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B.Tech. DEGREE EXAMINATION, MAY 2024
Second Semester

18PYB101J – PHYSICS: ELECTROMAGNETIC THEORY, QUANTUM MECHANICS, WAVES AND OPTICS
(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

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 & Part - C** should be answered in answer booklet.

Time: 3 hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

- | | Marks | BL | CO | PO |
|---|-------|----|----|----|
| 1. The vector field whose curl is zero called as _____
(A) Irrotational (B) Rotational
(C) Conservative (D) Solenoidal | 1 | 1 | 1 | 1 |
| 2. _____ theorem relates the volume integral of the divergence of a vector to the surface integral of the vector.
(A) Stoke's (B) Gauss divergence
(C) Green's (D) Cauchy's | 1 | 1 | 1 | 1 |
| 3. Orientation polarization arises due to the presence of
(A) Conductors (B) Polar molecules
(C) Semiconductors (D) Superconductors | 1 | 1 | 1 | 1 |
| 4. The process of producing electric dipoles are called as _____
(A). Electronic polarization (B) Ionic polarization
(C) Orientation polarization (D) Space charge | 1 | 1 | 1 | 1 |
| 5. Bubble memory is a _____ memory.
(A) Non-volatile (B) Permanent
(C) Temporary (D) Erasable | 1 | 1 | 2 | 1 |
| 6. In pyralspite garnets, aluminum in _____ site.
(A) X (B) Y
(C) XY (D) YX | 1 | 1 | 2 | 1 |
| 7. Space polarization will occur in _____ frequency range.
(A) Electric power (B) Audio
(C) Radio (D) Optical | 1 | 1 | 2 | 1 |
| 8. The boundary wall between domains is known as _____
(A) Potential wall (B) Bloch wall
(C) Magnetic wall (D) Semiconductor wall | 1 | 1 | 2 | 1 |

9. The waves associated with a material particle are called _____ waves. 1 1 3 1
 (A) Matter (B) Sonic
 (C) Ultrasonic (D) Infrasonic
10. $P=|\psi|^2$ is called as _____. 1 1 3 1
 (A) Probability density (B) Schrodinger's equation
 (C) Probability (D) Planck's equation
11. The Quantum energy levels of an electrons are _____. 1 1 3 1
 (A) Discrete (B) Continuous
 (C) Random (D) Orified
12. _____ experiment proved the existence of matter waves. 1 1 3 1
 (A) Raman (B) Davisson and Germer
 (C) De-Broglie (D) Fresnel
13. In Fraunhofer diffraction, the incident wavefront should be _____. 1 1 4 1
 (A) Elliptical (B) Plane
 (C) Spherical (D) Cylindrical
14. _____ is the process whereby waves travel across corners and obstacles in their paths. 1 1 4 1
 (A) Reflection (B) Refraction
 (C) Interference (D) Diffraction
15. Brewster's Law in terms of refractive index can be expressed as _____. 1 1 4 1
 (A) $\mu = \sin \theta_p$ (B) $\mu = \cos \theta_p$
 (C) $\mu = \tan \theta_p$ (D) $\mu = \cot \theta_p$
16. A Nicol prism is made from _____ crystal. 1 1 4 1
 (A) Calcite (B) Nickel
 (C) Cobalt (D) Zinc
17. The minimum population inversion density requires to overcome the losses is called as _____ population in version. 1 1 5 1
 (A) Threshold (B) Normal
 (C) Standard (D) Dense
18. The number of modes is graded index fiber is about $M_n =$ _____. 1 1 5 1
 (A) $V^2/2$ (B) $V^2/4$
 (C) $V^2/16$ (D) $V^2/32$
19. In single mode optical fibers, the V number is less than _____. 1 1 5 1
 (A) 0.5 (B) 0.25
 (C) 1 (D) 2.4
20. CO₂ is a _____ laser. 1 1 5 1
 (A) Solid (B) Liquid
 (C) Molecular gas (D) Semiconductor

PART – B (5 × 4 = 20 Marks)

Answer ANY FIVE Questions

Marks BL CO PO

21. Derive an expression for continuity equation.	4	3	1	1
22. Explain hysteresis loop and energy product with a neat diagram.	4	2	2	1
23. Write a note on magnetoplumbits.	4	2	2	1
24. Derive de-Broglie wave equation in terms of energy and voltage.	4	3	3	1
25. Analyse the physical significance of wave function.	4	4	3	1
26. Write a note on half wave plate.	4	2	4	1
27. Discuss the essential components of laser.	4	2	5	1

PART – C (5 × 12 = 60 Marks)

Answer ALL Questions

Marks BL CO PO

28. a.i. Define Gauss law. Using Gauss Law derive an expression to find the electric field intensity in a uniformly charged spherical shell.	8	2	1	1
ii. Derive an expression for Clausius Mosotti equation.	4	4	1	1
(OR)				
b.i. Using Faraday's law and Ampere's circuital Law deduce an expression for Maxwell's equations.	8	3	1	1
ii. Derive Poisson's equations.	4	3	1	1
29. a. Define magnetoresistance. Explain the different types of magnetoresistance and its working.	12	2	2	1
(OR)				
b.i. Explain in detail about the theory of magnetic domains in ferromagnetic material.	6	3	2	1
ii. Explain multiferroic materials. Write any four applications.	6	3	2	1
30. a. Derive an expression for the application of Schrodinger's wave equation to a particle enclosed in an one dimensional potential box.	12	4	3	1
(OR)				
b. Derive an expression for energy and wave function in Linear Harmonic Oscillator.	12	4	3	1
31. a.i. With a neat sketch explain the concept of Fraunhofer diffraction at single slit.	8	3	4	1
ii. Write a note on Brewster's law.	4	2	4	1
(OR)				
b. Explain the production and detection of circularly polarized light using quarter wave plate.	12	3	5	1
32. a. Explain the modes of vibrations of CO ₂ molecule. Describe the construction and working of CO ₂ laser with necessary diagrams.	12	3	5	1

(OR)

- b.i. Derive an expression for Einstein's coefficient and also explain rate of absorption and emission. 8 4 5 1
- ii. Calculate the V-number and number of modes propagating through the fiber having $a = 50 \text{ m}$, $n_1 = 1.53$, $n_2 = 1.50$ and $\lambda = 1 \mu\text{m}$. 4 4 5 1

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