Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2023

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 space charge polarization will occur in _____ frequency range. (A) Electric power (B) Audio (C) Radio (D) Optical	1	2	1	1
2. The vector field whose divergence is zero is called _____ (A) Irrotational (B) Rotational (C) Conservation (D) Solenoidal	1	2	1	1
3. Which law can ampere's circuital be derived from? (A) Gauss Law (B) Newton's Law (C) Kirchhoff's Law (D) Biot-Savart Law	1	3	1	1
4. A material of thickness 0.5 mm and a dielectric constant of 2.5 is subjected to 220 V. What will be the polarization produced? (A) 2.78 μC/m (B) 3.91 μC/m (C) 5.84 μC/m (D) 4.12 μC/m	1	5	1	1
5. The relative permeability of a medium is 0.050. What is its magnetic susceptibility? (A) 299 (B) 499 (C) 699 (D) 899	1	5	2	1
6. Which of the following is a property of a hard magnetic material? (A) Low hysteresis (B) Low eddy loss (C) Low coercive force (D) High residual induction	1	2	2	1
7. Piezo-electric materials are _____ class of material. (A) Active (B) Passive (C) Insulator (D) Magnetic	1	1	2	1
8. A piece of ferric oxide with magnetic field intensity 10^6 A/m and susceptibility is 1.5×10^{-3} . Find the magnetisation of the material. (A) 1000 A/m (B) 1500 A/m (C) 2000 A/m (D) 2500 A/m	1	5	2	1

9. The principal quantum number describes 1 4 3 1

(A) The spin of the electron (B) The shape of the orbital
(C) Energy and size of the orbit (D) Spatial orientation of the orbital

10. _____ is the probability of finding the particle inside the box. 1 2 3 1

(A) Quantisation (B) Normalization
(C) Hybridisation (D) Interference

11. If the uncertainty in the location of a particle is equal to its de Broglie wavelength, what is the uncertainty in its velocity? 1 3 3 1

(A) $\Delta v = v$ (B) $\Delta h = v$
(C) $\Delta p = v$ (D) $\Delta k = v$

12. The classical free electron theory could not explain the 1 3 3 1

(A) Ohm's law (B) Electrical conductivity in metals
(C) Wave nature of the particle (D) Photo electrical effect

13. In Fresnel diffraction, the relative phase difference between the curved wavefront is _____ 1 1 4 1

(A) Constant (B) -1
(C) Not constant (D) Linearly increased

14. The radius of the half-period zone is proportional to _____ 1 1 4 1

(A) The wavelength of the light (B) The square root of the frequency of light
(C) The square root of the wavelength (D) The frequency of light of light

15. A thin sheet with a refractive index of 1.5 and thickness of 1cm is placed in the path of light. What is the path difference observed? 1 5 4 1

(A) 0.001 (B) 0.005
(C) 0.008 (D) 0.009

16. If the distance between the two slits is doubled, the fringe width _____ 1 2 4 1

(A) Doubles (B) Halves
(C) 4 Times (D) Remains same

17. A pair of mirrors placed on either side of the active medium is known as _ 1 1 5 1

(A) Optical Resonator (B) Cavity
(C) Case (D) Shielding

18. Calculate the wavelength of radiation emitted by an LED made up of semiconducting material with a band gap energy of 2.8eV. 1 5 5 1

(A) 2.8 Å (B) 4.3308 Å
(C) 5548.4 Å (D) 4430.8 Å

19. Optical fiber is worked on principle. 1 1 5 1

(A) Laws of reflection (B) Total internal reflection
(C) Laws of interference (D) Brewster's law

20. Nd: YAG laser produces the wavelength of _____ microns. 1 1 5 1

(A) 1.064 (B) 10.603
(C) 9.602 (D) 2.564

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

		Marks	BL	CO	PO
21.	Explain electric field and electric potential due to surface charge distribution.	4	1	1	1
22.	Electromagnetic radiation propagating in free space has the values of electric and magnetic fields 86.6 V/m and 0.23 A/m respectively. Calculate the characteristic impedance.	4	5	1	1
23.	Discuss the magnetic behaviours based on their hystersis loop.	4	1	2	1
24.	Explain the normalized wave functions for Schrodinger wave equations.	4	3	3	1
25.	Explain the wave behavior of light, including diffraction and interference, the role of constructive and destructive interference in Young's single-slit method.	4	4	4	1
26.	Write notes on the characteristics of the laser.	4	1	5	1
27.	Discuss the difference between single-mode and multimode fiber.	4	4	5	1

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	Derive the Maxwell's equations of electromagnetism from the fundamental laws of electricity and magnetism.	12	3	1	1
	(OR)				
b.	Explain (i) frequency dependence and (ii) frequency versus power loss of various polarization mechanisms with suitable diagrams.	12	3	1	1
29. a.	What are ferrites? Explain their different types of structures and write their applications.	12	2	2	1
	(OR)				
b.	Explain the magnetic bubble memory with suitable diagrams and write a few applications.	12	2	2	1
30. a.	Obtain the wave function for a particle moving in a one-dimensional potential well using Schrodinger wave equations.	12	4	3	1
	(OR)				
b.i.	Derive the de-Brogle equations in terms of energy, voltage, and temperature.	8	4	3	1
ii.	Write a note of the non-existence of electrons in the nucleus with the help of the uncertainty principle.	4	4	3	1
31. a.	Derive an expression for the intensity distribution due to Fraunhofer diffraction at a double-slit method.	12	3	4	1
	(OR)				
b.	Explain how will you produce and detect plane, elliptically, and circularly polarized light.	12	3	4	1
32. a.	Explain the principle, working, and construction of CO_2 laser and write the merits and demerits of CO_2 laser.	12	3	4	1
	(OR)				
b.	Derive the expression for Numerical Aperture and acceptance angle for an optical fiber.	8	4	5	1
ii.	A step-index fiber has a numerical aperture of 0.26, a core refractive index of 1.5, and a core diameter of 100 micrometers. Calculate the acceptance angle.	4	4	5	1

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