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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

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|----|---|-----|
| 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

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| 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 8×10^4 , find the time after which its energy becomes $1/10^{\text{th}}$ 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 n^{th} and $(n+20)^{\text{th}}$ 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 **3.756×10^{-4}** . (4)
- 18 a) Starting from Maxwell's equations show that velocity of electromagnetic waves in free space is **$1/(\mu_0 \epsilon_0)^{1/2}$** . (10)
- b) State Gauss' divergence theorem and Stokes' theorem. (4)

Module-V

- 19 a) Explain 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)
