Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester B.Tech Degree Regular and Supplementary Examination December 2020 (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 What is amplitude resonance? Give two examples. (3)

2 What is the relation between path difference and phase difference in wave motion? (3)

3 Newton's rings are circular but air wedge fringes are straight. Why? (3)

4 Give 3 differences between Fresnel and Fraunhofer classes of diffraction. (3)

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

6 Explain the concept of quantum confinement. (3)

7 Define magnetic flux density and magnetic field intensity. Give the relation between them. (3)

8 Compare displacement current and conduction current. (3)

9 Give a qualitative account of BCS theory. (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-I

11 a) Frame the differential equation of a damped harmonic oscillator and deduce its solution. Compare the time-displacement curve in three cases. (10)

b) The frequency of a tuning fork is **200Hz**. If its quality factor is **8 x10^4**, find the time after which its energy becomes **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) Calculate the fundamental frequency of a string of **1 m** long & mass **2g** when stretched by a weight of **4 kg**. (4)

Module-II

13 a) Derive Cosine law and obtain the conditions of brightness and darkness for a thin film in reflected system. (10)

b) In Newton's ring arrangement using a light of wavelength **546nm**, the radius of the $\mathbf{n^{th}}$ and $\mathbf{(n+20)^{th}}$ dark rings are found to be **0.162cm** and **0.368cm** respectively. Calculate the radius of curvature of the lens. (4)

14 a) State Rayleigh's criterion for spectral resolution. With necessary theory explain the diffraction due to a plane transmission grating. (10)

b) How many lines per meter are there in a plane diffraction grating which gives an angle of diffraction **30°** in the second order for light of wavelength **520nm** incident normally on it? (4)

Module-III

15 a) Starting from the wave equation derive Schrodinger's time dependent equation and hence deduce Schrodinger's time independent equation. (10)

b) Compute the de Broglie wavelength of an electron whose kinetic energy is **15eV**. (4)

16 a) Explain the optical, electrical and mechanical properties of nanomaterials. Give two medical applications of nanotechnology. (10)

b) Explain surface to volume ratio of nanomaterials. (4)

Module-IV

17 a) Distinguish between paramagnetic and ferromagnetic substances with two examples for each. (10)

b) Calculate the magnetic susceptibility of a paramagnetic substance at **600 K**, if its susceptibility at **200 K** is $\mathbf{3.756 \times 10^{-4}}$. (4)

18 a) Starting from Maxwell's equations show that velocity of electromagnetic waves in free space is $\mathbf{1/(\mu_0 \varepsilon_0)^{1/2}}$. (10)

b) State Gauss' divergence theorem and Stokes' theorem. (4)

Module-V

19 a) Expalin Meissner effect and show that superconductors are perfect diamagnets. Distinguish between Type I and Type II superconductors with appropriate graphs. (10)

b) Explain high temperature superconductors with two examples. (4)

20 a) Define numerical aperture and acceptance angle of an optical fibre and derive the expression for numerical aperture of a step index fibre with a neat diagram. (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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