Course: F.Y.B. Tech.   Branch : E&CE/EE(VLSI Design &Tech)/Civil/Mech

Subject Code & Name: BTPESA102T & Engineering Physics   Semester : I

Max Marks: 60   Date: Duration: 3 Hr.

Instructions to the Students:
1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		Marks
Q. 1	**Solve Any six of the following.**	**6x2=12**
A)	Define absorption coefficient of a material. What is its unit?	
	Definition	**1**
	Unit	**1**
B)	What is magnetostriction effect?	
	Definition with diagram	**2**
C)	State any two advantages of fiber-optic communication systems.	
	Any two advantages.	**2**
D)	Differentiate between spontaneous and stimulated emission.	
	Any two differences	**2**
E)	Write the Miller indices of a plane intercepting axes at (a, 2b, 3c).	
	Intercepts (1, ½, 1/3)	**1**
	Miller Indices (632)	**1**
F)	Arrange α, β and γ radiations in terms of their ionizing power and penetration ability.	
	Ionizing Power: $\alpha > \beta > \gamma$	**1**
	Penetration Ability: $\gamma > \beta > \alpha$	**1**
G)	Define intrinsic semiconductor. Write the two types of charge carriers.	
	Definition	**1**
	Charge carriers.	**1**
H)	State the time-dependent Schrödinger wave equation. Explain the meaning of all symbols.	**2**
	$$i\hbar \frac{\partial \Psi}{\partial t} = \left[-\frac{\hbar^2}{2m}\nabla^2 + V(r,t) \right]\Psi\,(\mathbf{r},\,t)$$	
I)	What is a wave function? Mention its physical significance.	

		Definition	1
		Physical Significance (Relation between wave function and probability)	1
Q.2		**Solve Any Two of the following.**	**12**
A)		Derive Sabine's formula for reverberation time of a hall.	
		Definition (reverberation time)	1
		Derivation	4
		Sabine's formula with meaning of parameters $T = \frac{0.165\,V}{\alpha S}$	1
B)		Explain any three applications of ultrasonic waves in detail.	
		Any three applications (Figures + Explanation)	**2×3**
C)		a) Define piezoelectric and inverse piezoelectric effect.	
		Definition (piezoelectric effect)	1
		Definition (inverse piezoelectric effect)	1
		b) The fundamental vibrational frequency of a quartz crystal is 3×10^6 Hz. If it is vibrating at resonance, what is its thickness? Young's modulus of quartz $= 7.9 \times 10^{10}$ N/m^2 and density of quartz $= 2650$ kg/m^3.	
		Formula : $f = \frac{1}{2l}\sqrt{\frac{Y}{\rho}}$	1
			2
		Calculation (Steps)	1
		Answer: 0.9 mm.	
Q. 3		**Solve Any Two of the following.**	**12**
A)		Explain the construction and working of a He-Ne laser.	
		Construction of He-Ne Laser (Diagram)	1
		Construction of He-Ne Laser (Explanation)	2
		Energy Level Diagram	1
		Energy Level Diagram (Explanation)	2
B)		Define acceptance angle. Derive an expression for the acceptance angle for an optical fiber.	
		Definition	1
		Diagram	2
		Derivation	2
		Final Expression ($\theta_a = \sin^{-1}(\sqrt{n_1^2 - n_2^2})$)	1
C)		Explain the classification of solids into conductors, semiconductors and insulators using the energy band diagram.	
		Definitions (Conductors, semiconductors and insulators)	3

		Comparison based on energy band gap	**3**
Q.4		**Solve Any Two of the following.**	**12**
A)		Derive the packing fractions for SCC, BCC and FCC Lattice.	
		APF for SCC	**2**
		APF for BCC	**2**
		APF for FCC	**2**
B)		Explain the construction and working of a G.M. counter.	
		Construction (Diagram)	**2**
		Construction (Explanation)	**1**
		Working	**3**
C)		Explain the behavior of diamagnetic, paramagnetic and ferromagnetic materials in an external magnetic field.	
		Diamagnetic Materials (Diagram and explanation)	**2**
		Paramagnetic Materials (Diagram and explanation)	**2**
		Ferromagnetic Materials (Diagram and explanation)	**2**
Q. 5		**Solve Any Two of the following.**	**12**
A)		State the de Broglie hypothesis and show that the expression for the de Broglie wavelength ($\lambda = \frac{h}{\sqrt{2mE}}$).	
		De-Brogli hypothesis	**2**
		Derivation	**4**
B)		Derive the expression for the path difference in a thin film for reflected system. Also, state the condition for minima and maxima.	
		Diagram	**1**
		Derivation	**2**
		Expression for path difference ($\Delta = 2\mu t\cos r + \lambda/2$)	**1**
		Condition for maxima ($2\mu t\cos r = \frac{2n+1}{2}\lambda$, n = 0,1,2 ..)	**1**
		Condition for minima ($2\mu t\cos r = n\lambda$, n = 1,2 ..)	**1**
C)		a) In a Newton's ring experiment, the diameter of 4th and 12th dark rings are 0.4cm and 0.7 cm, respectively. Deduce the diameter of 20th dark ring.	
		Formula ($D_n^2 = 4Rn\lambda$)	**1**
		Calculations (Steps)	**1**
		Answer (D_{20} = 0.9055 cm)	**1**
		b) Interference fringes are formed in a thin air wedge using sodium light of wavelength 5893 Å. When observed normally, 10 fringes are found in a distance of 1 cm. Calculate	

	the angle of the wedge.	
	Formula ($\theta = \dfrac{\lambda}{2\mu\beta}$)	**1**
		1
	Calculations (Steps)	**1**
	Answer (2.946×10^{-4} rad)	
	*** End ***	

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