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 $y = 3\times10^{-3} \cos (8.4\times10^{13}t+2.8\times10^{5}z)$ where y and z are in m and t in second. Compute the following (4)

(i)amplitude (ii) frequency (ii) 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 10^{th} and 20^{th} Newton's rings formed with a plano - convex lens and an optically plane glass plate are 0.415×10^{-2}m and 0.616×10^{-2}m respectively. If the wavelength of the interfering light is 5893 A°, 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 656nm falls normally on a grating 20mm 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 2.0×10^{-8} 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 $6x10^{5}$ A/m applied. Magnetic susceptibility is $-8.2x10^{-6}$. (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 200×10^{-6} V/m. Calculate $H_{max.}$ (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)

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