Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Second Semester B.Tech Degree (R,S) Examination May 2024 (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 is meant by amplitude resonance? Give any two examples. (3)

2 Distinguish between transverse and longitudinal wave with examples. (3)

3 Write down the expression for the radius of n^{th} dark ring in Newton's ring. Explain with reason what happens to the radius when air is replaced by a liquid of refractive index μ? (3)

4 What is diffraction? Compare diffraction pattern with interference pattern. (3)

5 What is meant by quantum mechanical tunnelling? Name two devices based on this phenomenon. (3)

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

7 Mention any two properties of ferromagnetic materials. Give two examples. (3)

8 Define divergence of a vector field. Establish its physical significance. (3)

9 Why fibre optic communication system is preferred over other types of communication techniques. (3)

10 Explain the working of a solar cell. (3)

PART B

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

MODULE 1

11 a. Write down the differential equation of a damped harmonic oscillator and obtain its solution. Show graphically the displacement time curve for over damped, critically damped and under damped cases of a harmonic oscillator. Mention the conditions of their occurrence. (10)

b. The frequency of a tuning fork is **200Hz**. If its quality factor is $\mathbf{8\times10^4}$, find the time after which its energy becomes $\mathbf{1/10^{th}}$ of its initial value. (4)

12 a. Derive the differential equation for transverse wave in a stretched string and hence obtain the expression for fundamental frequency. (10)

b. The equation of a transverse wave travelling along a stretched string is given by $\boldsymbol{y(x,t) = 10\ sin(0.01\pi x + 2\pi t)}$ where x and y are in cm and t is in second. Find the amplitude, frequency, velocity and wavelength. (4)

MODULE 2

13 a. Describe how interference fringes are produced in an air wedge. Discuss its application in determining the diameter of a thin wire. (10)

b. Light of wavelength **$5893A^0$** is reflected at nearly normal incidence from a soap film of refractive index **1.42**. What is the least thickness of the film that will appear as dark? (4)

14 a. Discuss the theory of plane transmission grating and also derive the grating equation for normal incidence. What is the effect of increasing the number of lines on the resolving power of a grating? (10)

b. When a diffraction grating is used at normal incidence, it is found that the image at **30^0** consists of a yellow line of wavelength **575nm** of the **n^{th}** order spectrum is superimposed on a blue line of wavelength **460nm** of order **(n+1)**. Calculate the number of lines per unit length of grating. (4)

MODULE 3

15 a. Write the differential equation representing a particle confined within one dimensional infinite square well potential and obtain the permissible energy values and their corresponding normalized wave functions. (10)

b. The time gap between the excitation of an atom and emission of radiation is **10^{-8}** second. Find the uncertainty in the frequency of radiation. (4)

16 a. What are nanomaterials? Discuss their mechanical, electrical and optical properties. (10)

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

MODULE 4

17 a. State Gauss' law in magnetism, Ampere's circuital law, Faraday's laws of electromagnetic induction and Lenz's law. Give their equations. (10)

b. Find the relative permeability of a ferromagnetic material when a magnetic field of **200A/m** creates a magnetization of **2900A/m**. (4)

18 a. Derive Maxwell's equations from the fundamental laws of electricity and magnetism. (10)

b. State and explain Poynting's theorem. (4)

MODULE 5

19 a. Explain Meissner effect and show that superconductors are perfect diamagnets. Explain high temperature superconductors with two examples. (8)

b. Distinguish between Type I and Type II superconductors with appropriate diagrams. (6)

20 a. Derive the numerical aperture of a step index fibre in terms of the refractive index of core and cladding. Also write any four applications of optical fibres. (10)

b. Calculate the numerical aperture and acceptance angle of an optical fibre. The refractive index of the core is **1.5** and that of cladding is **1.45**. (4)

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