Reg. No.															

B.Tech / M.Tech (Integrated) DEGREE EXAMINATION, JULY 2023
First / Second Semester

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

(For the candidates admitted from the academic year 2021-2022 & 2022-2023)

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 = 20Marks)
Answer **ALL** Questions

	Marks	BL	CO	PO
1. Maxwells third equation is (A) Curl B = - dE/dt (B) Curl E = - dB/dt (C) Curl B = - dB/dt (D) Curl E = - dM/dt	1	1	1	2
2. Dielectrics are (A) Electric conductors (B) Materials that work under low voltages (C) Electric insulators (D) Hole conductors	1	1	1	1
3. Stoke's theorem uses which of the following operation? (A) Curl (B) Divergence (C) Gradient (D) Laplacian	1	1	1	2
4. The vector field whose curl is zero is called _____ (A) rotational (B) irrotational (C) Solenoid (D) conservative	1	2	1	1
5. The relationship between magnetic susceptibility and magnetic permeability is given by (A) $\mu_r = 1+\chi$ (B) $\mu_r = 1-\chi$ (C) $\mu_r = \chi - 1$ (D) $\chi = 1+\mu_r$	1	2	2	1
6. Ferrites are the modified structure of (A) Cobalt (B) Nickel (C) Iron (D) Gold	1	1	2	1
7. Magnetoresistance is the property of a material to change the value of (A) Magnetic moment (B) Mobility (C) Electrical resistance (D) Magnetism	1	1	2	1
8. In a Barium ferrite structure, S and S* blocks are rotated with respect to each other through the angle of _____ (A) 60° (B) 90° (C) 120° (D) 180°	1	1	2	1

9. Debroglie waves are characterized by a variable quantity called 1 1 3 1
   (A) Wave function (B) electron
   (C) photon (D) phonon

10. In Davisson and Germer's experiment _____ target is used to study the reflection of electrons 1 2 3 1
   (A) nickel (B) lithium
   (C) calcium (D) iron

11. Calculate the de-Broglie wavelength if the momentum is 'p' 1 1 3 1
   (A) $\lambda = p/h$ (B) $\lambda = h/p$
   (C) $\lambda = hp$ (D) $\lambda = hp^2$

12. _____ scattering is involved in Compton scattering of X-rays 1 1 4 1
   (A) Raman (B) Rayleigh
   (C) Elastic (D) Inelastic

13. The Alternate bright and dark bands are called _____ 1 1 4 1
   (A) Interference (B) Diffraction
   (C) Polarization (D) Reflection

14. The source of light and the screen are at finite distances from the obstacle is _____ 1 1 4 1
   (A) Fraunhoffer diffraction (B) Fresnel diffraction
   (C) Polarization (D) Scattering

15. The phenomenon of diffraction can be understood using 1 1 4 1
   (A) Huygens principle (B) Fraunhofer
   (C) Uncertainty principle (D) Fresnel

16. A Nicol prism is made from _____ Crystal. 1 1 4 1
   (A) Calcite (B) Nickel
   (C) Cobalt (D) Zinc

17. The average lifetime of carriers in the excited state is _____ seconds. 1 1 3 1
   (A) 10^{-2} (B) 10^{-8}
   (C) 10^{-32} (D) 10^{-34}

18. A pair of mirrors placed on either side of the active medium is known as _____ 1 1 5 1
   (A) Pumping mechanism (B) Active medium
   (C) Directionality (D) Optical resonator

19. In the ____ mode of the Carbon dioxide laser, the molecule ceases to be exactly linear as the atoms move perpendicular to the molecular axis. 1 1 5 1
   (A) symmetric (B) asymmetric
   (C) bending (D) constant

20. Band width of multi mode optical fiber is _____ 1 1 5 1
   (A) 1000 MHz (B) 2000 MHz
   (C) 50 MHz (D) 5000 MHz

PART – B (5 × 8 = 40 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
21. a.	Interpret the Gauss divergence theorem and Stokes theorem along with the equation.	8	4	1	2
	(OR)				
b.	Explain the various polarization mechanisms in the dielectric material.	8	3	1	1
22. a.	Compare the Soft and Hard magnetic materials.	8	3	2	1
	(OR)				
b.	Illustrate the regular and inverse Spinel structure of ferrites with a neat diagram.	8	3	2	2
23. a.	Derive the Schrodinger time-independent wave equation.	8	3	3	4
	(OR)				
b.	Explain the experimental support of the existence of matter waves with a neat sketch using Davisson and Germer`s diffraction setup.	8	3	3	1
24. a.	Describe the intensity distribution in the Fraunhofer diffraction pattern due to a double slit.	8	4	4	2
	(OR)				
b.	Explain the production and detection of circularly polarized light using a quarter wave plate.	8	3	4	2
25. a.	Describe the construction and working of the CO_2 laser with the necessary diagrams.	8	3	5	3
	(OR)				
b.	Define the numerical aperture and acceptance angle. Derive the expression for numerical aperture.	8	4	5	2

PART – C (1 × 15 = 15 Marks)

Answer **ANY ONE** Question

		Marks	BL	CO	PO
26.	Interpret Maxwell's equation for electromagnetism from fundamental laws of electricity and magnetism.	15	4	1	2
27.	Describe the application of the Schrodinger wave equation to a particle enclosed in a one-dimensional potential box.	15	4	3	4

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