

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)

NAAC Accredited with A++ Grade

Subject Name: Engineering Physics

Subject code 3000001

B.Tech. (First / Second year) with effect from 01.07.2023

Course Objectives: This course is designed to impart fundamental knowledge about some areas of physics which are to the core of emerging technologies. It is planned to provide knowledge about Quantum mechanics, Lasers, Fiber Optics, Holography, Superconductor, Nano materials, Dielectric and piezoelectric materials. Laboratory sessions are also designed which are blended with experiments on the fundamental and advanced areas of physics.

Course Contents:

Unit I Quantum mechanics: Planck's quantum hypothesis, Wave-particle duality of radiation, de-Broglie matter waves, Davisson and Germer's electron diffraction experiment, Compton effect, Phase and group velocity, Heisenberg uncertainty principle and its applications, wave function and its significance, Eigen value and Eigen function, Schrödinger wave equations, particle in one dimensional potential box.

Unit II Lasers: Properties of lasers, the basic process of lasers, Population-inversion, classification of lasers, working of He-Ne, Ruby, Nd: YAG and CO₂ lasers, Applications of Lasers in Communication, Medical and Industry.

Optical fibers: Light guidance through optical fibers, the qualitative idea of critical and acceptance angle, types of fibers, numerical aperture, V-Number, intermodal & material dispersions in fiber.

Holography: Basic principle of holography, Construction and reconstruction of Image on hologram and applications of holography.

Unit III Material science and Engineering: classification of materials, levels of structure and structure property relationship. The space lattices and crystal structure, unit cell, seven crystal structure system and fourteen Bravais lattices. Determination of crystal structure and defects in crystal.

Unit IV Superconductors: Free electrons theory of metals, Temperature dependence of resistivity in superconducting Metals, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type I and Type II superconductors, BCS theory (Qualitative), High-temperature superconductors and Applications of superconductors.

Nanomaterials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene and Carbon nanotubes, Applications of nanotechnology;

Unit V Dielectrics Materials: Polar and Non-Polar Dielectrics, Dipole moment and Polarization, Dielectric constant & Polarization, Gauss law in Dielectric, the relation between electric field vector E, P and D.

Piezoelectric materials- Ferroelectric materials, Piezoelectric effect direct and converse parameter definitions.

Course outcomes: After studying the course of Engineering Physics the student will be able to:

CO1 Explain the basic knowledge of quantum physics and apply it to the behaviour of a system at the microscopic level and solve the problems.

CO2 Interpret the requirements classification properties and application of laser and optical fibers.

CO3 Describe the basic concepts about different crystals and their specific applications.

CO4 Explain the principle, types, properties and application of superconductors and nanomaterials.

CO5 Apply the knowledge of characteristic of Dielectrics and Piezoelectric materials

Reference books

1. Optics, A.Ghatak, McGraw Hill, 2012.
2. Engineering Physics, Hitendra K Malik & A.K. Singh, McGraw Hill Education Private Limited
3. Material science and engineering by V. Raghavan (PHI)
4. Solid state physics by S O Pillai (New age international)
5. Kiruthiga Sivaprashta, Modern Physics, S. Chand.
6. Concepts of Modern Physics, Arthur Beiser, Tata McGraw-Hill, 6th edition, 2009
7. A Textbook of Engineering Physics, Gaur and Gupta, Dhanpat Rai Publishers, New Delhi, 8th edition, 2011.
8. Electrical Engineering Materials by A.J. Dekker, PHI publication
9. Lasers and non-linear optics, B.B.Laud, New Age international, 3rd edition, 2011
10. Solid State Physics, S.O.Pillai, New Age International Ltd, publishers
11. Theory for Telecommunications, C.S.Liu and V.K.Tripathi, Foundation Books, New Delhi, 2007.