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

Enrollment No.....

Faculty of Engineering / Science

End Sem (Odd) Examination Dec-2022

EN3BS13 / BC3BS02 Engineering Physics

Programme: B.Tech./ B.Sc.(CS) Branch/Specialisation: All/ Computer Science

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.

Q.1 i. Ruby laser produces the laser beam of wavelength- **1**
(a) 6493 Å (b) 6328 Å (c) 6943 Å (d) 6940 Å

ii. The numerical aperture of an optical fibre depends on- **1**
(a) Critical angle (b) Core refractive index
(c) Both (a) and (b) (d) None of these

iii. The diameters of dark rings in Newton's ring experiment are proportional to- **1**
(a) n (b) $n^{1/2}$ (c) n^2 (d) $(2n+1)$

iv. Light beam after reflection from an optically denser medium undergoes a phase change of- **1**
(a) π (b) 0 (c) π/2 (d) 2π

v. The scattered radiation in the Compton effect has- **1**
(a) Lower frequency (b) Higher frequency
(c) No change in frequency (d) None of these

vi. The uncertainty in the location of a particle is equal to its de-Broglie wavelength, then the uncertainty in its velocity will be- **1**
(a) Its velocity (b) Half of its velocity
(c) Twice its velocity (d) Four times its velocity

vii. If $a=b$=10.73 Å, c= 14.3 Å, α=β=90°, and γ= 120°, the crystal structure is- **1**
(a) Triclinic (b) Monoclinic (c) Orthorhombic (d) hexagonal

viii. The lattice planes of a crystal have intercepts 2a, 3b, and 6c on the axes. The Miller indices will be- **1**
(a) (1 2 3) (b) (3 2 2) (c) (3 2 1) (d) (2 1 3)

P.T.O.

ix. If a particle is oscillating on the same horizontal plane in the ground- **1**
(a) It has only kinetic energy but no potential energy
(b) It has only potential energy but no kinetic energy
(c) It has both kinetic and potential energies
(d) It has neither kinetic nor potential energies

x. What happens if the reverberation time is too large? **1**
(a) The sound becomes inaudible
(b) Echoes are produced
(c) Frequency becomes high
(d) The sound becomes infrasonic

Q.2 i. Find the intensity of a laser beam of 100 mW power and having a diameter of 1.3 m. Assume the intensity to be uniform. **2**

ii. Discuss the various properties of laser radiation. **3**

iii. Explain the basic principle of optical fibre. Discuss fibre classification. **5**

OR iv. Sketch and explain the working principle of He-Ne laser. How the population inversion is achieved in He-Ne laser? **5**

Q.3 i. In Newton's ring experiment, the diameter of the 10^{th} dark ring is 0.433 cm. Find the wavelength of incident light, if the radius of curvature of the lens is 70 cm. **2**

ii. Explain the formation of interference fringes by means of Fresnel's biprism when a monochromatic source of light is used and derive an expression for the fringe width. **8**

OR iii. Distinguish between Fresnel and Fraunhofer diffractions. Describe Fraunhofer diffraction due to a single slit and obtain an expression for maximum and minimum intensities. **8**

Q.4 i. Discuss the failures of classical physics. How does quantum mechanics overcome these failures? **3**

ii. What is Compton effect? Deduce an expression for the shift in wavelength of X-rays beams by giving its experimental verification. **7**

OR iii. Solve the Schrodinger equation for one-dimensional motion of a particle in a box of side L and obtain its eigen function and show that its eigen value is inversely proportional to the square of side L. **7**

Q.5 i. Determine the Miller indices of plane parallel to the *z* axis and cut intercepts of 2 and 2/3 along *x* and *y* axes, respectively. **2**

ii. Differentiate between type I and type II superconductors. **3**

iii. What is Hall effect? Deduce an expression for the hall coefficient and Hall Voltage for a solid. **5**

OR iv. Define the term packing density and deduce an expression for packing density of the face centred cubic structure. **5**

Q.6 Attempt any two:

i. Discuss various conditions for a good acoustical design. **5**

ii. Explain the simple harmonic oscillator and obtain an expression for its total mechanical energy. **5**

iii. What is meant by reverberation time? Explain Sabine's formula and its limitations. **5**

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Scheme of Marking

MEDI-CAPS UNIVERSITY Knowledge is Power	Faculty of Engineering End Sem (Odd) Examination Dec-2022 EN3BS13 Engineering Physics Programme: B.Tech. | Branch/Specialisation:

Note: The Paper Setter should provide the answer wise splitting of the marks in the scheme below.

Q.1	i)	Ruby laser produces the laser beam of wavelength c) 6943 Å	1
	ii)	The numerical aperture of an optical fibre depends on c) both (a) and (b)	1
	iii)	The diameters of dark rings in Newton's ring experiment are proportional to b) $n^{1/2}$	1
	iv)	Light beam after reflection from an optically denser medium undergoes a phase change of: a) π	1
	v)	The scattered radiation in the Compton effect has: a) lower frequency	1
	vi)	The uncertainty in the location of a particle is equal to its de-Broglie wavelength, then the uncertainty in its velocity will be: a) its velocity (b) half of its velocity → [–]	1
	vii)	If $a=b=10.73$ Å, c= 14.3 Å, α=β=90°, and γ= 120°, the crystal structure is d) hexagonal	1
	viii)	The lattice planes of a crystal have intercepts 2a, 3b, and 6c on the axes. The Miller indices will be c) (3 2 1)	1
	ix)	If a particle is oscillating on the same horizontal plane in the ground: c) It has both kinetic and potential energies	1
	x)	What happens if the reverberation time is too large? d) Echoes are produced	1
Q.2	i.	Find the intensity of a laser beam of 100 mW power and having a diameter of 1.3 m. Assume the intensity to be uniform.	2
		Formula, Intensity = power/area 1 mark $I = P/\pi r^2 = 4P/\pi d^2$ Intensity = 7.5 kW/m² : 75.32 1 mark	
	ii.	Discuss the various properties of laser radiation. 1 only Properties — 1 At least 3 properties Explanation — 2 1 mark each	3
	iii.	Explain the basic principle of optical fibre. Discuss fibre classification Principle + Diagram 2 marks Classification 3 marks	5
OR	iv.	Sketch and explain the working principle of He-Ne laser. How the population inversion is achieved in He-Ne laser? Sketch 1 mark Working Principle 2 marks Population inversion 2 marks	5
Q.3	i.	In Newton's ring experiment, the diameter of the 10th dark ring is 0.433 cm. Find the wavelength of incident light, if the radius of curvature of the lens is 70 cm Formula, $(D_n)^2 = 4nR\lambda$ 1 mark $\lambda = 6695$ Å 1 mark	2
	ii.	Explain the formation of interference fringes by means of Fresnel's biprism when a monochromatic source of light is used and derive an expression for the fringe width. Fresnel's biprism (Diagram) 2 marks Formation of interference fringes 3 marks Derivation for fringe width (Diagram) 3 marks	8
OR	iii.	Distinguish between Fresnel and Fraunhofer diffractions. Describe Fraunhofer diffraction due to a single slit and obtain an expression for maximum and minimum intensities.	8

		Fresnel and Fraunhofer diffraction 2 marks Intensity expression 4 marks Expression of Maxima 1 mark Expression of Minima 1 mark	
Q.4	i.	Discuss the failures of classical physics and how does quantum mechanics overcome these failures? Failures of classical mechanics 2 marks Superiority of Quantum mechanics 1 mark	**3**
	ii.	What is Compton effect? Deduce an expression for the shift in wavelength of X-rays beams by giving its experimental verification. Compton Effect with Diagram 2 marks Expression for Compton shift (2+2+1) 5 marks	**7**
OR	iii.	Solve the Schrodinger equation for one-dimensional motion of a particle in a box of side L and obtain its eigen function and show that its eigen value is inversely proportional to the square of side L. Explanation of diagram 1 mark Wave function 3 marks Eigen value 3 marks	**7**
Q.5	i.	Determine the Miller indices of plane parallel to the *z* axis and cut intercepts of 2 and 2/3 along *x* and *y* axes, respectively. (1, 3, 0) step Marks.	**2**
	ii.	Differentiate between type I and type II superconductors At least 3 differences 1 mark each	**3**
	iii.	What is Hall effect? Deduce an expression for the Hall coefficient and Hall Voltage for a solid Hall effect with sketch 2 marks Hall coefficient 1.5 marks Hall voltage 1.5 marks	**5**
OR	iv.	Define the term Packing density and deduce an expression for packing density of the face centred cubic structure. Packing density 2 marks	**5**

		Expression of packing density for FCC 3 marks	
Q.6			
	i.	Discuss various conditions for a good acoustical design. Conditions for a good acoustic 1 mark each (At least five conditions)	**5**
	ii.	Explain the simple harmonic oscillator and obtain an expression for its total mechanical energy Simple harmonic oscillator 1 mark Expression for total energy 4 marks	**5**
	iii.	What is meant by reverberation time? Explain Sabine's formula and its limitations. Reverberation time 1 mark Sabine's formula 2 marks Limitations 2 marks	**5**

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