MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

Subject Name: Engineering Physics
Subject code 3000001 (Under Flexible Scheme-2019-20)
B.Tech. (First / Second year) with effect from 01.07.2022

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, Hologhphy, 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.

Unit I

Quantum mechanics: Planck's quantum hypothesis, Wave-particle duality of radiation, de-Broglie matter waves, Davisson and Germen'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 CO_2 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

Basic of semiconductors: Density of energy states, Energy-band formations, direct and indirect band gap, Effective mass, Fermi energy levels. Mobility and carrier concentrations (intrinsic).

Semiconductor Devices: Properties of PN junction and I-V diode equation, Photovoltaic cell, LED Materials for fabrication, LED Structures and Characteristics; Injection Laser Diode (ILD).

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 ad 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: Upon successful completion of the course, 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 and theory of semiconductor for devices application.

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

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Concepts of Modern Physics, Arthur Beiser, Tata McGraw-Hill,6th edition,2009.

1. Optics, A.Ghatak, McGraw Hill, 2012.
2. Engineering Physics , Hitendra K Malik& A.K. Singh, Mc Graw Hill Education Private Limited
3. Elements of Modern Physics, S.H. Patil
4. Kiruthiga Sivaprastha, Modern Physics, S. Chand
5. A Textbook of Engineering Physics, Gaur and Gupta, Dhanpat Rai Publishers, New Delhi,8th edition,.2011.
6. Electrical Engineering Materials by A.J. Dekker, PHI publication
7. Lasers and non-linear optics, B.B.Laud, New Age international,3rd edition,2011
8. Solid State Physics, S.O.Pillai , New Age International Ltd, publishers
9. Theory for Telecommunications, C.S.Liu and V.K.Tripathi, Foundation Books, New Delhi,2007

List of Experiments

Subject Name: Engineering Physics laboratory
Subject code 3000001 (Under Flexible Scheme-2019-20)
B.Tech. (First / Second year) with effect from 01.07.2023

NOTE: At least 10 of the following experiments must be performed during the session.

S.No.	Experiment
1	To determine the specific charge (e/m) of an electron by Thomson method.
2	To determine the specific rotation of sugar solution with the help of Polari meter.
3	To measure the planks constant using light emitting diode.
4	To determine the energy band gap of a given sample material.
5	To measure the dielectric constant of a substance by resonance method.
6	To study and verify the outputs of various logic gates
7	To determine the wavelength of monochromatic light with the help of Newton's ring.
8	To study the V-I characteristics of semiconductor diode
9	To study V-I Characteristics of LED
10	To determine the dispersive power of the material prism for violet and yellow coolers of mercury light by spectrometer.
11	To study the working of halleffect device.
12	To study the working mechanism of spin coating unit.
13	To_determine_the prominent spectral lines of mercury spectrum by using a plane diffraction grating

Course outcomes

Lab CO	**After attending the lab in Engineering Physics (3000001) the student will be able to:**
CO1	Apply the concepts of theoretical physics in experimentation.
CO2	Demonstrate the working principles in optics, semiconductors physics.
CO3	Develop an understanding of Quantum Physics.
CO4	Develop observational and report writing skills and teamwork.