Reg. No.															

B.Tech / M.Tech (Integrated) DEGREE EXAMINATION, MAY 2023
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 divergence is zero is called _____ (A) Irrotational (B) Rotational (C) Conservative (D) Solenoidal	1	2	1	1
2. The displacement current per unit area is called _____ (A) Conduction current density (B) Displacement current density (C) Permittivity (D) Permeability	1	1	1	1
3. Dielectrics are (A) Electric insulators (B) Electric conductor (C) Materials that work under low voltage (D) Hole conductor	1	1	1	1
4. Gauss law cannot be used to find which of the following quantity? (A) Electric field intensity (B) Electric flux density (C) Charge (D) Permittivity	1	2	1	1
5. _____ magnetic material does not possess permanent magnetic moment. (A) Para (B) Ferro (C) Dia (D) Antifero	1	2	2	1
6. A tiny movable magnetized cylindrical volume in thin magnetic materials is called _____ (A) Ferrite (B) Magnetic bubble (C) Magnetoplumbites (D) Garnet	1	2	2	1
7. Which of the following technique is mostly used to fabricate magnetic thin film? (A) Cutting process (B) Slicing process (C) Sputtering process (D) Mechanical process	1	2	2	1
8. Garnets cyrstallize in _____ system (A) Isometric (B) Hexagonal (C) Orthorombic (D) Monoclinic	1	1	2	1

9. Compton effect proves that _____ 1 2 3 1
   (A) Electron are negatively charged particles (B) Electron are massive particles
   (C) Photon have energy (D) Photon have momentum

10. According to de-Broglie, smaller is the _____ of the particle, greater is wavelength associated with it. 1 2 3 1
   (A) Current (B) Velocity
   (C) Magnetization (D) Force

11. The lower limit of position-momentum uncertainty product is on the order of 1 2 3 4
   (A) 10^{-5} (B) 10^{-10}
   (C) 10^{-20} (D) 10^{-34}

12. In Davisson – Germer experiment electron's wavelength is experimentally determined using 1 2 3 1
   (A) Coulomb's Law (B) Newton's Law
   (C) Bragg's Law (D) Snell's Law

13. The path difference for destructive interference is _____ 1 1 4 1
   (A) $(2n+1)\lambda/2$ (B) $(2n+1)\lambda$
   (C) $(n+1)\lambda/2$ (D) $(n+1)\lambda$

14. In Fraunhofer diffraction _____ lens is used to focus the rays 1 1 4 1
   (A) Concave (B) Convex
   (C) No lens used (D) Glass plate

15. Brewster's Law in terms of refractive index can be expressed as 1 2 4 1
   (A) $\mu = \sin\theta p$ (B) $\mu = \cos\theta p$
   (C) $\mu = \tan\theta p$ (D) $\mu = \cot\theta p$

16. The refractive index of the Canada Balsam is _____ 1 1 4 1
   (A) 1.42 (B) 1.49
   (C) 1.58 (D) 1.550

17. _____ refers to correlation in phase at a given point in space over a length of time. 1 1 5 1
   (A) Temporal (B) Spatial
   (C) Intensity (D) Monochromaticity

18. _____ is a technique of recording of complete information of an object. 1 1 5 2
   (A) Holography (B) Photography
   (C) Scanning (D) Masking

19. In single mode optical fiber the V-number is less than 1 2 5 2
   (A) 0.5 (B) 0.25
   (C) 1 (D) 2.4

20. The number of mode in a graded index fiber is about $M_N =$ 1 2 5 3
   (A) $V^2/2$ (B) $V^2/4$
   (C) $V^2/16$ (D) $V^2/32$

PART – B (5 × 8 = 40 Marks) Marks BL CO PO
Answer **ALL** Questions

21. a. Obtain I and III Maxwell's equation for electromagnetism from fundamental laws of electricity and magnetism. 8 3 1 1

(OR)

b. Apply Gauss law to find electric field due to an infinite line of charge. 8 4 1 2

22. a. Explain inverse spinel structure of Ferrite and estimate the magnetic moment in ferrite. 8 3 2 1

(OR)

b. Explain Giant magnetoresistance (GMR) and Colossal Magnetoresistance (CMR) with neat diagram. 8 3 2 1

23. a. What is photoelectric effect? Describe photoelectric effect with diagram. 8 3 3 4

(OR)

b. Describe the experimental verification of Davisson and Germer's diffraction experiment. 8 3 3 4

24. a. Explain the Fraunhofer diffraction at a single slit with necessary diagram. 8 3 4 1

(OR)

b.i. State and derive the Brewster's Law. 4 4 4 2

ii. Explain principle, construction and working of Nicol Prism. 4 3 4 1

25. a. Discuss the absorption and emission process of two-level system and derive the Einstein coefficient. 8 3 5 3

(OR)

b. Define Numerical aperture and acceptance angle. Derive the expression for numerical aperture. 8 3 5 2

PART – C (1 × 15 = 15 Marks) Marks BL CO PO
Answer **ANY ONE** Question

26. Explain various polarization mechanism with proper diagram and write Langevin-Debye equation. 15 4 1 1

27. Derive the Schrodinger equation for a particle in a 1D box and obtain the expression for energy Eigen value and normalized wave function. 15 4 3 4

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