APPLIED PHYSICS

Common to ECE, CSE, IT, CSE(AI&ML) & CSE(DS) Branches

21AP102BS/21AP202BS

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COURSE OBJECTIVES: Develop an ability to Understand

1.The interaction of light through Interference, Diffraction & Polarization.
2.Basic concepts in quantum physics required to deal with behavior particle.
3.Various types of semiconductor devices and their principle of operations.
4.The basic principles of lasers to various systems and optical fibers.
5.The concepts of magnetic and dielectric materials.

COURSE OUTCOMES: After completion of course, the student would be able to

CO 1: Realize the importance of light phenomenon in thin films due to interference, and to demonstrate the physical properties of light.
CO 2: Explain the fundamental concepts on Quantum behaviour of matter in its microstate.
CO 3: Analyze the formation of p-n junction diode and importance of semiconductor devices.
CO 4: Explain the principles and production of LASER beams & transfer of information by optical fibers.
CO 5: Differentiate magnetic materials and dielectric materials.

UNIT-I: WAVE OPTICS

INTERFERENCE

Coherence, Interference in thin films (Transmitted and Reflected cases), Wedge shaped film, Newton's rings experiment, Antireflection coatings.

DIFFRACTION

Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to single slit, double slits, and N-slits (quantitative), Diffraction grating experiment.

POLARIZATION

Polarized and unpolarized lights, Malus law, double refraction, Construction and working of Nicol Prism, Brewster's law.

UNIT-II: PRINCIPLES OF QUANTUM MECHANICS

Black body radiation, Wien's law, Rayleigh-Jeans law, Planck's law, Photoelectric effect, Compton effect, Wave-particle duality, de-Broglie's hypothesis, Matter waves, Davisson and Germer's experiment, Heisenberg's uncertainty principle, Physical significance of wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

UNIT-III: SEMICONDUCTOR DEVICES

Intrinsic and Extrinsic semiconductors, Hall effect, PN diode: Formation of p-n junction, Energy diagram, V-I Characteristics, Construction of bipolar Junction Transistor (BJT): Principle of operation and Characteristics, LED: Device structure, Materials, Characteristics and Applications, Photodetectors: PIN and Avalanche diodes and their structure, Working principle and Characteristics, Solar cell: Device structure, Materials, Characteristics and Applications.

UNIT-IV: LASERS AND FIBER OPTICS

LASERS:

Characteristics of lasers, Interaction of radiation with matter, Principle and working of Laser, Metastable state, Population inversion, Pumping, Types of Lasers: Ruby laser, Carbon dioxide(CO_2) laser, He-Ne laser, Semiconductor laser, Applications of lasers.

FIBER OPTICS:

Total internal reflection, Construction of Fiber, Acceptance angle, Acceptance cone and Numerical aperture, Classification of Optical Fibers: Step and Graded index fibers, Modes of transmission, Losses associated with optical fibers, Optical fiber communication system.

UNIT-V: MAGNETIC & DIELECTRIC PROPERTIES OF MATERIALS

MAGNETIC PROPERTIES OF MATERIALS:

Origin of magnetic moment, Magnetic dipole, Magnetic moment, Permeability, Magnetic field induction, Magnetic field intensity, Intensity of magnetisation, Susceptibility, Relative permeability, Classification of magnetic materials: Día, para, ferro, anti-ferro and ferrimagnetic materials, Domain theory of ferromagnetism, Hysteresis, Applications of magnetic materials.

DIELECTRIC PROPERTIES OF MATERIALS:

Electric dipole, Dipole moment, Permittivity, Dielectric constant, Polarizability, Electric susceptibility, Displacement vector, Dielectric break down, Types of Polarizations: Electronic, Ionic and Orientational polarizations, Calculation of their polarizabilities, Internal field, Clausius-Mossotti equation, Ferroelectricity, piezoelectricity and, pyroelectricity, Structure and Properties of Multiferroics.

TEXTBOOKS:

1.Modern Engineering Physics, K. Vijaya Kumar, S.Chandralingam, S. Chand & Co. Pvt LtdVolume I & II
2.Engineering Physics, B.K.Pandey, S.Chaturvedi-CengageLearning.
3.Halliday and Resnick, Physics -Wiley.
4.A textbook of Engineering Physics. M. N. Avadhanulu, Dr.P.G.K. Shirsagar- S.Chand
5.Engineering Physics, S.O. Pillai, New Age International

REFERENCES:

1.Richard Robinett, Quantum Mechanics
2."Optics" by Ajay Ghatak, 6th edition McGraw Hill Education, 2017
3.Engineering Physics by R.K. Gaur, and S.L. Gupta, -Dhanpat Rai publishers, 2012
4.J. Singh, Semiconductor Optoelectronics: Physics and Technology, Mc Graw-Hill inc. (1995)
5.Monika Katiyar & Deepak Gupta, "Optoelectronics Materials & Devices", NPTEL Onlinecourse