27. a.	Illustrate regular and inverse spinel structure of ferrites with neat diagram. Write their applications.	10	3	2	2
	(OR)				
b.i.	Explain the phenomenon of giant magnetoresistance and tunnel Magnetoresistance.	6	3	2	2
ii.	Compare soft and hard magnetic materials.	4	4	2	1
28. a.i.	Derive the Eigen value of a particle enclosed in an one dimensional potential box.	8	3	3	4
ii.	If the momentum of two particles are in the ratio 1:0.25, compare their de-Broglie wavelengths.	2	3	3	1
	(OR)				
b.i.	Derive Schrodinger time dependent wave equation.	6	3	3	4
ii.	Calculate the de – Broglie's wavelength of an electron having a velocity of 10^6 m/sec.	4	3	3	1
29. a.	Explain the production and detection of circularly polarized light using quarter wave plate.	10	3	4	2
	(OR)				
b.	Explain the Fraunhofer diffraction at single slit and determine the width of the central maxima.	10	3	4	2
30. a.	Illustrate the construction and working of Nd-YAG laser with neat diagram.	10	3	5	1
	(OR)				
b.	Derive an expression for numerical aperture.	10	3	5	3

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Reg. No.															

B.Tech. DEGREE EXAMINATION, MAY 2022
First and Second Semester

18PYB101J – PHYSICS: ELECTROMAGNETIC THEORY, QUANTUM MECHANICS, WAVES AND OPTICS

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

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** should be answered in answer booklet.

Time: 2½ Hours Max. Marks: 75

PART – A (25 × 1 = 25 Marks)
Answer **ALL** Questions

		Marks	BL	CO	PO
1.	The expression for current density is (A) IA (B) IEA (C) I/A (D) E/I	1	1	1	1
2.	Dielectrics are _____ (A) Electric insulators (B) Electric conductors (C) Materials that work under low voltages (D) Hole conductors	1	1	1	2
3.	In free space, the Poisson's equation becomes (A) Maxwell equation (B) Ampere equation (C) Laplace equation (D) Steady state equation	1	1	1	2
4.	_____ is existence of permanent dipole in the absence of electric filed. (A) Non-polar dielectrics (B) Polar dielectrics (C) Dielectric constant (D) Polarizability	1	1	1	1
5.	The common feature between ionic polarization and electronic polarization (A) Both are strongly dependent on temperature (B) Both are responsible for infrared absorption of a dielectric (C) Both are caused by electronic displacements (D) Both the polarizations are unaffected by variations in temperature of the dielectrics	1	2	1	1
6.	When the coercivity and retentivity of a magnetic material is large, then they are called as _____ magnetic materials (A) Para (B) Dia (C) Hard (D) Soft	1	2	2	2
7.	The general chemical formula of a ferrite molecule is _____. (A) $M^{4+}Fe_2^{3+}O_4^{2-}$ (B) $M^{2+}Fe_2^{2+}O_4^{2-}$ (C) $M^{2+}Fe_2^{3+}O_4^{2-}$ (D) $M^{2+}Fe_2^{3+}O_3^{2-}$	1	1	2	2

8. Magneto resistance is the property of a material to change the value of ____ 1 2 2 1
(A) Magnetic moment (B) Magnetism
(C) Mobility (D) Electrical resistance

9. Magnetoplumbites belong to a family to _____. 1 1 2 1
(A) Ferrites (B) Diamagnet
(C) Paramagnet (D) Conductors

10. _____ is a measure of the degree at which lines of force can penetrate through the material. 1 1 2 2
(A) Magnetic flux density (B) Magnetic permeability
(C) Magnetic susceptibility (D) Magnetic field intensity

11. Time dependent Schrodinger wave equation in shorter form is given by $H\Psi$ is equal to _____. 1 2 3 1
(A) $E\Psi^2$ (B) E^2
(C) E^2H^2 (D) $E\Psi$

12. According to Corpusclar theory, light consist of tiny perfect elastic particles called _____. 1 2 3 1
(A) Corpuscles (B) Photons
(C) Phonons (D) Quanta

13. The _____ is a phenomenon in which electrons are ejected from the surface of a metal when light is incident on it. 1 2 3 4
(A) Photoelectric effect (B) Compton effect
(C) de Broglie concept (D) Wien's radiation

14. The energy levels of an electron in 1 D box are _____. 1 1 3 4
(A) Discrete (B) Continuous
(C) Random (D) Unified

15. The potential energy (V) of the electron inside the 1-D box is 1 2 3 4
(A) 4 (B) 3
(C) 0 (D) 2

16. In Fresnel diffraction 1 2 4 2
(A) Source of light is kept as infinite distance from the aperture (B) Source of light is kept at finite distance from the aperture
(C) Convex lens is used (D) Aperture width is selected so that it can acts as a point source

17. In Fraunhofer diffraction _____ lens is used to focus the rays. 1 1 4 1
(A) Concave (B) Convex
(C) Plano concave (D) Plano convex

18. Half Wave Plate produces a phase difference of _____ between the waves 1 2 4 1
(A) 45 degree (B) 90 degree
(C) 180 degree (D) 270 degree

19. _____ and _____ are the two types of diffraction 1 1 4 2
(A) Fraunhofer and Michelson (B) Fraunhofer and De Broglie
(C) Fraunhofer and Fresnel (D) Fresnel and Huygens

20. The expression for the thickness of Quarter wave plate is given by 1 2 4 2
(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) $d = \lambda / 5(\mu_e - \mu_0)$

21. _____ distribution law specifies the fraction of atoms that are found in any particular energy state at a given equilibrium temperature. 1 1 5 3
(A) Maxwell (B) Boltzmann
(C) Planck's (D) Newton

22. The minimum population inversion density required to overcome the losses is called _____ population inversion. 1 2 5 3
(A) Threshold (B) Normal
(C) Standard (D) Dense

23. 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

24. _____ of the optical fiber is the light collecting efficiency of the fiber and is a measure of the amount of light rays that can be accepted by the fiber. 1 2 5 1
(A) Numerical Aperture (B) Cone
(C) Efficiency (D) Voltage

25. The length and diameter of the Nd : YAG laser rod is ____ 1 1 5 3
(A) 10cm to 20 cm and 6 to 10 mm (B) 5 cm to 15 cm and 8 to 9 mm
(C) 5 cm to 10 cm and 6 to 9 mm (D) 20 cm to 30 cm and 16 to 9 mm

PART – B (5 × 10 = 50 Marks) Marks BL CO PO
Answer **ALL** Questions

26. a. Apply the fundamental laws of electricity and magnetism, derive II and IV Maxwell's equation. 10 3 1 2

(OR)

b. Apply the concept of various polarization and derive the Langevin-Debye equation. 10 3 1 1