COURSE TITLE	**ENGINEERING PHYSICS**
COURSE CODE	**01EC0111**
COURSE CREDITS	**3**

Objective:

1 This course introduces foundational principles of engineering physics with relevance to electronics and communication engineering, covering quantum and semiconductor physics, electromagnetics, optical and acoustic wave behavior, and modern advancements like superconductivity, nanomaterials, and plasma. It aims to develop a strong conceptual base for understanding electronic materials and wave phenomena essential for advanced technologies in electronics.

Course Outcomes: After completion of this course, student will be able to:

1 Explain classical and quantum physics differences and describe applications of ultrasonic waves, superconductors, nanomaterials, and plasma. (Bloom's Level: Understand)

2 Analyze energy band structures and carrier transport mechanisms in different semiconductor materials. (Bloom's Level: Analyze)

3 Apply the principles of interference, diffraction, and polarization to solve problems in wave and optical systems. (Bloom's Level: Apply)

4 Evaluate electromagnetic wave behavior using Maxwell's equations and explain their role in signal propagation. (Bloom's Level: Evaluate)

Pre-requisite of course: Understanding of topics of physics covered in Class 12th.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**Introduction to Engineering Physics** Physical Fundamentals and Importance in ECE, Classical Physics and Its Limitations, Basics of Quantum Mechanics, Key Quantum Phenomena – Black Body Radiation, Photoelectric Effect, Specific Heat	4
2	**Semiconductor Physics** Definition and Basics of Semiconductors, Energy Bands in Solids vs. Insulators and Conductors, Covalent Bonds in Semiconductor Materials, Crystalline Structure of Semiconductor Materials, Types of Semiconductors, Electron and Hole Mobility, Carrier Transport Mechanisms, Drift and Diffusion Currents	8

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Contents : Unit	Topics	Contact Hours
3	**Fundamentals of Optics and Applications** Nature of Light: Wave-like and Particle-like Behavior, Maxwell's Equations and Light Wave Propagation, Laws of Reflection and Refraction (Ray Optics), Interference in Wave Optics, Coherence and Its Role in Optics, Diffraction and Its Applications, Polarization of Light and Applications, Laser and Its Applications	8
4	**Electromagnetics & Wave Propagation** Understanding Maxwell's Equations – Basics, Interpretation of Maxwell's Equations in Time and Frequency Domains, Generation and Propagation of Electromagnetic Waves, Reflection of Electromagnetic Waves, Refraction of Electromagnetic Waves, Polarization of Electromagnetic Waves	6
5	**Acoustics & Ultrasonic** Principles of Sound Wave Propagation, Definition and Characteristics of Sound Waves, Frequency Range of Audible and Ultrasonic Waves, Properties of Ultrasonic Waves, Applications of Ultrasonic Waves in Non-Destructive Testing, Principles and Applications of SONAR, Doppler Effect – Concept and Derivation, Doppler Effect in Sound and Light – Applications	8
6	**Emerging Materials & Technologies for Electronics** Introduction to Superconductors, Applications of Superconductors in Various Fields, Introduction to Nanomaterials and Carbon Composites, Properties and Applications of Graphene, Carbon Nanotubes (CNT) and Their Applications, Fundamentals of Plasma, Applications of Plasma in Science and Engineering, Piezoelectric Materials and Their Applications	8
Total Hours		**42**

Textbook :

1 Engineering Physics, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand Publishing, 2019

References:

1 Solid State Electronic Devices, Solid State Electronic Devices, Ben G. Streetman and Sanjay Banerjee, Pearson Education, 2016

2 A Textbook of Engineering Physics, A Textbook of Engineering Physics, H.K. Malik and A.K. Singh, McGraw Hill, 2018

3 Concepts of Modern Physics, Concepts of Modern Physics, Arthur Beiser, McGraw Hill, 2017

4 A Textbook of Optics, A Textbook of Optics, Subramanyam, Brijlal, and M.N. Avadhanulu, S. Chand, 2022

5 Introduction to Nanoscience and Nanotechnology, Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay and A.N. Banerjee, PHI Learning, 2012

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
15.00	25.00	40.00	10.00	10.00	0.00

Instructional Method:

1. The internal evaluation will be done based on the continuous evaluation of students in the class-room. The external evaluation shall be done in form of Mid semester examination and End Semester Examination
2. Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.
3. The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools/techniques such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs, etc. for effective teaching.

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