APJ Abdul Kalam Technological University

B.Tech S1 (Special Improvement) Examinations January 2021(2019 Scheme)

Course Code: PHT110

Course Name: Engineering Physics B

Max. Marks: 100

Duration: 3 Hours

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PART A

Answer all questions, each carries 3 marks.

1. Draw the displacement-time curves for all types of damped harmonic oscillators and write the conditions.
2. List two differences between longitudinal and transverse waves. Give an example for each.
3. Explain colours of thin films.
4. What is Rayleigh's criterion of spectral resolution?
5. State and explain Heisenberg's uncertainty principle.
6. What is the significance of surface to volume ratio in nanomaterials?
7. What is echelon effect? How it can be resolved?
8. What is magnetostriction effect? Give two examples for magnetostrictive materials.
9. Give any three properties of laser.
10. Write a short note on intensity modulated sensor.

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 forced harmonic oscillator and find the expression for its resonance frequency. (10 marks)

b) A 1 kg weight is suspended from a spring of force constant 25 N/m. If the damping constant is 2 kg/s, calculate the natural frequency and the period of oscillation. (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 2 m and mass 0.04 kg is stretched with a tension of 80 N. Find the frequency of the fundamental note. (4 marks)

Module-II

13. a) Explain the formation of Newton's rings in reflected light. Derive the expressions for the radii of n^{th} dark and bright rings. (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 589.3 nm. (4 marks)

OR

14. a) Define the resolving power of a grating. Derive an expression for it. (10 marks)

b) A plane transmission grating has 5000 lines/cm. Find the resolving power of the grating in the second order for a wavelength of 589 nm. (4 marks)

Module-III

15. a) Derive the time-independent Schrödinger equation for a particle in a one-dimensional potential. (10 marks)

b) Explain the term probability density and its physical significance. (4 marks)

OR

16. a) Explain the electrical, optical and mechanical properties of nanomaterials. (10 marks)

b) A microscope using photons is employed to locate an electron in an atom within a distance of 0.2 Å. What is the minimum uncertainty in the momentum of the electron located in this way? (4 marks)

Module-IV

17. a) Explain reverberation and reverberation time. What is the significance of reverberation time? Write down Sabine's formula for evaluating reverberation time and explain the terms. (10 marks)

b) What is threshold of hearing and threshold of pain intensity? Give their values. (4 marks)

OR

18. a) With a neat diagram explain how the velocity of ultrasonic waves can be determined using an ultrasonic diffractometer. (10 marks)

b) Find the frequency of ultrasonic waves that can be generated by a nickel rod of length 4 cm. (Young's modulus of nickel = 207 GPa and density = 8900 kg/m^3). (4 marks)

Module-V

19. a) Explain the terms spontaneous emission, stimulated emission, population inversion, and metastable state with respect to a laser system. (8 marks)

b) Describe with figure the construction and reconstruction of a hologram. (6 marks)

OR

20. a) Develop an expression for numerical aperture of a step index fibre. Explain the fibre optic communication system with a block diagram. (10 marks)

b) An optic fibre has a core of refractive index 1.6 and cladding of refractive index 1.58. If this fibre is immersed in a liquid of refractive index 1.33, calculate its new numerical aperture. (4 marks)