APPLIED PHYSICS

I B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A4BS08	BSC	3	1	0	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Learn the behaviour of matter waves and applications of Schrodinger wave equations inperiodic potential energy of electron.
2. Understand the formation of energy bands in solids.
3. Gain the knowledge of carrier concentration and recombination process of semiconductor materials.
4. Learn the basic principles of laser and optical fibre.
5. Understand the development of nano technology and synthesis of nano materials by using different techniques.

COURSE OUTCOMES:

The student will able to:

1. Conclude the dual nature of material particles and able to explain how moving particles are associated with its energies
2. Analyse the energy bands in solids and accordingly classify the materials
3. Evaluate the mobility of charge carrier concentration of a given semiconductor material.
4. Justify how the graded index optical fiber is more efficient than step index optical fiber in fiber optic communication system.
5. Recommend appropriate synthesis method and explain the characterization techniques.

UNIT-I	QUANTUM MECHANICS	CLASSES: 08

Introduction to quantum physics: Black body radiation, Planck's law, photoelectric effect, Compton effect, Waves and Particles, de Broglie Hypothesis, Matter Waves, Davisson and Germer's Experiment, Heisenberg's Uncertainty Principle, Schrodinger's Time Independent Wave Equation-Physical Significance of the wave Function, Particle in One Dimensional Potential Box.

UNIT-II	INTRODUCTION TO ELECTRONIC MATERIALS	CLASSES: 07

Band theory - Free electron theory, Origin of Energy Band formation in Solids, Estimation of Fermi energy level, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps.
Classification of Materials: Conductors, Semiconductors & Insulators, Effective mass of an Electron. Fermi-Dirac Statistics (Qualitative treatment).

UNIT-III	SEMICONDUCTORS AND OPTOELECTRONICS	CLASSES: 08

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, Hall effect and its applications.
Semiconductors design- PN junction-diode, Zener diode, fabrication and characterization techniques- Heterojunctions and associated band-diagrams.
Optoelectronic devices: properties of photo detectors, solar cells, Semiconductor laser, Four-point probe measurement for carrier density.

UNIT-IV	LASER & OPTICAL FIBER	CLASSES: 08

Laser: Characteristics of Laser beams, Energy levels in atoms, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers -He-Ne, solid-state lasers -ruby, Nd-YAG, Applications of Lasers.
Fiber Optic Communication: Structure of Optical fibers, Basic principle of fibers, Acceptance angle and Numerical aperture, Types of Optical Fibers-Step Index and Graded Index fibers; Modes of fibers-SMSI, MMSI, MMGI., Optical fiber Communication System with block diagram. Applications of fibers, fiber optic sensors – Basic principle, Intrinsic, Extrinsic sensors. Working of Pressure and Temperature Sensors.

UNIT-V	INTRODUCTION TO ENGINEERED MATERIALS	CLASSES: 08

Fundamentals of nano particles, nano scale, properties, Techniques for synthesis of nano materials - Sol-gel, Chemical vapour deposition (CVD) methods.
Characterization of nanomaterials: Imaging methods- SEM, TEM, Scanning Probe Microscopy: STM. Fabrication method- quantum wire, Applications of Nano materials in engineering and Biomedical fields.

TEXT BOOKS:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing
2. Haliday and Resnick, Physics – wiley
3. R. Robinett, "Quantum Mechanics", OUP Oxford, 2006.IIndEdn.
4. P.K Palanisamy, Engineering Physics, Sitech Publications, 2013, IVthEdn.
5. Essentials of Nano Tecnology by Jeremy Ramsden.

REFERENCE BOOKS:

1. E. Hecht, "Optics", Pearson Education, 2008.
2. J. Singh, Semiconductor Optoelectronics: Physics and Technology, Mc Graw-Hill inc.(1995)
3. R. Robinett, "Quantum Mechanics", OUP Oxford, 2006.
4. O. 1Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
5. D. A. Neamen, "Semiconductor Physics and Devices", Times Mirror High EducationGroup, Chicago,1997.

WEB REFERENCES:

1. https://www.edx.org/course?search_query=semiconductor+physics
2. https://www.edx.org/course/nanotechnology-fundamentals-purduex-nano530x
3. https://www.edx.org/course/physics-electronic-polymers-pep-purduex-nano600

E-TEXT BOOKS:

1. http://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010_Fall/classnotes/NanoB_week14.pdf
2. https://www.scribd.com/document/70908178/Semiconductor-Devices-Basic-Principles-Jasprit-Singh
3. https://www.scribd.com/doc/105174065/Fundamentals-of-Photonics
4. ftp://nozdr.ru/biblio/kolxo3/P/PE/PEo/Thyagarajan%20K.,%20Ghatak%20A.%20Lasers..%20Fundamentals%20and%20Applications%20(2ed.,%20GTP,%20Springer,%202010)(ISBN%20144196441X)(O)(674s)_PEo_.pdf
5. https://subodhtripathi.files.wordpress.com/2012/01/optical-fiber-communications-by-gerd-keiser_2.pdf
6. http://www.hailienene.com/resources/nano-technology.pdf

MOOC COURSE:

1. http://nptel.ac.in/courses/115103030/(Four-point probe measurement for carrier density)
2. http://nptel.ac.in/courses/115102025/ (Fundamental concepts of semiconductors)
3. http://nptel.ac.in/courses/118104008/1 (Fundamentals of Nano technology)
4. http://nptel.ac.in/courses/118104008/13 (Nano structures, synthesis and characterization)
5. http://nptel.ac.in/courses/104104085/2(Lasers and its applications)