

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
 B.Tech S1 (Special Improvement) Examinations January 2021 (2019 scheme)

Course Code: PHT100

Course Name: **ENGINEERING PHYSICS A**  
 (2019-Scheme)

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer all questions, each carries 3 marks.*

- |     |   | Marks |
|-----|---|-------|
| 1 ✓ | Distinguish between free oscillation and damped oscillation.  | (3)   |
| 2 ✓ | Define frequency, wavelength and wave velocity of a wave.   | (3)   |
| 3   | Write a short note on colours of thin films.  | (3)   |
| 4 ✓ | What is meant by the phenomenon of diffraction? Why diffraction of light is not evident in daily experience as that of sound? | (3)   |
| 5 ✓ | What are matter waves? Derive the expression for de-Broglie wavelength.   | (3)   |
| 6   | Explain the effect of increased surface to volume ratio in nanomaterials.   | (3)   |
| 7 ✓ | State Faradays laws of electromagnetic induction and Lenz's law.  | (3)   |
| 8   | Give the physical significance of curl.   | (3)   |
| 9   | What is critical magnetic field? How is it related to temperature of superconductor?  | (3)   |
| 10  | What is a light emitting diode? Give its working principle.   | (3)   |

**PART B***Answer one full question from each module, each question carries 14 marks***Module-I**

- ✓ 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 transverse wave on a stretched string is described by (4)
- $$y(x,t) = 5 \sin(25t + 0.016x + \pi/2)$$
- where x and y are in cm and t is in second. Obtain (1) Speed (2) Amplitude (3) Frequency and (4) Initial phase of the wave
- 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 (4)  
the frequency of the second harmonic.

### Module-II

- 13 a) Starting from the expression of radius of  $n$ th dark ring in Newton's rings (10)  
pattern, describe an experiment to determine the refractive index of a  
transparent liquid.
- b) Two optically plane glass plates of length **0.1m** are placed one over the other (4)  
with a thin wire at one end, separating the two. The fringes formed with light of  
wavelength **589.3 nm** are of width **3mm**. Calculate radius of the wire.
- 14 a) Derive grating equation for a plane transmission grating. Explain resolving (10)  
power and dispersive power of grating with expressions.
- b) When a diffraction grating is used at normal incidence, it is found that the (4)  
image at  $30^\circ$  consists of a yellow line of wavelength **5750 Å** of the  $n$ th order  
spectrum is superimposed on a blue line of wavelength **4600 Å** of order  $(n+1)$ .  
Calculate the number of lines per unit length of grating.

### Module-III

- 15 a) State and explain uncertainty principle. Write the three forms of uncertainty (10)  
relations. How this principle is used to prove the absence of electron in the  
nucleus? Given  $m_e = 9.1 \times 10^{-31} \text{ kg}$ ;  $h = 6.625 \times 10^{-34} \text{ Js}$
- b) For an electron in a one dimensional box of width **1Å**, calculate the first three (4)  
energy levels in **electron volt**.
- 16 a) Why do nanomaterials exhibit properties different from those of their classical (10)  
counter parts? Explain the electrical and mechanical properties of  
nanomaterials.
- b) Mention any four applications of nanotechnology. (4)

### Module-IV

- 17 a) Compare the properties of paramagnetic, diamagnetic and ferromagnetic (10)  
materials.
- b) Find the relative permeability of a ferromagnetic material if a field strength of (4)  
**200 A/m** produces a magnetization of **3100 A/m**.
- 18 a) Starting from Maxwell's equations show that electromagnetic waves are (10)  
existing in free space and find an expression for velocity.

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- b) Calculate the value of Poynting's vector at the surface of the sun if the power radiated by sun is  $3.8 \times 10^{26}$  Watts and its radius is  $7 \times 10^8$  m. (4)

**Module-V**

- ✓ 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 the advantages of optical fibres over conventional transmission lines. (8)
- b) What are sensors? Explain the working of intensity modulated sensor. (6)

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