ENTRI

APJ Abdul Kalam Technological University

Second Semester B.Tech Degree Examination July 2021

(2019 Scheme)

- **Course Code:** PHT100
- **Course Name:** Engineering Physics A
- **Max. Marks:** 100
- **Duration:** 3 Hours

PART A

Answer all questions, each carries 3 marks.

1. What is meant by sharpness of resonance?
2. State the 3 laws of transverse vibrations.
3. Explain Anti-reflection coating.
4. Give Rayleigh's criteria for spectral resolution. Illustrate it with a figure.
5. Write the physical significance of the wave function.
6. Why do nanomaterials exhibit properties different from those of their classical counterparts?
7. State and explain Ampere's circuital law.
8. State and explain Poynting's theorem.
9. What are high-temperature superconductors? Give two examples.
10. What are fibre optic sensors? Name two different types.

PART B

Answer one full question from each module, each question carries 14 marks.

Module-I

11. a) Derive the expression for the displacement of a damped harmonic oscillator and represent graphically the three cases of damping. (10 marks)

b) A 1 kg weight is suspended from a spring of force constant 25 N/m. The system is undamped. Calculate the natural frequency of the system. (4 marks)

OR

12. a) What are ultrasonic waves? With a neat circuit diagram, explain the production of ultrasonic waves using a Piezoelectric oscillator. (10 marks)

b) A quartz crystal of thickness 5 mm is vibrating in the fundamental mode. Find the fundamental frequency. (Young's modulus of quartz is 8 times $10^{10}\ N/m^2$ and density is 2650 kg/m^3). (4 marks)

Module-II

13. a) Explain the formation of Newton's rings. Derive an expression for the radius of the n^{th} dark ring. (10 marks)
b) In a Newton's rings experiment, the diameter of the 4th dark ring is 0.4 cm. Find the wavelength of the light used. (The radius of curvature of the lens is 100 cm). (4 marks)
OR

14. a) Distinguish between Fresnel and Fraunhofer diffraction. Derive an expression for the resolving power of a plane transmission grating. (10 marks)

b) A grating has 6000 lines per cm. Find the maximum number of orders visible for a wavelength of 600 nm. (4 marks)

Module-III

15. a) Write the differential equation for a particle in a one-dimensional box and obtain the possible energy values and normalized wave functions. (10 marks)

    b) Calculate the quantum number associated with a marble of mass 10 gm trapped to move with speed 1 m/s in a one-dimensional box of width 20 cm. (4 marks)

    OR

16. a) Explain the following: (i) Nanomaterials (ii) Nano sheets (iii) Nano wires and (iv) Quantum dots. (10 marks)
    b) What are the conditions to be satisfied by a well-behaved wavefunction? Write its normalization condition. (4 marks)

Module-IV

17. a) Distinguish between paramagnetic and diamagnetic substances with two examples for each. (10 marks)

    b) Calculate induced emf and current in a closed circuit at time t=3s if the magnetic flux through it varies with time obeying the equation $\phi = t^3 + 2t^2 + 5t$. The resistance in the circuit is $4\ \Omega$. (4 marks)

    OR

18. a) Starting from basic laws of electricity and magnetism, derive Maxwell's equations. (10 marks)

    b) If $\Phi(x, y, z) = 4x^2y - y^3z^2$, find the gradient of Φ at the point (1,-1,-1). (4 marks)

Module-V

19. a) Explain the Meissner effect in superconductivity. Distinguish between Type I and Type II superconductors with appropriate diagrams and examples. (10 marks)

    b) Give any four applications of superconductivity. (4 marks)

    OR

20. a) Explain the propagation of light through an optical fibre. Derive an expression for Numerical Aperture. (10 marks)

    b) A fibre has an acceptance angle of 26.85° in air. Find the numerical aperture. (4 marks)