b. Explain the production and detection of circularly polarized light using quarter wave plate?

32. a. Explain the modes of vibrations of CO_2 molecule. Describe the construction and working of CO_2 laser with necessary diagrams.

(OR)

b.i. Define Numerical aperture and derive an expression for numerical aperture? (8 Marks)

ii. Find the relative population of the two states in a Nd-YAG laser that produces a light beam of wavelength 6943 Å at 300 K. (4 Marks)

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Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2018
First Semester

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

(For the candidates admitted during the academic year 2018-2019)

Note:

(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.

(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. _____ is defined as the number of magnetic lines of force passing through an unit area of cross section.
   (A) Magnetic flux density (B) Magnetic flux
   (C) Magnetic field Intensity (D) Intensity of magnetization

2. The vector field whose divergence is zero is called _____
   (A) Irrotational (B) Rotational
   (C) Conservative (D) Solenoidal

3. The dipole moment per unit volume of the dielectric material is called_____
   (A) Polarizability (B) Polarization vector
   (C) Permittivity (D) Dielectric constant

4. Orientation polarization arises due to the presence of _____
   (A) Conductors (B) Polar molecules
   (C) Semiconductors (D) Superconductors

5. In soft magnetic materials, the nature of the hysteresis loop is_____
   (A) Very steep (B) Very broad
   (C) Negligible (D) Straight line

6. A tiny movable magnetized cylindrical volume in thin magnetic material is called_____
   (A) Garnet (B) Magnetoplumbites
   (C) Magnetic bubble (D) Ferrites

7. Two ferromagnets are separated by a few atomic layers of insulator are known as ----------
   (A) Giant magnetoresistance (B) Tunnel magnetoresistance
   (C) Clossal Magnetoresistance (D) Superconductor

8. The boundary wall between domains is known as
   (A) Potential wall (B) Bloch wall
   (C) Magnetic wall (D) Semiconductor wall

9. The characteristics of wave function ψ are
   (A) Real function, finite and discontinuous
   (B) Complex, single valued, finite and continuous function
   (C) Complex, infinite and discontinuous function
   (D) Complex single valued and infinite

10. The existence of matter waves was experimentally proved by
   (A) Raman
   (B) Davisson and Germer
   (C) De-Broglie
   (D) Fresnel

11. A variable quantity which characterizes de-Broglie waves is known as _____.
   (A) Photon
   (B) Wave Function
   (C) Phonon
   (D) Field

12. _____is the probability of finding the particle inside the box.
   (A) Quantisation
   (B) Normalisation
   (C) Hybridisation
   (D) Interference

13. Brewster's law in terms of refractive index can be expressed as
   (A) $\mu = \sin \theta_p$
   (B) $\mu = \cos \theta_p$
   (C) $\mu = \tan \theta_p$
   (D) $\mu = \cot \theta_p$

14. A Nicol prism is made from ..... Crystal
   (A) Calcite
   (B) Nickel
   (C) Cobalt
   (D) Zinc

15. In Fraunhofer diffraction, the incident wavefront should be
   (A) Elliptical
   (B) Plane
   (C) Spherical
   (D) Cylindrical

16. In Fresnel Diffraction
   (A) Source of light is kept at infinite distance from the aperture
   (B) Source of light is kept at finite distance from the aperture
   (C) Convex lens is used
   (D) Concave lens is used

17. The minimum population inversion density required to overcome the losses is called _____population inversion.
   (A) Threshold
   (B) Normal
   (C) Standard
   (D) Dense

18. In _____mode, the oxygen atoms oscillate along the axis of the molecule simultaneously departing or approaching the carbon atom which is stationary.
   (A) Symmetric stretching
   (B) Asymmetric stretching
   (C) Bending
   (D) Normal

19. _____of the 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.
   (A) Numerical Aperture
   (B) Cone
   (C) Efficiency
   (D) Aperture

20. In a _____fiber, the refractive index changes in a step fashion from the centre of the fiber, to cladding.
   (A) Step Index
   (B) Graded index
   (C) Photo
   (D) Glass

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Derive Poisson's equations.
22. Compare soft and hard magnetic materials.
23. Explain Blackbody Radiation with neat diagram.
24. Derive the expression for de Broglie wave length in terms of energy and voltage.
25. Write the differences between Fresnel's and Fraunhofer's diffraction.
26. Explain fiber optic communication system with a neat block diagram.
27. Derive Einstein's relations and hence deduce the expressions for the ratio of spontaneous emission rate to be stimulated emission rate.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. What is meant by internal field? Derive an expression for the internal field in the case of dielectrics?

(OR)

b.i. Derive an expression for Clausius-Mossotti equation. (8 Marks)

ii. Apply Gauss law to find the electric field intensity outside a uniformly charged spherical shell. (4 Marks)

29. a. What are ferrites? Explain their different types of structures. Write their applications.

(OR)

b.i. Explain in detail about the theory of magnetic domains in ferromagnetic material. (8 Marks)

ii. Write a note on magnetoplumbities. (4 Marks)

30. a. Discuss the application of Schrodinger's wave equation to a particle enclosed in an one dimensional potential box.

(OR)

b.i. Describe the experimental verification of Davisson and Germer's diffraction experiment. (8 Marks)

ii. A neutron of mass 1.675×10^{-27} kg is moving with a kinetic energy 10 keV. Calculate the de-Broglie wavelength associated with it. (4 Marks)

31. a. Describe the intensity distribution in Fraunhofer diffraction pattern due to a single slit?

(OR)