

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester B.Tech Degree Examination December 2021 (2019 scheme)

Course Code: PHT100**Course Name: ENGINEERING PHYSICS A****(2019-Scheme)**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 3 marks.*

- 1 What is Q-factor? How is it related to angular frequency? (3)
- 2 Calculate the frequency of the fundamental note produced by a string **1m** long and weighing **2gm** kept stretched by a load of **400kg**. (3)
- 3 Why does the central fringe of Newton's ring appear dark? (3)
- 4 What is meant by dispersive power of grating? Give the expression with relevant terms. (3)
- 5 Estimate the uncertainty in the frequency of light emitted by an atom. (3)
- 6 Describe the significance of large surface area to volume ratio of nano materials. (3)
- 7 State Gauss' law in magnetism. Write the mathematical statement. (3)
- 8 Define divergence of a vector field. Establish its physical significance. (3)
- 9 What are Cooper pairs? What is their role in superconductivity? (3)
- 10 What is a photo detector? Give two examples. (3)

PART B*Answer one full question from each module, each question carries 14 marks***Module-I**

- 11 a) Derive the differential equation of a forced harmonic oscillator and find its solution. Define amplitude resonance. (10)
- b) A damped oscillator of mass **1 gram** has force constant **10 N/M** and damping factor **1 s⁻¹**. Calculate the angular frequency without damping and with damping. (4)
- 12 a) Derive an expression for fundamental frequency of transverse vibrations of a stretched string. (10)

- b) A wave is represented by $y = 3 \times 10^{-3} \cos (8.4 \times 10^{13} t + 2.8 \times 10^5 z)$ where y and z are in m and t in second. Compute the following (4)
- (i) amplitude (ii) frequency (iii) wavelength (iv) wave velocity

Module-II

- 13 a) Explain the formation of interference fringes in air wedge. How is it used to determine the diameter of a thin wire? (10)
- b) The diameter of the **10th** and **20th** Newton's rings formed with a plano - convex lens and an optically plane glass plate are **$0.415 \times 10^{-2} \text{ m}$** and **$0.616 \times 10^{-2} \text{ m}$** respectively. If the wavelength of the interfering light is **5893 Å**, calculate the radius of curvature of the lens. (4)
- 14 a) Discuss the theory of plane transmission grating and also derive the grating equation. State and explain Rayleigh's criterion for the limit of resolution in the case of grating. (10)
- b) Light of wavelength **656 nm** falls normally on a grating **20 mm** wide. The first order is **18°** from the normal. What is the total number of lines in the grating? (4)

Module-III

- 15 a) Derive the Schrodinger's time dependent equation for a moving particle and hence derive the Schrodinger's time independent equation. (10)
- b) If an electron's position can be measured to an accuracy of **$2.0 \times 10^{-8} \text{ m}$** , how accurately can its velocity be known? (4)
- 16 a) Give a brief note on mechanical, optical and electrical properties of nanomaterials. Mention any four applications of nanotechnology (10)
- b) Explain Quantum confinement. (4)

Module-IV

- 17 a) Define the terms magnetisation, magnetic flux density, magnetic permeability, relative permeability and susceptibility. Obtain the relation between relative permeability and susceptibility. (10)
- b) Calculate the magnetic flux density and the magnetic moment per unit volume when a magnetising field of **$6 \times 10^5 \text{ A/m}$** applied. Magnetic susceptibility is **-8.2×10^{-6}** . (4)
- 18 a) Derive Maxwell's equations from the fundamental laws of electricity and magnetism. (10)
- b) Plane electromagnetic wave (sinusoidal) has maximum intensity of electric field **$200 \times 10^{-6} \text{ V/m}$** . Calculate **$H_{\text{max}}$** . (4)

Module-V

- 19 a) Describe the phenomenon of superconductivity. Define critical temperature and critical magnetic field. Mention any four applications of superconductors. (8)
- b) Distinguish between Type I and Type II superconductors. (6)
- 20 a) Define acceptance angle and numerical aperture of optic fibre. Derive an expression for numerical aperture of a step index fibre. (10)
- b) The numerical aperture of an optic fibre is **0.5075** and the refractive index of the cladding is **1.475**. Calculate the refractive index of the core, acceptance angle, and the critical angle for total internal reflection. (4)
