Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Second Semester B.Tech Degree (S, FE) Examination January 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 Define Q factor of a damped harmonic oscillator. State the factors on which it depends. (3)

2 Write the one dimensional wave equation. Explain the parameters in it. (3)

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

4 What is grating element? Write down the relation connecting grating element, wavelength of light and angle of diffraction. (3)

5 What is Quantum Mechanical Tunnelling? Name two electronic devices based on this effect. (3)

6 Discuss the mechanical properties of nano materials. (3)

7 Distinguish between magnetic induction and magnetizing field. (3)

8 Write down Maxwell's equations in differential form. (3)

9 Show that superconductors are perfect diamagnets. (3)

10 Explain the working of a Photo diode. (3)

PART B

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

MODULE 1

11 a Write down the differential equation for a forced harmonic oscillator. Derive expressions for the amplitude and initial phase of forced oscillations in terms of the driving frequency. (10)

b The equation of a wave travelling along a string is given by $y = \cos \pi(0.5x - 200t)$, where **y** is in centimetres and ***t*** is in seconds. Evaluate the amplitude, wavelength, frequency and speed of the wave. (4)

12 a Derive an expression for the velocity of transverse waves in a stretched string and state the laws of transverse vibrations. (10)

	b	A piece of wire **60 cm** long and mass **1.2 g** is stretched by a load of **3 kg**. Find the frequency of the second harmonic.	(4)

MODULE 2

13	a	Show that in Newton's rings experiment, the radii of dark rings are directly proportional to square root of natural numbers. What will happen if a liquid drop is introduced in between the lens and glass plate.	(10)
	b	Light of wavelength **500 nm** falls normally on two glass plates enclosing a wedge shaped air film. The plates touch at one end and are separated at **5 cm** from that end by a wire. If the band width of the fringes obtained is **0.05 mm**, find the diameter of the wire.	(4)
14	a	How a plane transmission grating is produced? What is grating element? State Rayleigh's criterion for spectral resolution. Define resolving power and dispersive power of a grating with expression.	(10)
	b	Light of wavelength **550 nm** is incident normally on a plane transmission grating having **6000 lines/ cm**. Calculate the angle at which the principal maxima of the first order is formed.	(4)

MODULE 3

15	a	Write the Schrodinger equation for a particle in one dimensional infinite square well potential and derive the normalised wave function.	(10)
	b	Compute the de-Broglie wavelength of an electron whose kinetic energy is **15eV**.	(4)
16	a	Explain increase in surface to volume ratio in nanomaterials. Write a short note on quantum confinement and explain nanosheet, nanorod and quantum dot.	(10)
	b	Write any four applications of nano materials.	(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	A magnetising field of **1000A/m** produces a magnetic flux of **$2x10^{-5}$ Weber** in a bar of iron of **0.2 cm^2** cross-section. Calculate permeability and susceptibility of the bar.	(4)
18	a	Define gradient, divergence and curl and illustrate their physical significance. State Gauss' divergence theorem.	(10)
	b	Distinguish between conduction current and displacement current.	(4)

MODULE 5

19	a	Write a note on high temperature superconductors. Distinguish between Type I and Type II superconductors with appropriate diagrams and examples.	(10)
	b	Mention any four applications of superconductivity.	(4)
20	a	Draw the block diagram of optical fibre communication system and explain its various functional blocks. Mention any four advantages of optical fibres over conventional transmission lines.	(10)
	b	Calculate the numerical aperture and acceptance angle of an optical fibre with a core of refractive index 1.62 and a cladding of refractive index 1.52.	(4)

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