NARASIMHA REDDY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad

Accredited by NAAC with A Grade, Accredited by NBA

B.TECH FIRST YEAR

QUESTION BANK

Course Title : APPLIED PHYSICS

Course Code : AP1102BS

Regulation : NR21

Course Objectives:

1. Students will demonstrate skills in scientific inquiry, problem solving and laboratory techniques.
2. Students will be able to demonstrate competency and understanding of the concepts found in Quantum Mechanics, Fiber optics and lasers, Semiconductor physics and Electromagnetic theory and a broad base of knowledge in physics.
3. The graduates will be able to solve non-traditional problems that potentially draw on knowledge in multiple areas of physics.
4. To study applications in engineering like memory devices, transformer core and superconductors.

Course Outcomes (CO's)

C112.1	**Analyze, demonstrate, evaluate, categorize** the importance of behavior of a particle quantum mechanically
C112.2	**Analyze, Develop, evaluate,** the concentration estimation of charge carriers in semi conductors
C112.3	**Analyze & compare** the device structures in Semiconductor electronics
C112.4	**Analyze** and **explain** principle, working of various laser systems and **examine** light propagation through optical fibers.
C112.5	**Analyze, demonstrate, evaluate and compare** various magnetic dielectric properties and apply them in engineering applications

UNIT–I

Principles of Quantum Mechanics

S.No	Questions	BT	CO	PO
	Part – A (Short Answer Questions)			
1	What is photo electric effect. Give the Einstein equation	L1	1	1,2,3
2	Give the Born's interpretation of wave function.	L3	1	1,2,3
3	State Planck's law with formula	L2	1	1,2,3
4	Define a Black body and what black body radiations are.	L2	1	1,2,3
5	State Compton effect and write Compton shift	L2	1	1,2,3
6	What are matter waves? Write some characteristics of matter waves.	LI	1	1,2,3

7		Write the significance of quantum mechanics.	L2	1	1,2,3
8		State Stefan's law.	L2	1	1,2,3
9		State Wien's displacement law.	L2	1	1,2,3
10		State Wien's law and Raliegh Jeans formula.	L2	1	1,2,3
Part – B (Long Answer Questions)					
11	a)	Discuss about de-Broglie Hypothesis? Derive an expression for de- Broglie wavelength for an electron.	L2	1	1,2,3
	b)	Summarize how did G-P Thomson in their experiment give the experimental verification of matter waves?	L2	1	1,2,3
12	a)	Explain Compton Effect. And derive Compton shift	L2	1	1,2,3
	b)	In Compton scattering the incident photons wave length is doubled when it is scattered through an angle of 90 by a target material. Find the incident wavelength.	L3	1	1,2,3
13	a)	Derive Schrodinger 1-D wave equation. Discuss Born's interpretation of the wave length.	L3	1	1,2,3
	b)	Elucidate Black body radiation with energy distribution curves.	L2	1	1,2,3
14	a)	Summarize how did DAVISSON-GERMER in their experiment give the experimental verification of matter waves?	L2	1	1,2,3
	b)	Find the de-Broglie wavelength associated with electron accelerated to a potential of 6400V	L3	1	1,2,3
15	a)	Discuss about Photoelectric Effect? What are the factors influencing the photo electric effect?	L2	1	1,2,3
	b)	Calculate the work function of sodium if its threshold wavelength is 5040 A^o.	L3	1	1,2,3
16	a)	Estimate the energy of a particle in 1-D potential box.	L3	1	1,2,3
	b)	For an electron in a one-dimensional infinite potential well of width $1A^0$, calculate the energy separation between the two lowest energy level and also calculate the frequency and wavelength of phonon corresponding to a transition between these two levels.	L3	1	1,2,3

UNIT–II

Semiconductor Physics

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		What are donors and acceptors? Give two examples each.	LI	2	1,2,3
2		Explain the concept of Hall effect.	L2	2	1,2,3
3		What are intrinsic and extrinsic semiconductors?	LI	2	1,2,3
4		What is Fermi level	LI	2	1,2,3
5		Write any two applications of Hall effect.	L2	2	1,2,3
6		Discuss Zener effect & Zener break down	L2	2	1,2,3
7		Discuss Drift and Diffusion Mechanism	L2	2	1,2,3
8		What is biasing and explain the different types of biasing.	L1	2	1,2,3
9		Write any two applications of Zener diode.	L2	2	1,2,3
10		Write a note on formation of P-N Junction.	L2	2	1,2,3
Part – B (Long Answer Questions)					
11	a)	Derive an expression for the Carrier Concentration of n-type Extrinsic semiconductor.	L3	2	1,2,3
	b)	Discuss the drift and diffusion currents in a semiconductor	L2	2	1,2,3
12	a)	State and explain the Hall Effect with its applications?	L2	2	1,2,3

	b)	A silicon plate of thickness 1mm, breadth 10mm, and length 100mm is placed in a magnetic field of 0.5 wb/m^2 acting perpendicular to its thickness. If 10^{-2} A current flows along its length, calculate the Hall voltage developed if the hall coefficient is 3.66X10^{-4} m^3/C	L3	2	1,2,3
13	a)	Analyze the Energy band Diagram of P-N Junction Diode with various bias conditions	L4	2	1,2,3
	b)	Discuss the V-I Characteristics of P-N Junction Diode		2	1,2,3
14	a)	Explain the variation of Fermi energy level with temperature for an n-type extrinsic semiconductor.	L2	2	1,2,3
	b)	Differentiate between n-type and p-type extrinsic semiconductor	L2	2	1,2,3
15	a)	Derive an expression for the Carrier Concentration of electrons in conduction band.	L3	2	1,2,3
	b)	An n-type germanium sample has a donor concentration of 10^{21} m^3. It is arranged in a hall experiment having magnetic field of 0.5 T and the current density is 500 A/m^2. Find the Hall voltage if the sample is 3mm wide	L3	2	1,2,3

UNIT–III

Physics of Semiconductor Devices

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		Give the applications of solar cell in Day to day life	L3	3	1,2,3
2		What are direct band gap and indirect band gap semiconductors	L1	3	1,2,3
3		Give three differences between semiconductor laser and LED.	L3	3	1,2,3
4		Give few applications LED	L3	3	1,2,3
5		Give few applications semiconductor laser diode	L3	3	1,2,3
6		Give few applications Photo Diode	L3	3	1,2,3
7		Write a short note on materials used for the construction of LED.	L2	3	1,2,3
8		Write some advantages of LED	L2	3	1,2,3
9		Write some advantages of Solar cell	L2	3	1,2,3
10		Write a short note on recombination mechanism	L2	3	1,2,3
Part – B (Long Answer Questions)					
11	a)	What is an LED? Explain the working and characteristics of LED with a neat diagram.	L1	3	1,2,3
	b)	What is a radiative and non – radiative recombination mechanism in semiconductors.	L1	3	1,2,3
12	a)	What are the semiconductor laser diodes? Describe the construction and working of a semiconductor laser with energy band diagram.	L1	3	1,2,3
	b)	Discuss advantages of diode lasers over gas lasers.	L2	3	1,2,3
13	a)	Discuss the construction, working, characteristics of a solar cell with neat diagrams	L2	3	1,2,3
	b)	Discuss merits, demerits and applications of solar cell	L2	3	1,2,3
14	a)	Discuss the construction, working, characteristics of a photo diode with neat diagrams.	L2	3	1,2,3
	b)	Write some applications of Photo diode	L2	3	1,2,3
15	a)	Discuss about Photo detectors with there working	L2	3	1,2,3
	b)	Discuss merits, demerits and applications of LED	L2	3	1,2,3

UNIT–IV

Lasers & Fiber Optics

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		Explain total internal reflection?	L2	4	1,2,3
2		Explain losses associated with optical fibers.	L2	4	1,2,3
3		Why population inversion is necessary for lasing action?	L3	4	1,2,3
4		What is population inversion in LASERS? How to achieve it.	L1	4	1,2,3
5		Explain spontaneous and stimulated emission of radiation with energy level diagram.	L2	4	1,2,3
6		Explain the term 'numerical aperture' and 'acceptance angle'	L2	4	1,2,3
7		Write any two applications of optical fiber	L2	4	1,2,3
8		What is the importance of Step Index fiber?	L1	4	1,2,3
9		Define Acceptance Cone.	L2	4	1,2,3
10		An optical fiber having refractive indices of 1.6 and 1.59 for core and cladding respectively is placed in water of refractive index 1.33. Find the Numerical Aperture of the fiber.	L3	4	1,2,3
Part – B (Long Answer Questions)					
11	a)	Write down the characteristics of Laser light.	L2	4	1,2,3
	b)	Describe the construction and working of He-Ne laser with suitable diagrams.	L3	4	1,2,3
12	a)	Explain the interaction of light radiation with matter and hence deduce Einstein coefficients.	L2	4	1,2,3
	b)	Write applications of lasers in scientific and medical fields.	L3	4	1,2,3
13	a)	Derive an expression for acceptance angle and numerical aperture.	L3	4	1,2,3
	b)	Give an account of graded and step index fiber.	L3	4	1,2,3
14	a)	Explain with neat diagram the principle and working of a Ruby laser.	L2	4	1,2,3
	b)	Write the applications of optical fibers in sensor field.	L3	4	1,2,3
15	a)	Discuss the losses associated with optical fibers.	L2	4	1,2,3
	b)	Write the medical applications of optical fibers.	L3	4	1,2,3
16	a)	Distinguish between step-index and graded index fibers with the help of refractive index profile.	L2	4	1,2,3
	b)	Draw the block diagram of an optical fiber communication sytem and explain the function of each block.	L2	4	1,2,3

UNIT–V

Dielectric and Magnetic Properties

S.No	Questions	BT	CO	PO
Part – A (Short Answer Questions)				
1	What is Piezoelectric effect	L1	5	1,2,3
2	Explain dielectric constant and electrical susceptibility	L2	5	1,2,3
3	Distinguish between Ferro- electricity and Piezoelectricity	L2	5	1,2,3

4		Explain Ferro magnetism	L2	5	1,2,3
5		What is electronic polarization	L1	5	1,2,3
6		What is an internal field in dielectrics? Explain.	L1	5	1,2,3
7		Derive the relation between B, H and M	L3	5	1,2,3
8		Define polarization vector and displacement vector	L2	5	1,2,3
9		Derive relation between D,P and E	L3	5	1,2,3
10		Define the terms dielectric polarizability and dielectric susceptibility	L2	5	1,2,3
Part – B (Long Answer Questions)					
11	a)	Explain in detail the classification of magnetic materials	L2	5	1,2,3
	b)	Describe the Hysteresis behavior of ferromagnetic material.	L3	5	1,2,3
12	a)	What are the differences between soft and hard magnetic materials?	L2	5	1,2,3
	b)	Derive an expression for Clausius Mosotti relation	L3	5	1,2,3
13	a)	Obtain an expression for the internal field seen by an atom in an infinite array of atoms subjected to an external field.	L3	5	1,2,3
	b)	Write a note on domain theory of ferromagnetism	L2	5	1,2,3
14	a)	Discuss different types of polarization and hence derive Langevin – Debye Equation	L2	5	1,2,3
	b)	Find the relative permeability of a ferromagnetic material if a field of strength 220amp/meter produces a magnetization 3300amp/meter in it.	L3	5	1,2,3
15	a)	Differentiate between Dia and Para Magnetic materials	L2	5	1,2,3
	b)	Explain the terms: I. Electric field intensity II. Polarization vector III. Displacement vector	L2	5	1,2,3

* **Blooms Taxonomy Level (BT)** (L1 – Remembering; L2 – Understanding; L3 – Applying; L4 – Analyzing; L5 – Evaluating; L6 – Creating)

Course Outcomes (CO)

Program Outcomes (PO)

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