APJ Abdul Kalam Technological University

First Semester B.Tech Degree Regular and Supplementary Examination December 2020(2019 Scheme)

Course Code: PHT110

Course Name: Engineering Physics B

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

1. List any six points to compare mechanical and electrical oscillatory systems.
2. Derive one dimensional wave equation.
3. Explain the principle and working of antireflection coatings.
4. Distinguish between Fresnel and Fraunhofer classes of diffraction.
5. List any two characteristics of matter waves. Find the expression for de Broglie wavelength.
6. Define zero, one and two dimensional nanomaterials.
7. How echo is different from reverberation?
8. Write a note on SONAR. Give any two uses of it.
9. Define metastable state and population inversion.
10. Differentiate between step index and graded index fibre.

PART B

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

Module-I

11. a) Define the terms: resonance, logarithmic decrement, and Q-factor. Derive the expression for the displacement of a damped harmonic oscillator. (10 marks)

    b) A forced harmonic oscillator is described by the equation $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 10x = 20\cos 2t$. Find the amplitude of the steady-state vibration. (4 marks)

    OR

12. a) What are the laws of transverse vibrations of a stretched string? Derive the expression for the fundamental frequency of a stretched string. (10 marks)

    b) A string of length 1 m has a mass of 5 gm. If it is stretched by a tension of 200 N, calculate the fundamental frequency and the first two overtones. (4 marks)

Module-II

13. a) Explain the formation of Newton's rings. Describe how it can be used to determine the wavelength of a monochromatic source of light. (10 marks)

    b) In a Newton's rings experiment, the diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of the lens if the wavelength of light used is 589 nm. (4 marks)

OR

14. a) What is meant by diffraction? Explain the Fraunhofer diffraction at a single slit and obtain the conditions for the positions of principal maximum and minima. (10 marks)

b) A light of wavelength 600 nm is incident normally on a slit of width 0.1 mm. Find the angular width of the central maximum. (4 marks)

Module-III

15. a) Write the Schrödinger equation for a particle in a one-dimensional box. Obtain the energy eigenvalues and normalized wave functions for the particle. (9 marks)

b) Discuss the physical significance of the wave function and the probability density. (5 marks)

OR

16. a) Explain the mechanical, electrical and optical properties of nanomaterials. (9 marks)

b) Mention any five applications of nanotechnology. (5 marks)

Module-IV

17. a) Explain the terms absorption coefficient and reverberation time. What is the significance of reverberation time? Discuss the factors on which the reverberation time depends and write the Sabine's formula. (10 marks)

b) A hall has dimensions of 25m x 20m x 8m. The reverberation time is 4 s. Determine the average absorption coefficient of the surfaces. (4 marks)

OR

18. a) What is meant by magnetostriction effect? Give two examples for magnetostrictive materials. Explain the production of ultrasonic waves by magnetostriction method. Mention any two medical applications of ultrasonic waves. (10 marks)

b) A quartz crystal of 2mm is vibrating at resonance. Calculate the fundamental frequency of vibration, if Young's modulus of quartz is $6.5 \times 10^{10} \, N/m^2$ and density is $3000 \, Kg/m^3$. (4 marks)

Module-V

19. a)Explain construction and working of Ruby laser. (10 marks)

b) Describe the recording of a hologram. (4 marks)

OR

20. a) Define numerical aperture of an optical fibre. With a neat diagram derive an expression for numerical aperture of a step-index fibre. (10 marks)

b) A step index fibre has a core refractive index of 1.48 and a cladding refractive index of 1.45. Calculate the numerical aperture and the acceptance angle for the fibre. (4 marks)