

**APPLIED PHYSICS****B.Tech.IYear**

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	TOTAL
	Basic Sciences	3	1	0	4	40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil				Total Classes:64		

**Course Objectives:**

The objectives of this course for the student are to:

1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric, magnetic and energy materials.
4. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
5. Study the characteristics of lasers and optical fibres

**Course Outcomes: Upon graduation he student will be able to:**

1. Analyze the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
2. Identify the role of semiconductor devices in science and engineering Applications.
3. Explore the fundamental properties of dielectric and magnetic materials.
4. Appreciate the features and applications of Nanomaterials.
5. Analyze various aspects of Lasers and Optical fiber and their applications in diverse fields.

**UNIT - I: QUANTUM PHYSICS AND SOLIDS**

**Quantum Physics:** Introduction to quantum physics, Blackbody radiation – Stefan-Boltzmann's law, Planck's radiation law - Wein's and Rayleigh-Jean's law, Photoelectric effect, Matter Waves, de - Broglie Hypothesis, Davisson and Germer experiment, Heisenberg uncertainty principle, Time independent Schrodinger wave equation, Born interpretation of the wave function, Particle in one dimensional potential box.

**Solids:** Classical & Quantum free electron theory (Qualitative), Bloch's theorem, Kronig-Penney model, E-K diagram, Effective mass of electron, Origin of energy bands - classification of solids.

**UNIT - II: SEMICONDUCTORS AND DEVICES**

Intrinsic and extrinsic semiconductors(Qualitative) – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and I-V characteristics of P-N Junction diode, Zener diode, bipolar junction Transistor(BJT) - LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and I-V characteristics.

**UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS**

**Dielectric Materials:** Basic definitions, Types of polarizations (qualitative) - Langevin-Debye equation, Internal fields in a solid, Clausius - Mossotti equation ferroelectric, piezoelectric, and pyroelectric materials – applications, liquid crystal displays (LCD) and crystal oscillators.

**Magnetic Materials:** Basic definitions, Classification of magnetic materials, Domain theory, Hysteresis - soft and hard magnetic materials, magnetostriction, magneto resistance - applications - magnetic field sensors and multiferroics.

**UNIT-IV : NANOTECHNOLOGY**

Nanoscale, Quantum Confinement, Surface to volume ratio, Bottom-Up Fabrication: Sol-Gel – Precipitation- Combustion methods, Top-Down Fabrication: Ball Milling - Physical Vapor Deposition (PVD) - Chemical Vapor Deposition (CVD), Characterization Techniques: XRD, SEM & TEM, Applications of Nanomaterials.

**UNIT - V: LASER AND FIBER OPTICS**

**Lasers:** Laser beam characteristics, Three quantum processes, Einstein coefficients and their relations, Population Inversion, Lasing action, Pumping methods, Ruby laser, He-Ne Laser , CO<sub>2</sub> Laser, Nd-Yag Laser, semiconductor laser-applications of laser.

**Fiber Optics:** Introduction to optical fiber- advantages of optical Fibers - total internal reflection, construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers -losses in optical fiber - optical fiber for communication system - applications.

**TEXT BOOKS:**

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy” A Text book of Engineering Physics”- S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4 thEdition,2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

6. Modern Engineering Physics by Dr. K. Vijay Kumar, Dr. Chandralingam, S.Chand Publications,

### REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons, 11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhyaya - Nano Materials, New Age International, 1st Edition, 2007.
6. Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group
7. Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

### CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PO12
CO-1	3	3	-	-	-	-	-	-	-	-	-	-
CO-2	3	3	-	-	-	-	-	-	-	-	-	-
CO-3	3	3	-	-	-	-	-	-	-	-	-	-
CO-4	3	3	-	-	-	-	-	-	-	-	-	-
CO-5	3	3	-	-	-	-	-	-	-	-	-	-
CO	3	3	-	-	-	-	-	-	-	-	-	-