# 19SH1102 - APPLIED PHYSICS

**(Common to EEE, ECE, CSE & IT)**

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| Course Category: | Basic Science | Credits: | 3 |
| Course Type: | Theory | Lecture-Tutorial-Practical: | 2-1-0 |
| Prerequisite: | Fundamental concepts of Physics | Sessional Evaluation:  Univ. Exam Evaluation:  Total Marks: | 40  60  100 |
| Objectives: | Students undergoing this course are expected:   1. To understand various phenomena exhibited by light and describe the characteristics, construction & working of lasers along with applications in Science & Technology. 2. To acquire knowledge of crystal systems and their analysis using X-rays. 3. To apply principles of Quantum Mechanics to various atomic phenomena and understand the electrical behaviour of solids. 4. To explain and provide the knowledge about semiconductors and their use in electronic devices. 5. To understand basic properties of dielectric &magnetic materials and their uses in Science & Technology. 6. To understand the behaviour of superconductors, nano materials, quantum phenomena and the limitations of basic physical laws. | | |

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| Course Outcomes | Upon successful completion of the course, the students will be able to: | |
| CO1 | Understand the utilization of laser technology in various disciplines. |
| CO2 | Understand the structure of Crystalline solids and their applications in x-ray  diffraction. |
| CO3 | Understand the basic concepts of quantum physics applicable to solids. |
| CO4 | Know the properties of semiconductor materials by projecting the view of  energy bands. |
| CO5 | Understand the concept of polarization& magnetization and also applications of  dielectric& magnetic materials in various disciplines. |
| CO6 | Recognize basic ideas about superconductors and nano materials with their uses in various fields of Science & Technology |
| Course Content | UNIT-I  **WAVE OPTICS**: Introduction (Interference of light) - Interference of light by wave front splitting (Young’s double slit experiment) and amplitude splitting (Newton rings)  – Fraunhoffer diffraction from a single slit, double slit - Diffraction grating & its resolving power.  **LASERS**: Spontaneous & stimulated emission of radiation - Population inversion - Pumping methods – Properties of lasers (monochromacity, coherence, directionality, brightness) – Types of lasers: solid state (Ruby), gas (He–Ne) – Applications of lasers in science, engineering & medicine.  UNIT-II  **CRYSTALLOGRAPHY**: Introduction – Space lattice – Unit cell – Lattice parameters  – Bravais lattice – Crystal systems – Packing fractions of S.C., B.C.C., F.C.C. – Planes in crystal: Miller indices – Inter planar spacing in cubic crystals.  **X-RAY DIFFRACTION**: X – Ray diffraction in crystals – Bragg’s law of diffraction – X- ray diffraction techniques: Laue method – Powder method (Debye – Scherrer method).  UNIT-III  **INTRODUCTION TO QUANTUM MECHANICS:** Wave nature of particles (deBroglie hypothesis) – Uncertainty principle – Schrodinger time independent wave equation - Significance of wave function (Born interpretation) – Solution of stationary state Schrodinger equation for one dimensional problems (particle in a box)  **FREE ELECTRON THEORY:** Introduction (classical & quantum: postulates, success& drawbacks) – Fermi–Dirac distribution function and its temperature dependence – Fermi level – Density of states (qualitative) – Statement of Bloch’s theorem for a particle in a periodic potential – Kronig–Penny model (non mathematical treatment) - Origin of energy bands.  UNIT-IV  **SEMICONDUCTOR PHYSICS**: Intrinsic Semiconductors – Intrinsic conductivity – P&N type semiconductors - Variation of Fermi level with temperature –Law of mass action – Drift & diffusion –Einstein relation – Hall effect and its applications.  **SEMICONDUCTOR DEVICES:** Formation of P-N junction – V-I Characteristics of P-N junction diode (forward & reverse bias) - Diode equation – Direct & indirect bandgap semiconductors – Light emitting diodes (construction, working, materials & applications) – Photo detectors – Solar cells  UNIT-V  **DIELECTRIC PROPERTIES**: Basic definitions – Electronic, ionic (quantitative) and orientation (qualitative) polarizations – Internal fields in solid dielectrics – Clausius – Mossotti equation.  **MAGNETIC PROPERTIES:** Introduction and basic definitions – Origin of magnetic moment – Classification of magnetic materials into dia, para, ferro, anti-ferro & ferri magnetics –Hysteresis – Soft & hard magnetic materials – Applications of magnetic materials.  UNIT-VI  **SUPERCONDUCTORS:** Introduction – Effect of temperature and magnetic field – Meissner effect – Types of superconductors – BCS theory - Josephson effect (DC & AC)  Applications of superconductors  **NANOMATERIALS:** Introduction – Significance of nanoscale – Types of nanomaterials – Properties of nanomaterials: physical, mechanical, magnetic and optical Synthesis of nanomaterials: top-down-Ball milling, bottom up – Chemical vapour deposition – Applications of nanomaterials. | |
| Text Books &  References  Books | **TEXT BOOKS:**   1. Engineering Physics by Palanisamy, Scitech. 2. Engineering Physics by K.Thyagarajan, McGraw Hill. 3. Engineering Physics by Maninaidu, Pearson.   **REFERENCE BOOKS:**   1. Solid State Physics, by Kittel, Wiley 2. Engineering Physics by Gaur and Gupta, Dhanpatrai Publications | |