

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER B.TECH DEGREE EXAMINATION(2019 SCHEME), DECEMBER 2019**

**Course Code: PHT110**

**Course Name: ENGINEERING PHYSICS B**

**(2019-Scheme)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

- 1 Derive the differential equation of a damped harmonic oscillator (3)
- 2 Find the equation of a progressive wave of amplitude 2cm, frequency 1 Hz (3)  
and velocity 20 cm/s moving along positive x-axis.
- 3 How will you test the planeness of a surface using air wedge? (3)
- 4 Distinguish between Fresnel and Fraunhofer classes of diffraction. (3)
- 5 What is de Broglie hypothesis of matter waves? Write the equation of (3)  
de Broglie wave length
- 6 Give three medical applications of nanotechnology. (3)
- 7 What is meant by intensity of sound? Give the equation connecting (3)  
intensity and amplitude.
- 8 What are ultrasonic waves? Mention any four properties of them. (3)
- 9 What is an optical resonator? Explain its role in laser emission. (3)
- 10 Discuss the advantages of optical fibre over conventional transmission lines. (3)

**PART B**

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

**Module-I**

- 11 a) What is amplitude resonance? Give any two examples. Derive an expression (10)  
for resonant frequency. What is sharpness of resonance?
- b) In the case of a forced harmonic oscillator, the amplitude of vibrations (4)  
increases from **0.05 mm** at very low frequencies to a value **7.5mm** at the  
frequency **210Hz**. Find Q- factor, damping constant and relaxation time.
- 12 a) Obtain an expression for fundamental frequency of transverse vibrations in a (10)  
stretched string.
- b) A wave of wavelength **30cm** is travelling through a **300m** long wire whose (4)  
mass is **15kg**. If the wire is under tension of **1kN**, compute the speed and  
frequency of the wave.

**Module-II**

- 13 a) Explain how Newton's rings are formed? Show that the radius of dark ring formed by Newton's rings is proportional to square root of the order of the ring. (10)
- b) Light of wavelength  $5893\text{\AA}$  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 (i) dark and (ii) bright? (4)
- 14 a) What is a plane transmission grating? Derive the grating equation. What is Rayleigh's criterion for spectral resolution? (10)
- b) What is the highest order spectrum which may be obtained with a light of wavelength **650 nm** by means of a plane transmission grating having **5000 lines per cm**? (4)

**Module-III**

- 15 a) Derive Schrodinger's time dependent equation and hence obtain time independent equation. (10)
- b) Explain the absence of electron in the nucleus. (4)
- 16 a) Write the significance of material at nanoscale and explain the quantum confinement in nanomaterials. (10)
- b) Discuss quantum mechanical tunnelling and give two examples. (4)

**Module-IV**

- 17 a) Explain any six factors affecting acoustics of a hall and give their remedial measures. (9)
- b) An auditorium has dimensions **45m X 10m X 8m**. The average absorption coefficients of wall, ceiling and floor are **0.8, 0.4** and **0.5** respectively. Evaluate reverberation time of the hall. (5)
- 18 a) What is inverse piezoelectric effect? How is ultrasonic waves detected using piezoelectric effect? What is NDT? Explain any one NDT method. (10)
- b) Calculate the fundamental frequency of vibration of quartz crystal of thickness **8mm** at resonance if its Young's modulus is  $Y = 7.9 \times 10^{10} \text{ N/m}^2$  and density  $= 2650 \text{ kg/m}^3$ . (4)

**Module-V**

- 19 a) Explain the construction and working of a ruby laser with schematic and energy level diagrams. (10)

- b) What are Einstein's coefficients? Give their significance in lasing action. (4)
- 20 a) Explain total internal reflection. With the help of a neat diagram derive expression for numerical aperture of a step index fibre. (10)
- b) An optic fibre has an acceptance angle of  $45^\circ$ . If the refractive index of core is **1.57**, calculate numerical aperture and refractive index of cladding. (4)

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