Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 30309

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

First Semester

PH 3151 – ENGINEERING PHYSICS

(Common to: All Branches)

(Regulations 2021)

Time : Three hours
Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the characteristic about the energy and momentum of a body at the centre of mass.

2. If the force of an oscillation is given by $F(x) = -kx - bx^2 - cx^3$, what kind of an oscillation is this?

3. Write the significance of Maxwell's equation $div.B = 0$.

4. Estimate the radiation pressure 'R' for a reflected EM wave if the electromagnetic wave intensity is 'I'.

5. How will you differentiate travelling and standing wave with respect to energy?

6. Identify any two properties of laser useful for communication applications.

7. Define matter waves.

8. State the correspondence principle.

9. Brief about on quantum tunneling.

10. Give the expression for Bloch function and explain the terms.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the expression for rotational kinetic energy and moment of inertia for the rigid body in rotation.   (16)

Or

(b) (i) Explain the working principle, construction, types and uses of Gyroscope.   (10)

(ii) Derive the rotational energy of a diatomic molecule.   (6)

12. (a) (i) Using Maxwell's equations, derive the electromagnetic wave equation.   (12)

(ii) An electromagnetic wave propagates along the x direction. The magnetic field oscillates at a frequency of 10^{10} Hz with an amplitude of 10^{-5}T in y-direction. Compute the wavelength of the wave.   (4)

Or

(b) (i) With suitable sketches discuss the details of Polarization of EM waves.   (10)

(ii) Calculate the reflection and transmission coefficients of an EM wave propagating from air to glass with refractive index 1.5.   (6)

13. (a) (i) Explain simple hormonic motion and occurrence of resonance.   (8)

(ii) What is the analogy between electrical and mechanical oscillators?   (8)

Or

(b) (i) Elaborate various emission processes and tabulate the differences between Nd:YAG and CO_2 laser.   (10)

(ii) An air wedge is formed by placing a sheet of foil between the edges of two glass plates at 75 mm from their point of contact. When the wedge is illuminated with light of wavelength $5.8 \times 10^{-7} m$, the fringes are 1.30 mm apart. Calculate the thickness of the foil.   (6)

14. (a) (i) Derive the time dependent Schrodinger equation. (8)

    (ii) In a Compton scattering event, the scattered photon has an energy of 120 keV and the recoiling electron has an energy of 40 keV. Estimate the photon scattering angle. (8)

                                    Or

    (b) (i) Deduce the eigen values and eigen function of a particle in an 1D box. (12)

    (ii) List the properties of wave function. (4)

15. (a) (i) Explain the phenomena of 'quantum tunneling'. (6)

    (ii) Illustrate the working of scanning tunneling microscope. (10)

                                    Or

    (b) (i) Discuss the principle, construction and working of resonant diode. (6)

    (ii) Explain the Kronig-penney model and highlight the salient features of the model and its applications. (10)