Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem Examination Dec-2023

EN3BS10 Physics for Computing Science

Programme: B.Tech. Branch/Specialisation: CSBS

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. What is the condition for optical transition from ground state to excited state of an atom? (Incident photon energy = hν and energy gap between the states = ΔE) **1**

(a) $h\nu > \Delta E$ (b) $h\nu < \Delta E$ (c) $h\nu = \Delta E$ (d) None of these

ii. Optical fiber communication uses carrier wave as- **1**

(a) Laser wave (b) Radio wave

(c) Ordinary light (d) Microwaves

iii. When a light ray is incident on a thick glass plate (μ=1.732), the reflected light is plane polarised. The angle of incidence is- **1**

(a) 45^o (b) 55^o (c) 60^o (d) 68^o

iv. Diffraction grating is an arrangement of- **1**

(a) 2 slits (b) 4 slits (c) 6 slits (d) N slits

v. According to quantum mechanics, for the particle moving in a box- **1**

(a) The energy levels are discrete and equispaced

(b) The energy levels are continuous

(c) The energy levels are discrete but not equispaced

(d) The energy is always zero

vi. If a = 10.8 Å, b = 9.47 Å, c = 5.2 Å, $\alpha = 41^0$, $\beta = 83^0$ and $\gamma = 93^0$, the crystal structure is- **1**

(a) Trigonal (b) Cubic

(c) Orthorhombic (d) Triclinic

vii. As the particle approaches from the extreme position to the mean position its- **1**

(a) Kinetic energy decreases (b) Potential energy decreases

(c) No change in potential energy (d) Potential energy increases

P.T.O.

viii. The vector field **A** is irrotational if- **1**

(a) $\vec{\nabla} \times \vec{A} = 1$ (b) $\vec{\nabla} . \vec{A} = 0$

(c) $\vec{\nabla} \times \vec{A} = 0$ (d) $\vec{\nabla} . \vec{A} = 1$

ix. With fall of temperature, the forbidden energy gap of a semiconductor- **1**

(a) Remains unchanged

(b) Increases

(c) Sometimes increases and sometimes decreases

(d) Decreases

x. Entropy remains constant in- **1**

(a) Isothermal process (b) Adiabatic process

(c) Cyclic process (d) Isobaric process

Q.2 i. A step index fiber has a core with a refractive index of 1.55 and a cladding with a refractive index of 1.51. Calculate the numerical aperture, acceptance angle and fractional refractive index change. **3**

ii. With the help of block diagram and energy level diagram explain the construction and working of Carbon dioxide (CO_2) laser. **7**

OR iii. Derive the expression for Einstein's 'A' and 'B' coefficients. Why it is difficult to build up laser in X-ray region? **7**

Q.3 i. Distance between the two virtual coherent sources in biprism is 0.1 mm and the width of the fringes formed on the screen is 5 mm. If the distance between the screen and the slit is one meter, what would be the wavelength of light used? **3**

ii. Make a neat and clean diagram of Newton's ring set up. Why circular fringes are formed in this setup? Prove that diameter of n^{th} dark fringe is proportional to the square root of natural number. **7**

OR iii. In Fraunhofer's diffraction due to a single slit, show that the intensity of the first secondary maximum is roughly 4.5 % of that of the principal maxima. **7**

Q.4 i. Calculate the deBroglie wavelength associated with the automobile of mass 2 x 10^3 kg which is moving with a speed of 96 km /hr. **3**

ii. Obtain the energy eigen values and normalized wave function for a particle enclosed in an infinite square well potential. **7**

OR iii. Starting from the wave equation and introducing energy and momentum of the particle obtain an expression for one dimensional Schrodinger's equation in time independent form **7**

Q.5 Attempt any two:

i. Derive a general equation of motion for a simple harmonic oscillator and obtain its solution. **5**

ii. Explain the following terms with suitable example- **5**

(a) Forced oscillation (b) Resonance

iii. What are Maxwell's equations? Write down their differential form with physical significance. **5**

Q.6 Attempt any two:

i. On this basis of energy level diagram of solids, differentiate between insulator, conductor and semiconductor. **5**

ii. What is the first law of thermodynamics? How can we apply it in the cyclic and isothermal process? **5**

iii. What are the different statements of the second law of thermodynamics? **5**

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Scheme of Marking

Physics for Computing Science (T) - EN3BS10 (T)

Q.1	i)	c) $h\nu = \Delta E$		**1**
	ii)	a) laser wave		**1**
	iii)	c) 60^o		**1**
	iv)	d) N slits		**1**
	v)	c) the energy levels are discrete but not equispaced		**1**
	vi)	d) triclinic		**1**
	vii)	b) potential energy decreases		**1**
	viii)	c) $\vec{\nabla} \times \vec{A} = 0$		**1**
	ix)	a) remains unchanged		**1**
	x)	b) adiabatic process		**1**
Q.2	i.	Correct Formula	1 mark	**3**
		Remaining calculation (**Ans**. NA = 0.3499, Accp. angle =20.47 degree, FRIC= 0.0258)	2 marks	
	ii.	block diagram	1 mark	**7**
		energy level diagram	2 marks	
		construction	2 marks	
		working	2 marks	
OR	iii.	Derivation upto three quantum process	2 marks	**7**
		Remaining derivation	3 marks	
		Reason for (X-ray region)	2 marks	
Q.3	i.	Correct Formula	1 mark	**3**
		Remaining calculation (Ans. 5000 Angstrom)	2 marks	
	ii.	experimental arrangement	2 marks	**7**
		rings are circular in nature	1 mark	
		Derivation	4 marks	
OR	iii.	Diagram	1 mark	**7**
		Expression upto the resultant intensity	2 marks	
		Condition for principle maxima and minima	2 marks	
		Condition for secondary maxima	2 marks	
Q.4	i.	Correct Formula		**3**
		Remaining calculation (Ans. 1.24×10^{-38} m)	2 marks	
	ii.	Boundary Condition and equation	2 marks	**7**
		Value of constant 'B'	2 marks	
		Energy eigen value	1 mark	
		Normalized wave function	2 marks	
OR	iii.	Wave equation	2 marks	**7**
		Diff. w. r. to 'x'	2 marks	
		Total energy	1 mark	
		Final expression	2 marks	
Q.5	i.	Attempt any two:		
	ii.	Upto the diff eq. of SHM	2 marks	**5**
		Remaining derivation	3 marks	
	iii.	Forced oscillation with example	2.5 marks	**5**
		Resonance with example	2.5 marks	
		What are Maxwell's equations?	1 mark	**5**
		One mark each for all four (eq. with physical significance.)	4 marks	
Q.6	i.	Attempt any two:		
	ii.	Energy level diagram of all three	2 marks	**5**
		Three differences between insulator, conductor and semiconductor	3 marks	
	iii.	First law of thermodynamics	2 marks	**5**
		cyclic and isothermal process	3 marks	
	iv.	Clausius statement	2.5 marks	**5**
		Kelvin statement	2.5 marks	

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