Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester B.Tech Degree Regular and Supplementary Examination December 2022 (2019 Scheme)

Course Code: PHT 110

Course Name: ENGINEERING PHYSICS B

(2019 -Scheme)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1		Define quality factor and relaxation time of a damped harmonic oscillator. What are the factors that quality factor depends on?	(3)
2		What are harmonic waves? Obtain the relation between velocity, wavelength and frequency in wave motion.	(3)
3		Explain why the central fringe of Newton's rings are dark?	(3)
4		Distinguish between Fresnel and Fraunhoffer diffraction.	(3)
5		What is meant by wave function? Write its normalized condition.	(3)
6		What are excitons in nano materials?	(3)
7		Define intensity of sound. Write the unit of intensity of sound.	(3)
8		What are the characteristics of ultrasonic waves?	(3)
9		What are the difference between holography and photography ?	(3)
10		What are the advantages of optical fibre communication system?	(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 forced harmonic oscillator and obtain its solution. Derive the expressions for amplitude and phase difference.	(10)
	b)	A damped oscillator of mass **2g** has a force constant **10 N/m** and damping constant **2 s^{-1}**. Find the angular frequency with and without damping.	(4)
12	a)	Derive an expression for the velocity of transverse waves in a stretched string.	(10)
	b)	The string of violin **36 cm** long and has a mass of **0.2g**. With what tension it must be stretched to tune **1000 Hz**?	(4)

MODULE 2

13 a) Draw a neat diagram representing the reflection of light from top and bottom surface of a thin transparent film of refractive index **μ** and uniform thickness **t**. Also derive the conditions for the constructive and destructive interferences of the reflected components. (10)

b) The diameter of the **5th** bright ring in Newton's ring experiment is **4x10^{-3} m**. Find the radius of curvature of the lens used, if the wavelength of light is **589nm.** (4)

14 a) What is meant by transmission grating? Obtain the grating equation. (10)

b) A grating has **6000 lines/cm**. Find the angular separation of the two yellow lines of mercury of wavelengths **577 nm** and **579.1 nm** in the second order. (4)

MODULE 3

15 a) Starting from plane wave equation, formulate Schrodinger's time dependent equation by using de-Broglie formula and Einstein relation for photon energy. (10)

b) An electron and a Proton are moving with same kinetic energy. Which one has shorter wavelength? Why? (4)

16 a) What is quantum confinement? Classify nanomaterials based on dimensionality of quantum confinement and explain the following nanostructures. (i) Nano sheets (ii) Nano wires (iii) Quantum dots. (9)

b) List out five applications of nanomaterials. (5)

MODULE 4

17 a) With a neat circuit diagram explain the principle and working of piezoelectric oscillator. (10)

b) A classroom has dimensions **30 x 15 x 15 m^3** and reverberation time **1.8 s**. Calculate the total absorption of its surface and the average absorption coefficient. (4)

18 a) Define Reverberation, Echo, Loudness, Echelon effect and Noise that affect the acoustics of an auditorium. Explain how are they controlled? (10)

b) An ultrasonic sources of **0.09MHZ** sends down pulse towards the sea bed, which returns after **0.65 seconds**. The velocity of sound in sea water is **1440m/s**. Calculate the depth of sea and the wavelength of pulse. (4)

MODULE 5

19 a) With the help of properly marked diagram explain the construction and working of Ruby laser . (10)

b) Numerical aperture of an optic fibre cable is **0.5565** and refractive index of cladding is **1.464**. Calculate the refractive index of core and acceptance angle (4)

20 a) What is numerical aperture and acceptance angle of optic fibre cable? How are they related? Derive an expression for numerical aperture of an optical fibre cable in terms of refractive indices of core and cladding. (9)

b) Using a well labelled diagram explain how radiation is interacted with matter in the process of spontaneous emission and stimulated emission? Which of the process is maximised for laser emission? (5)

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