Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Physics
Scheme and Syllabus - 2022 -2023

Course Title	**Physics for Electrical & Electronics Engineering Stream**						
Course Code	**22PHT102EE/202EE**						
Category	Applied Science Course (ASC) (IC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	06	40+26	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE: To introduce the Engineering students to the basics of quantum Mechanics, Electric and Dielectric properties of materials, Laser and fiber optics, fundamentals of vector calculus and EM waves and semiconductors and devices with an emphasis on inculcating strong analytical skills among them so that they can understand and analyze complex engineering problems with relative ease.

UNIT I **8 hours**

Elasticity: Review of elasticity. Torsion: Expression for couple per unit twist of a solid cylinder (derivation). Torsional Pendulum: Expression for period of oscillation and Rigidity modulus (derivation). Bending of Beams: Definition of beam, neutral surface and neutral axis. Expression for bending moment of a beam (derivation). Expression for Young's modulus of the material of a single cantilever (derivation). Numerical problems.

UNIT II **8 hours**

Vibrations: ***Review of Simple harmonic Motion.*** Theory of free vibrations, theory of damped vibrations and discussion of three cases of damping. Theory of Forced vibrations. Resonance: Condition for resonance, sharpness of resonance. Numerical problems.

Thermoelectric materials and devices:

Thermo emf and thermo current, Seeback effect, Peltier effect, Seeback and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity. Expression for thermo emf in terms of T1 and T2, Thermo couples, thermopile, Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high-temperature thermoelectric materials, Applications: Exhaust of Automobiles, Refrigerator, Space Program (RTG). Numerical Problems.

Pre-requisites: Basics of Electrical conductivity

Self-learning: Thermo emf and thermo current

Cryogenics:

Production of low temperature - Joule Thomson effect (Derivation with 3 cases), Porous plug experiment with theory, Thermodynamical analysis of Joule Thomson effect, Liquefaction of Oxygen by cascade process, Lindey's air liquefier, Liquefaction of Helium and its properties, Platinum Resistance Thermometer, Applications of cryogenics, in aerospace, Tribology and food processing(qualitative). Numerical problems.

Pre-requisites: Basics of Heat and Thermodynamics

Self-learning: Joule Thomson effect

UNIT V **8 hours**

Nanomaterials and Characterization Techniques:

Introduction to nanomaterials: Nano Scale, Surface to Volume Ratio, Quantum Confinement, types of nanomaterials, size determination by Scherrer equation.

Characterization Technique: Principle, construction and working of X-ray Diffractometer, Transmission electron microscopy (TEM), Atomic Force Microscopy (AFM), Numerical problems **Pre-requisites: Principle and working of Optical Microscope** **Self-learning: X-Ray Diffractometer**

TEACHING and LEARNING PROCESS: Chalk and Talk, power point presentation, animatio videos

Course outcome (Course Skill Set) At the end of the course the student will be able to:	
CO1	**Describe** the fundamental principles of Quantum Mechanics and the essentials of Photonics
CO2	**Elucidate** the concepts of dielectrics and superconductivity
CO3	**Discuss** the fundamentals of vector calculus and their applications in Maxwell's Equations and EM Waves
CO4	**Summarize** the properties of semiconductors and the working principles of semiconductor devices
CO5	**Practice** working in groups to conduct experiments in physics and perform precise and honest measurements

Suggested Learning Resources:

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

1. A Textbook of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand. & CompanyLtd, New Delhi.
2. An Introduction to Lasers theory and applications by M.N.Avadhanulu and P.S.Hemne revised Edition 2012. S.Chand and Company Ltd -New Delhi.
3. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017.
4. Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006.
5. Fundamentals of Fibre Optics in Telecommunication & Sensor Systems, B.P. Pal, New Age International Publishers.
6. Introduction to Electrodynamics, David Griffith, 4th Edition, Cambridge University Press 2017.
7. Lasers and Non-Linear Optics – B.B. Laud, 3rd Ed, New Age International Publishers 2011.
8. LASERS Principles, Types and Applications by K.R. Nambiar-New Age International Publishers.
9. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018.

Web links and Video Lectures (e-Resources):

Laser:https://www.britannica.com/technology/laser, k
Laser:https://nptel.ac.in/courses/115/102115102124/
Quantummechanics:https://nptel.ac.in/courses/115/104/115104096/
Physics:http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

NumericalApertureoffiber: https://bop-iitk.vlabs.ac.in/exp/numerical-aperture-measurement
NPTELSupercoductivity:https://archive.nptel.ac.in/courses/115/103/115103108/

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

http://nptel.ac.in
https://swayam.gov.in
https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
https://virtuallabs.merlot.org/vl_physics.html
https://phet.colorado.edu
https://www.myphysicslab.com

Laboratory Component:

Any Ten Experiments have to be completed from the list of experiments
Note: The experiments have to be classified into
a) Exercise
b) Demonstration
c) Structured Inquiry
d) Open Ended
Based on convenience classify the following experiments into the above categories. Select at least one simulation/spreadsheet activity.

List of Experiments:

1. Wavelength of LASER using Grating
2. Numerical Aperture using optical fiber
3. Four Probe Method
4. Charging and Discharging of a Capacitor
5. Transistor Characteristics
6. Photo-Diode Characteristics
7. Series and Parallel LCR Circuits
8. Magnetic Field at any point along the axis of a circular coil
9. Plank's Constant using LEDs.
10. Fermi Energy
11. Black Box
12. Energy Gap of the given Semiconductor
13. Dielectric Constant
14. PHET Interactive Simulations (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)
15. Online Circuit Simulator (https://www.partsim.com/simulator)
16. Study of Electrical quantities using spreadsheet

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

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	1	-	-	-	-	-	-	2
CO5	3	2	1	-	2	-	-	3	3	-	-	2

Note: The CO-PO mapping values are indicative. The course coordinator can alter the mapping using **Competencyand Performance Indicators** mentioned in the **AICTE Exam reforms.**