Reg. No.															

B.Tech / M.Tech (Integrated) DEGREE EXAMINATION, MAY 2024
First and Second Semester

21PYB101J - PHYSICS: ELECTROMAGNETIC THEORY, QUANTUM MECHANICS, WAVES AND OPTICS

(For the candidates admitted from the academic year 2022-2023 onwards)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours | Max. Marks: 75

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

	Marks	BL	CO	PO
1. The vector field whose curl is zero is called _____ (A) Conservative (B) Rotational (C) Irrotational (D) Solenoid	1	1	1	1
2. The differential form of Maxwell's second equation is _____ (A) Div B = 0 (B) Curl B = 0 (C) Curl E = 0 (D) Div b = dE / dt	1	1	1	1
3. Orientation polarization arises due to presence of _____ (A) Conductor (B) Polar molecule (C) Semiconductor (D) Superconductor	1	1	1	1
4. The electronic polarizability of an argon atom with density 2.7×10^{25} atoms/m^3 and the relative permittivity $\epsilon_r=1.0024$ is _____ (A) 7.9×10^{-41} Fm^2 (B) 7.9×10^{-41} Fm (C) 7.9×10^{-41} F/m^2 (D) 7.9×10^{-41} F/m	1	2	1	2
5. In soft magnetic materials the nature of hysteresis loop is _____ (A) Straight line (B) Very broad (C) Negligible (D) Very steep	1	1	2	1
6. Ferrites are the modified structure of _____. (A) Cobalt (B) Iron (C) Nickel (D) Gold	1	1	2	1
7. Magneto resistance is the property of a material to change the value of ___ (A) Magnetic moment (B) Magnetism (C) Mobility (D) Electrical resistance	1	1	2	1
8. The magnetic field strength of silicon is 900 A/m. If the magnetic susceptibility is -0.35×10^{-5}, then the value of the magnetization. (A) -3.15×10^{-3} A/m (B) -3.5×10^{-3} A/m (C) -3.15×10^{-4} A/m (D) -3.5×10^{-4} A/m	1	2	2	2

9. In photoelectric effect, work function of a metal is the minimum energy needed to liberate an electron from the surface of the metal which is _____ 1 1 3 1

(A) $\phi=(1/2)mv^2+hv$ (B) $\phi=(1/2)mv^2$

(C) $\phi=mv^2+hv$ (D) $\phi=mv\times hv$

10. The wavelength of photon is 3.6Å, if the velocity of photon is equal to velocity of light then the mass of photon is given by ___ 1 2 3 2

(A) 4.125×10^{-33} kg (B) 5.235×10^{-30} kg

(C) 6.135×10^{-33} kg (D) 7.434×10^{-30} kg

11. The energy levels of an electron in 1 D box are _____ 1 1 3 1

(A) Discrete (B) Continuous

(C) Random (D) Unified

12. The probability of finding the particle inside the box can be done using the process called as _____ 1 1 3 1

(A) Quantization (B) Normalization

(C) Hybridization (D) Interference

13. Superposition of light waves from two or more coherent sources is known as _____ 1 1 4 1

(A) Reflection (B) Refraction

(C) Interference (D) Polarization

14. In Fraunhofer diffraction, the incident wave front should be _____ 1 1 4 1

(A) Elliptical (B) Plane

(C) Spherical (D) Cylindrical

15. The refractive index of a polarizer is 1.9218. What will be the polarization angle? 1 2 4 2

(A) 45° 30' (B) 50° 55'

(C) 90° (D) 62° 24'

16. The expression for the thickness of Quarter wave plate is given by ___ 1 1 4 1

(A) $d=\lambda/8(\mu_e-\mu_0)$ (B) $d=\lambda/3(\mu_e-\mu_0)$

(C) $d=\lambda/4(\mu_e-\mu_0)$ (D) $d=\lambda/5(\mu_e-\mu_0)$

17. The atom in the excited state emits a photon and returned to the ground state is called _____ 1 1 5 1

(A) Spontaneous Emission (B) Spontaneous Absorption

(C) Stimulated Emission (D) Stimulated Absorption

18. _____ lasers are used in military as range finders and target designators. 1 1 5 1

(A) CO_2 (B) Semiconductor

(C) Ruby (D) YAG

19.	The numerical aperture of fiber with a core index of 1.52 and a cladding index of 1.42 is _____ (A) 0.54 (B) 0.64 (C) 0.34 (D) 0.24	1	2	5	2
20.	_____ is a transducer which is used to convert one physical variable into another. (A) Optical fibre (B) Sensor (C) Capacitor (D) Light	1	1	5	1

PART – B (5 × 8 = 40 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
21. a.	Illustrate the Maxwell's equations in free space and obtain the expression for velocity of light in free space.	8	3	1	1
	(OR)				
b.	Describe the concept of various polarization with necessary diagrams and derive the Langevin – Debye equation.	8	3	1	1
22. a.	Illustrate the concept of i. Magnetic Bubble Memory (4 Marks) ii. Giant Magnetoresistance with necessary diagrams (4 Marks)	8	3	2	1
	(OR)				
b.i.	A magnetic field of 1800 ampere / metre produces a magnetic flux of 3×10^{-5} Weber in an iron bar if cross – section area 0.2 cm^2. Calculate permeability.	4	3	2	2
ii.	Illustrate the inverse spinel structure of ferrites with neat diagram.	4	3	2	2
23. a.	Derive the expression for time independent Schrodinger wave equation.	8	4	3	1
	(OR)				
b.i.	Illustrate the concept of Photoelectric effect.	4	3	3	1
ii.	Determine the de Broglie wavelength of an electron that has been accelerated through a potential difference of 100 V.	4	3	3	1
24. a.	Explain the Fraunhofer diffraction at single slit and determine the width of central maxima.	8	3	4	1
	(OR)				
b.	Explain the production and detection of elliptically polarized light using a quarter wave plate.	8	3	4	1
25. a.	Illustrate the construction and working of the CO_2 laser with the neat diagrams.	8	2	5	1
	(OR)				
b.	Define the numerical aperture. Obtain the expression for numerical aperture.	8	3	5	1

PART – C (1 × 15 = 15 Marks)

Answer **ANY ONE** Question

		Marks	BL	CO	PO
26.i.	Illustrate the Basic Laws of Electrostatics and Magnetostatics and obtain the differential and integral form all the FOUR Maxwell's equation with necessary steps.	12	3	1	1
ii.	Write any six differences between soft and hard magnetic materials.	3	1	2	1
27.i.	Discuss the application of Schrodinger wave equation to a particle enclosed in one dimension (1D) box. Illustrate the Energy eigen value and eigen function of particle in a 1 D box by applying Normalization condition.	12	3	3	4
ii.	Explain the concept of construction and reconstruction of Hologram with necessary diagrams.	3	2	5	1

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