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**DEPARTMENT OF PHYSICS**

**Engineering Physics**

**TPH 101/201**

1. **Subject Code**: **Course Title:**

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2. **Contact Hours**: L: T: P:

 . **Semester**: I / II

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3. **Credits:**

4. **Pre-requisite**: Basic Knowledge of Physics

5. **Course Outcomes**: After completion of the course students will be able to

1. Define the wave nature of light through different phenomenon.
2. Extend the knowledge of Laser, fiber optics and polarization in engineering problems.
3. (a) Apply band theory of solids to study the properties of different electronic materials.

(b) Understand the concept of theory of relativity.

1. (a) Examine the electrical properties of semiconductors and study their dependence on various

parameters.

(b) Examine the behavior of Electromagnetic Waves (EM) using Maxwell Equations.

1. (a)Explain the concepts of nanostructures and study their fabrication and characterization techniques.

(b) Explain the properties of Superconductors.

1. (a) Discuss probe technique to measure the electrical properties of semiconductors.

(b) Discuss quantum theory of radiation and applications of Schrodinger wave equations.

6**. Detailed Syllabus: [Unit/ Module I-V for CS Branch & Unit/ Module IV-VIII for Other Branches**]

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|  **UNIT** | **CONTENTS** | **Contact Hrs** |
| **Unit/ Module - I** | **Electronic materials:** Free electron theory, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Fermi level, Effective mass, Schrodinger wave equation, 1-D Potential well | **8** |
| **Unit/ Module - II** | **Semiconductors :** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction | **8** |
| **Unit/ Module – III** | **Nano Physics**: Density of states in 2D, 1d and 0D (qualitatively), quantum wells, wires, and dots: design, fabrication and characterization techniques.**Measurements** Four-point probe, and Vander Pauw measurements for carrier density, resistivity, and hall mobility;  | **8** |
| **Unit/ Module – IV** | **Interference:** Conditions of interference, Spatial and temporal coherence, Bi-prism experiment, interference in wedge shaped film, Newton’s rings.**Diffraction:** Fraunhofer diffraction at single slit and n-slits (Diffraction Grating). Rayleigh’s criteria of resolution. Resolving power of grating. | **9** |
| **Unit/ Module – V** | **Polarization:** Basic theory of double refraction, Malus Law, Ordinary and Extra-ordinary ray, Production and detection of plane, circularly and elliptically polarized light, specific rotation and polarimeters. **Laser:** Spontaneous and Stimulated emission of radiation. Einstein Coefficients’ Principle of laser action. Construction and working of Ruby and He-Ne laser. Photovoltaic effect**Fiber Optics:** Introduction to Fiber Optics, types of fiber, acceptance angle and cone , numerical aperture | **9** |
| **Unit/ Module - VI** | **Special theory of relativity**: inertial and non inertial frames, Galilean transformation, Michelson-Morley experiment, Einstein postulates of special theory of relativity, Lorentz transformation equation, length contraction, time dilation, variation mass of velocity, Mass energy relation  | **8** |
| **Unit/ Module -VII** | **Superconductivity:** Essential properties of Superconductors, Zero resistivity, Type I, Type II superconductors and their properties**Electromagnatism:** Displacement current, Three electric vectors (**E**, **P**, **D**,), Maxwell’s equations in integral and differential forms. Electromagnetic wave propagation in free space. | **8** |
| **Unit/ Module - VIII** | **Quantum Mechanics:** Quantum concept and radiation**,** Wave particle duality (de-Broglie concept of matter waves). Heisenberg’s uncertainty principle, Schrodinger’s wave equation in one dimension under a conservative force field, wave function and its significance, Eigen values and Eigen functions for particle confined in one dimensional infinite potential well (rigid box).  | **8** |
|  | **Total** | **66** |

**Text Books:**

1. Ajoy Ghatak, “Optics”, 4th Edition, Tata Mc Graw Hill, 2009
2. N. Subrahmanyam Brijlal & M. N. Avadhanulu, “Optics :”, 24th Edition, S. Chand, 2010
3. A. Beiser, “Concepts of Modern Physics”, Tatac Mc Graw Hill
4. Introduction to Solid State Physics, Charles Kittle, Wiley
5. Introduction to Electricity and Magnetism by Sadiku
6. Resnick, Krane, Halliday, “Physics (vol I&II)”, 5th Edition, Wiley, 2007
7. B. B. Laud, “Laser & Non liner Optics”,3rd Edition, New Age International Publisher
8. Robert Resnick, “Introduction to Special Relativity”, Wiley Publishers, 2007

**Reference Books:**

1. John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, “Modern Physics”, 1st Edotion, Pearson Education , 2007
2. Frank L. Pedrotti, S. J. , Leno S. Pedrotti, Leno M. Pedrotti, “Introduction to Optics”, 3rd Edition, Pearson Education,
3. Gerd Keiser, “Optic Fiber Communication” 5th Edition, Tata Mc. Graw Hill, 2017
4. Alastair I M Rae, Jim Napolitano, “Quantum Mechanics” 6th Edition, Wiley, 2015
5. David J. Griffiths, “Introduction to Electrodynamics”, 3rd Edition, Prentice, 2011
6. Charles P. Poole, Jr. Frank J. Owens , “Introduction to Nanotechnology”, Wiley, 2017
7. Hug D. Young & Roger A. Freedman, “University Physics”, 12th Edition, Pearson Publication, 2008
8. Alan Giambattista, Betty Mc. Carthy Richardson, Robert C Richardson, “Fundamentals of Physics”, 1st Edition, Tata Mc Graw Hill, 2009