Code:1BPHCS102/202 **Course: Applied Physics for Computer Science and Engineering stream**

Credits: 3 **L:T:P:S- 2:2:0:0**

SEE: 50 Marks **CIE: 50 Marks**

SEE Hours: 3 **Max. Marks:100**

Learning objectives	1. Learn the basic principles of Physics pertaining to the Engineering field 2. To understand and explain the concepts of Physics relevant to Engineering and Technology 3. Applying the knowledge of Physics in solving problems

Course Outcomes:

On the successful completion of the course, the student will be able to

Cos	**Course Outcomes**	**Bloom's level**
CO1	Discuss the concepts of photonics, quantum physics, superconducting, dielectric materials, and quantum computing.	Understand
CO2	Apply the principles of quantum physics, photonics, and quantum computing to solve engineering and material science problems	Apply
CO3	Analyze the behavior of metals, semiconductors, superconductors, and dielectric systems using Physics principles.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11		PSO1	PSO2	PSO3
CO1	3	2											To be identified for each branch by the Course Instructor		
CO2	3	2													
CO3	3	3													

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

Module – 1: Photonics		**No. of Lecture Hours**	**No. of Tutorial Hours**
1.1	Interaction of radiation with matter, Basic Characteristics of lasers	1	0
1.2	Einstein's coefficients (derivation), Requisites and conditions for Lasers	1	0
1.3	Ruby laser, Applications of Lasers: LIDAR and Quantum RADARs	1	0
1.4	Numerical problems	0	1
1.5	Introduction to optical fibers, Numerical aperture, V-	1	0

	number		
1.6	Types of optical fibers, Attenuation, fiber losses	1	0
1.7	Applications: point-to-point communication	1	0
1.8	Merits and demerits of optical fiber, Numerical problems	0	1
Module – 2: Quantum Mechanics			
2.1	de Broglie hypothesis, Matter waves and their properties, Compton effect	1	0
2.2	Phase velocity, Group velocity (derivation)	1	0
2.3	Group and particle velocity relation (relativistic method)	1	0
2.4	Heisenberg's uncertainty: Physical significance and application	0	1
2.5	Numerical problems, Wave function: Properties and Physical significance	0	1
2.6	One-dimensional time-independent Schrödinger wave equation	1	0
2.7	Eigenvalues and Eigenfunctions of a particle in a 1D infinite potential well	1	0
2.8	Role of higher dimensions, quantum tunnelling (Qualitative); Numericals	0	1
Module – 3: Electrical properties of metals and semiconductors			
3.1	Classical free-electron theory, Electrical conductivity in metals (derivation)	1	0
3.2	Failure of classical free electron theory, Numerical problems	0	1
3.3	Assumptions of Quantum free-electron theory (QFET), FD statistics	1	0
3.4	Fermi Energy, Variation of Fermi Factor with Temperature and Energy	1	0
3.5	Density of states (derivation), Expression for Fermi Energy at zero Kelvin	1	0
3.6	Merits of QFET, Numerical problems	0	1
3.7	Intrinsic and extrinsic & direct and indirect band gap semiconductors	0	1
3.8	Fermi level in an intrinsic semiconductor (derivation)	1	0
3.9	Numerical problems	0	1
Module – 4: Superconductivity and Dielectric Materials			
4.1	Superconductors, Temperature dependence of resistivity, Meissner effect	1	0
4.2	Types of superconductors, BCS theory	1	0
4.3	Qualitative discussion on Josephson junction and Flux quantization	0	1
4.4	Applications: MAGLEV and SQUIDs, Numerical problems	0	1
4.5	Introduction to dielectric materials, Types of polarization	1	0
4.6	Equation for internal fields in solids (1D), Clausius-Mossotti equation	1	0
4.7	Numerical problems	0	1
Module – 5: Quantum computing			
5.1	Introduction to quantum computing, Moore's law	1	0

5.2	Qubit and its properties, Bloch Sphere, Types of qubits, Dirac notation	1	0
5.3	Matrix algebra for Quantum Computing	1	0
5.4	Difference between classical and quantum computing, Numerical problems	0	1
5.5	Quantum Gates – Pauli Gates (X, Y, Z)	1	0
5.6	Phase gates (S, T), Hadamard Gate	1	0
5.7	CNOT gate, Basic types of quantum algorithms (Qualitative)	1	0
5.8	Types of errors and corrections (Qualitative), Numerical problems	0	1
	Total No. of Lecture Hours	**26**	**-**
		Total No. of Tutorial Hours	**14**

Text Books:

1. Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
2. Quantum Computing, Parag K Lala, McGraw-Hill, 2020
3. Solid State Physics by S O Pillai, New Age International, 9th Edition, 2020

Reference Books:

1. Concepts of Modern Physics by Arthur Beiser, Shobhit Mahajan & S. Rai Choudhury, Tata McGraw–Hill Publication, 7th Edition, 2017
2. A textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
3. Engineering Physics, Satyendra Sharma and Jyotsna Sharma, Pearson, 2018.
4. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge University Press, 2010 Edition.
5. Vishal Sahani, Quantum Computing, McGraw Hill Education, 2007 Edition.

Online Resources:

1. LASER : https://www.youtube.com/watch?v=WgzynezPiyc
2. Quantum Mechanics : https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
3. NPTEL Supercoductivity: https://archive.nptel.ac.in/courses/115/103/115103108/
4. NPTEL Quantum Computing : https://archive.nptel.ac.in/courses/115/101/115101092

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

1. http://nptel.ac.in
2. https://swayam.gov.in
3. https://virtuallabs.merlot.org/vl_physics.html
4. https://phet.colorado.edu
5. https://www.myphysicslab.com