



## COURSE CONTENT

APPLIED PHYSICS								
<b>I Semester: CE / EEE / ME/ECE/CSM/CSD</b>								
<b>II Semester: CSE</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
24X0008	Basic Science	L	T	P	C	CIA	SEE	Total
		3	1	0	4	40	60	100
<b>Contact Classes: 45</b>	<b>Tutorial Classes: 15</b>	<b>Practical Classes: Nil</b>			<b>Total Classes: 60</b>			
<b>Prerequisites: Intermediate</b>								

### Course Overview:

Applied Physics is the application of the Physics to solve Scientific or Engineering Problems. It is considered as bridge between Physics and Engineering. Applied Physics under graduate program stress the basic Physics that under lies most developments in engineering and mathematical tools that are important to engineers.

### Course Objectives:

- The student will try to learn
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 materials.
  4. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
  5. Study the characteristics of lasers and optical fibers.

### Course Outcomes: After Completion of the Course, Students should be able to

1. Illustrate the concepts of the dual nature of matter and the Schrödinger wave equation of a particle confined in a basic system.
2. Classification of semiconductors and their roles in different types of optoelectronic devices utilized in a range of engineering applications.
3. Understand the properties of dielectric and magnetic materials and their applicability in engineering contexts.
4. Explain the key factors, fabrication methods, characterization techniques, and applications of nanomaterials.
5. Relate the concepts of lasers and optical fibers, when used with normal light, in terms of their mechanisms and applications across various fields and scientific practices.

### UNIT-I: QUANTUM PHYSICS AND SOLIDS

**Quantum Mechanics:** Introduction to quantum physics, Blackbody radiation, Photoelectric effect, de-Broglie Hypothesis and matter waves, Davisson and Germer experiment, Heisenberg uncertainty principle, Born interpretation of the wave function, Time independent Schrodinger wave equation, Particle in one dimensional potential box.

**Solids:** Free electron theory (Drude & Lorentz, Sommerfeld), Bloch's theorem -Kronig- Penney model, Effective mass of electron, Origin of energy bands, Classification of solids.

## UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors, Hall effect, Direct and Indirect band gap semiconductors, Construction, principle of operation and characteristics of P-N Junction diode, Zener diode and Bipolar junction transistor (BJT)

Opto-devices- Light emitting diode (LED), PIN diode, and Solar cell, their structure, materials, working principle and characteristics, Solar cell application- Space craft.

## UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS

**Dielectric Materials:** Introduction to dielectrics, Polarization, Permittivity, Dielectric constant, Types of polarizations (Qualitative), Internal field in Solids, Clausius-Mossotti equation, Ferroelectric, Piezoelectric and Pyroelectric materials, Applications.

**Magnetic Materials:** Introduction to Magnetism, Magnetization, Permeability, Susceptibility, Classification of Magnetic Materials, Hysteresis curve, Soft and Hard magnetic materials, Magnetostriction, Magneto resistance, Magnetic field sensors and bubble memory devices.

## UNIT - IV: NANOTECHNOLOGY

Introduction to magnetic materials, Origin of magnetic moment, Classification of magnetic Nanoscale, Quantum confinement, Surface to volume ratio, Bottom-up fabrication: Sol- gel, Precipitation methods, Top-down fabrication: Ball milling, Physical Vapor Deposition (PVD), Characterization techniques - XRD, SEM and TEM, Applications of nanomaterials.

## UNIT - V: Laser and Fibre Optics

**Lasers:** Laser beam characteristics-three quantum processes-Einstein coefficients and their relations, Lasing action, Population inversion, Pumping methods, Ruby laser, He-Ne laser, CO<sub>2</sub>laser, Applications of laser- Medical and Military.

**Fiber Optics:** Introduction to optical fiber, 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 of optical fiber- Endoscopy

### TEXT BOOKS:

1. M.N.Avadhanulu, P.G.Kshirsagar & TVSArjunMurthy “ ATextbook of Engineering Physics”, S. Chand Publications, 11<sup>th</sup> Edition 2019.
2. Engineering Physics by Shatendra Sharma and JyotsnaSharma, Pearson Publication, 2019
3. Semiconductor Physics and Devices-Basic Principle–DonaldA, Neamen, McGraw Hill, 4<sup>th</sup> Edition, 2021.
4. B.K. Pandeyand S. Chaturvedi, Engineering Physics, Cengage Learning, 2<sup>nd</sup> Edition, 2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1<sup>st</sup> Edition, 2021.

### REFERENCE BOOKS:

1. Quantum Physics, H.C.Verma, TBS Publication, 2<sup>nd</sup> Edition 2012.
2. Fundamentals of Physics–Halliday, Resnick and Walker, John Wiley & Sons, 11<sup>th</sup> 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.Bhandhopadhya -NanoMaterials, New Age International, 1<sup>st</sup> Edition, 2007

### ELECTRONIC RESOURCES:

- <https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf>
- <https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles-Kittel.pdf>
- <https://www.fi.muni.cz/usr/gruska/qbook1.pdf>

- <https://www.youtube.com/watch?v=hJ71IAWx3o>
- [https://youtu.be/4CbU\\_NtQjLg?si=BBd1A4dxxeQE\\_kIA](https://youtu.be/4CbU_NtQjLg?si=BBd1A4dxxeQE_kIA)
- <https://youtu.be/rhw7QDp1scY?si=89-Msq6jBRf51OZf>
- [https://youtu.be/NvS9I\\_8j-w?si=TgfnbfUwbiFOmxRz](https://youtu.be/NvS9I_8j-w?si=TgfnbfUwbiFOmxRz)
- [https://youtu.be/RSeMfAoXqQw?si=C5qvwDkF5gig\\_1f1](https://youtu.be/RSeMfAoXqQw?si=C5qvwDkF5gig_1f1)
- <https://youtu.be/nFROY70WbDc?si=87KoX22vuErTIBhY>
- [https://youtu.be/36UQSzYPTm4?si=LKUsBrP7Kx\\_0Gaf2](https://youtu.be/36UQSzYPTm4?si=LKUsBrP7Kx_0Gaf2)

#### **MATERIALS ONLINE:**

1. Course template
2. Concept Video topics and Certificate Course in mindluster
3. Assignments
4. Cognitive Assessment Resource Bank
5. Lecture notes
6. E-Learning Readiness Videos (ELRV)