B **0100PHT100052407** **Pages: 3**

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S1 (S,FE) S2 (S,FE) Degree Examination December 2025 (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 Marks

1 Write the equations for kinetic energy and potential energy of a simple harmonic oscillator and Show graphically that, the total energy is a constant. (3)

2 Write the three-dimensional wave equation and its solution (3)

3 Explain the principle of superposition of waves (3)

4 Explain the differences between interference and diffraction (3)

5 State uncertainty principle and write down any one uncertainty relation (3)

6 Specify any three properties of nanomaterials (3)

7 Define Gauss law in magnetism (3)

8 What are the significances of Poynting' vector (3)

9 Explain BCS theory of super conductivity (3)

10 Write a short note on the intensity modulated optical sensors? (3)

PART B

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

MODULE 1

11 (a) Formulate differential equation of a Damped Harmonic Oscillator and obtain its solution. Illustrate the nature of solution when $\sqrt{k^2 - {\omega_0}^2} = 0$, $\sqrt{k^2 - {\omega_0}^2} = positive$ and $\sqrt{k^2 - {\omega_0}^2} = negative$. (10)

(b) The Q-factor of a damped harmonic oscillator of frequency 600 Hz is 9×10^4 . Calculate the relaxation time. Also find the number of oscillations during relaxation time. (4)

12 (a) State one dimensional wave equation and explain its general solution. Discuss the transverse vibrations of a stretched string and the laws of vibrations. (10)

(b) The equation of transverse vibration of a stretched string is given by $y = 2 \sin 3\pi \left(\frac{x}{24} - \frac{t}{0.02}\right)$, where t is expressed in seconds and x and y expressed (4)

in cm. Find *i.* amplitude, *ii.* Wave vector, *iii.* Frequency, *iv.* Period and *v.* velocity of the wave.

MODULE 2

13 (a) Derive the condition for constructive and destructive interference in thin film. (10)

(b) In a Newton's ring experiment the diameter of the 4^{th} and 14^{th} dark rings are 0.400 cm and 0.560 cm respectively. If the radius of curvature of the Plano convex lens used in this experiment is calculated as 65.2 cm. Calculate the wavelength of light used in this experiment. (4)

14 (a) With necessary theory, explain the principle and working of a plane transmission grating and derive the grating equation. Define dispersive power of a grating. (10)

(b) Light is incident normally on a grating of N= 5000 lines/cm. Find the angle of diffraction and angular separation for the principle maxima of two sodium lines of wavelengths 589.0 nm and 589.6 nm in the first order spectrum. (4)

MODULE 3

15 (a) Derive time dependent Schrodinger equation. Explain the properties and significances of wave function in quantum mechanics? (10)

(b) An electron at rest is accelerated with a potential difference of 100 V. Calculate the de Broglie wavelength associated with the electron. Assume the values of fundamental constants. (4)

16 (a) Explain quantum confinement of nanomaterials. Based on the confinement effect classify the nanosystems with examples. (10)

(b) Explain the medical applications of nanomaterials (4)

MODULE 4

17 (a) Define M, B and H and express the relations between them. How magnetic vectors are related to the permittivity and susceptibility of magnetic materials? Classify ferro, dia and paramagnetic materials. (10)

(b) Calculate Magnetisation (**M**) for a material with relative permeability **3.1** and magnetising field **900 A/m**. (4)

18 (a) Derive Maxwell's equations in electrodynamics. (10)

(b) State Gauss divergence theorem and Stokes theorem and give their mathematical form. (4)

MODULE 5

19 (a) Show that superconductors exhibit perfect diamagnetism. Distinguish between type I and type II superconductors (10)

(b) A superconducting material has a critical field of 0.1 T at 7K, and 0.2T at 0K. Calculate its critical temperature of the material. (4)

20 (a) Write a detailed note on the principle, working and characteristics of a of a solar cell (7)

(b) Explain the principle of optical fibres. Explain how the optical fibre cables are classified and compare their properties. (7)

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