Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Second Semester B.Tech Degree Regular and Supplementary Examination June 2023 (2019 Scheme)

Course Code: PHT 100
Course Name: ENGINEERING PHYSICS A
(2019 -Scheme)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1 What do you meant by resonance in forced oscillations? Give one example. (3)

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

3 How can you test the optical planeness of a glass plate by air wedge method? (3)

4 Distinguish between Fresnel and Fraunhoffer classes of diffraction, (3)

5 What is quantum mechanical tunnelling? Give two examples based on this phenomenon. (3)

6 What are nanomaterials? Why do these materials exhibit properties different from those of their classical counterparts? (3)

7 Differentiate between Magnetic susceptibility and Magnetic permeability. Write the relation between them. (3)

8 State and explain the equation of continuity for time varying fields. (3)

9 Mention three advantages of fibre optic communication system. (3)

10 Explain the working of LED. (3)

PART B

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

MODULE 1

11 a) Frame and solve the differential equation of a damped harmonic oscillator. Derive the expression of displacement for underdamped, critically damped and over damped conditions and plot the results in a time - displacement graph. (10)

b) The amplitude of an underdamped harmonic oscillator reduces to **$1/10^{th}$** of its initial value after **100** oscillations. Its time period is **1.15s**. Calculate the damping constant and relaxation time. (4)

12 a) Derive an expression for the fundamental frequency of transverse vibrations of a stretched string. (10)

b) The equation of a wave travelling in a string is given by (4)
$\mathbf{y = 3.5x10^{-3} Sin\ 2\pi(0.2x - 50t)}$ where x is measured in meters and t in seconds. Evaluate the amplitude, wavelength, frequency and velocity of propagation.

MODULE 2

13 a) Explain the formation of Newton's rings and show that the radius of dark ring is proportional to the square root of natural numbers. How can we use Newton's rings experiment to determine the refractive index of a liquid. (11)

b) In Newton's ring experiment the radius of the $\mathbf{10^{th}}$ dark ring is **0.75cm**. When the air film is replaced by a drop of liquid, the radius reduces to **0.65cm**. Find the refractive index of the liquid. (3)

14 a) Derive grating equation with proper diagram. What is the effect of increasing the number of lines on the dispersive power of grating? (10)

b) At what angle will **650nm** light produce a second order maximum when falling on a grating whose grating element is $\mathbf{1.2\ x10^{-3}}$ cm. (4)

MODULE 3

15 a) What are matter waves? Obtain an expression for de Broglie wavelength. Derive expressions for the de Broglie wavelength of an electron (i) accelerated from rest through a potential of V volts (ii) having kinetic energy T. (10)

b) An electron is confined to one dimensional potential box of width **25Å**. Calculate the energies corresponding to the first and second quantum states in eV. (4)

16 a) Explain optical, electrical and mechanical properties of nanomaterials. Write any four applications of nanomaterials in the medical field. (10)

b) What are quantum dots and quantum sheets? (4)

MODULE 4

17 a) How paramagnetic substances differ from Ferromagnetic substances? Write two examples for each of them. (10)

b) State Faraday's laws of Electromagnetic induction. What is Lenz's law? (4)

18 a) From the basic laws of electricity and magnetism, deduce Maxwell's four field equations. (10)

b) Compare displacement current and conduction current. (4)

MODULE 5

19 a) Explain BCS theory of superconductivity. Describe high temperature superconductors. Write three applications of superconductors. (10)

b) A light emitting diode is made of GaAsP having a band gap of **1.9eV**. Determine the wavelength of the radiation emitted. (4)

20 a) Explain how light is propagated through an optical fibre. Define numerical aperture of an optical fibre and derive the expression for numerical aperture of a step index fibre. (10)

b) In an optical fibre, the core material has refractive index **1.43** and refractive index of the cladding material is **1.4**. Find numerical aperture and acceptance angle. (4)

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