinivasan, "Engineering Physics", 1st edition, New Age International Publishers, 2008.
2. M.N. Avadhanulu and P.G. Kshirsagar, "Engineering Physics", 1st edition, S. Chand and Company Ltd, 1992.
3. S.P. Sukhatme, "Solar Energy", 2nd edition, TMH Publication, 2005.
4. Dr. Arumugam, "Materials Science", 3rd edition, Anuradha Publications, 2002.

ACTIVITIES:

- *Estimate acoustic impedance of a given material.*
- *Measurement of distances using ultrasonic range finder.*
- *Study of linear density of yarn/ fibre using Melde's experiment.*
- *Determination of refractive index of a given liquid using laser.*
- *Find height of a room using laser.*
- *Identify the type of semi-conductor using Hall effect.*
- *Study of numerical aperture of optical fibres made of different materials.*
- *Design of solar panel to obtain required voltage.*
- *Evaluate thermal conductivity of materials.*
- *Measure temperature using thermo couple.*