Course Title:	**Applied Physics for Electronics and Communication Engineering**		
Course Code:	**23PHYE22**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory + 10 to 12 Lab slots	Credits	04

Course objectives

- To study the essentials of photonics for engineering applications.
- To understand the types of oscillation, shock waves & its generation, and applications.
- To study the principles of quantum mechanics.
- To study the electrical properties of materials.
- To study the knowledge about semiconductors and devices.

Teaching-Learning Process

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching-Learning more effective

1. Flipped Class
2. Chalk and Talk
3. Blended Mode of Learning
4. Simulations, Interactive Simulations and Animations
5. NPTEL and Other Videos for theory topics
6. Smart Class Room
7. Lab Experiment Videos

Module-1 (8 Hours)

Laser and Optical Fibers:

LASER: Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients (derivation of expression for energy density), Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Nd-YAG Laser, Application of Lasers.

Optical Fiber: Principle and structure, Acceptance angle and Numerical Aperture (NA) and derivation of Expression for NA, Classification of Optical Fibers, Attenuation and Fiber Losses, Applications: Fiber Optic Communication. Numerical Problems.

Pre-requisite: Properties of light

Self-learning: Total Internal Reflection & Propagation Mechanism (Optical Fibers)

Module-2 (8 Hours)

Quantum Mechanics:

de Broglie Hypothesis and Matter Waves, Photoelectric Effect, Compton Scattering, Dual nature, Heisenberg's Uncertainty Principle and its application (Nonexistence of electron inside the nucleus-Non Relativistic), Wave Function, Time independent Schrodinger wave equation (derivation) , Physical Significance of a wave function and Probability density, Eigen functions and Eigen Values, Particle inside one-dimensional infinite potential well, Waveforms and Probabilities. Numerical problems.

Pre-requisite: Wave-Particle dualism

Self-learning: de Broglie Hypothesis

Module-3 (8 Hours)

Oscillations and Waves

Oscillations: Basics of SHM, derivation of equation for SHM, Equation of motion for free oscillations, Natural frequency of oscillations.

Damped Oscillations: Theory of damped oscillations (derivation), over damping, critical & under damping (graphical representation), quality factor.

Forced Oscillations: Theory of forced oscillations (derivation).

Shock waves: Mach number, Properties of Shock waves, Construction and working of Reddy shock tube, applications of shock waves, Numerical problems.

Pre-requisites: Basics of Oscillations

Self-learning: Simple Harmonic motion, differential equation for SHM

Module-4 (8 Hours)

Electrical Properties of Materials and Applications

Free Electron concept, Electrical conductivity in metals, Resistivity and Mobility, Concept of Phonon, Matthiessen's rule. Introduction to Super Conductors, Temperature dependence of resistivity, Meissner's Effect, Silsbee Effect, Types of Superconductors, Temperature dependence of critical field, BCS theory (Qualitative), Quantum Tunneling, High- Temperature superconductivity, Josephson Junction, DC and AC SQUIDs (Qualitative), MAGLVE, Applications in Quantum Computing (Mention). Numerical problems.

Pre-requisites: Basics of Electrical conductivity

Self-learning: Resistivity and Mobility

Module-5 (8 hours)

Semiconductor and Devices:

Fermi energy and Fermi level, Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band & holes concentration in valance band (only mention the expression), Law of mass action, Electrical conductivity of a semiconductor (derivation), Hall effect, Expression for Hall coefficient (derivation) and its Application.

Photodiode and Power responsivity, Construction and working of Semiconducting Laser, Four probe method to determine resistivity, Phototransistor. Numerical problems.

Pre-requisite: Basics of Semiconductors

Self-learning: Photodiode

Laboratory Component:

a) Exercise
b) Demonstration (DM)
c) Virtual Lab (VL)
d) Open Ended (OE)

List of Experiments:

1. Wavelength of LASER using Grating
2. Charging and Discharging of a Capacitor
3. Series LCR
4. Parallel LCR
5. Photo-Diode Characteristics
6. Black Box (DM)
7. Fermi Energy (DM)
8. Four Probe Method (VL)
9. Numerical Aperture using Optical fiber (VL)
10. Planck's Constant using LEDs (OE)

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	**Understand** the fundamentals of photonics, oscillation, waves, quantum mechanics, semiconductor devices and material properties.
CO2	**Apply** the concept of photonics, oscillation, waves, quantum mechanics, semiconductor devices and transport phenomena in metals.
CO3	**Analyze** the desired parameters for to use it in various engineering applications.
CO4	Usage of **Modern tools** to develop the concept of physics & to perform as a **member of team** to build a model.
CO5	**Conduct**, **analyze** and **interpret** the data and results for applied physics experiments.

Assessment Details (both CIE and SEE)

Evaluation Type			Component	Max. Marks	Marks reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Test(IAT)		IAT - 1	25	15	10	Average of two IATs, Scaled down to 15 marks
			IAT - 2	25			
	Comprehensive Continuous Evaluations (CCE)		CCE -1	10	10		Minimum of two Assessments methods as per 22OB4.2 of regulations. Average of CCEs, scaled down to 10marks.
			CCE -2	10			
	Total CIE – Theory				25	10	Scale down marks of IAT & CCE to 25
Laboratory Component	Practical and Lab Records	-		15	25	10	Conduction of experiments and preparation of Lab records, etc.
	Lab test	50		10			One test to be conducted after the completion of all lab experiments.
	Total CIE – Practicals				25	10	
Total CIE (Theory + Lab)					50	20	
SEE				100	50	18	Conduction of 100 marks and scaled down to 50.
CIE + SEE					100	40	

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Solid State Physics, S O Pillai, New Age International Private Limited, 8th Edition, 2018.
2. Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
3. Concepts of Modern Physics, ArthurBeiser, McGraw-Hill, 6th Edition, 2009.
4. Lasers and Non-Linear Optics, B B Loud, New age international, 2011 edition.
5. A textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventhedition, S Chand and Company Ltd. New Delhi-110055.
6. Engineering Physics, S P Basavaraj, 2005 Edition,
7. Introduction to Superconductivity, Michael Tinkham, McGraww Hill, INC, II Edition

Web links and Video Lectures (e-Resources):

LASER: https://www.youtube.com/watch?v=WgzynezPiyc

Superconductivity:

https://www.youtube.com/watch?v=MT5Xl5ppn48**Optical Fiber:**

https://www.youtube.com/watch?v=N_kA8EpCUQo

Quantum Mechanics: https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s

NPTEL Supercoductivity:https://archive.nptel.ac.in/courses/115/103/115103108/

Virtual LAB:https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

http://nptel.ac.in

https://swayam.gov.in

https://virtuallabs.merlot.org/vl_physcs.

htmlhttps://phet.colorado.edu

https://www.myphysicslab.com

COs and POs Mapping (Individual teacher has to fill up)

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	8	9	10	11	12
CO1												2
CO2	3	1										2
CO3	3	3										2
CO4	1				2			1	3			2
CO5	1			2	2			1				2

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped