Register No.: ................................... Name: ..................................................................

# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SECOND SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023**

**(2020 SCHEME)**

**Course Code :** **20PHT100**

**Course Name:** **Engineering Physics A**

**Max. Marks :** **100** **Duration: 3 Hours**

## PART A

***(Answer all questions. Each question carries 3 marks)***

1. What is the effect of damping on the natural frequency of an oscillator?
2. Derive one dimensional wave equation.
3. An air wedge is formed using two optically plane glass strips of length 20 cm. A spacer of thickness 0.020 mm is introduced at one end to form an air film. If the light used is of wavelength 5900 Å, find the band width.
4. Distinguish between Fresnel and Fraunhofer diffractions.
5. Compute the De- Broglie wavelength of an electron whose kinetic energy is 10 eV (Mass of electron=$9.1\times10^{-31}$ Kg).
6. How the surface to volume ratio affect the properties of Nano materials?
7. Define magnetization (M) and susceptibility ($\chi$). How does $\chi$ vary with temperature for diamagnetic and paramagnetic materials?
8. What is divergence of a vector. State Gauss divergence theorem.
9. What are high temperature superconductors.
10. Write any three advantages of optical fiber communication over other conventional types of communication.

## PART B

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

### MODULE I

| | | | |
|---|---|---|---|
| 11. | a) | Explain damped harmonic oscillator. Discuss overdamped, critical damped and under damped cases with the help of graphs. | ( 10) |
| | b) | Derive the equation for Q factor of a damped harmonic oscillator. | (4 ) |

**OR**

12. a) Obtain the expression for velocity of transverse waves in a stretched string? (10 )

    b) The equation for a transverse wave is $y = 3\sin 2\pi\left(\frac{x}{40} - \frac{t}{0.04}\right)$ in SI system. Calculate the amplitude, frequency, wavelength and velocity of the wave. (4 )

**MODULE II**

13. a) Derive the equation for the wavelength of a monochromatic light using Newton's rings? Explain why the center of Newton's rings is dark? (10)

    b) Light of wavelength 5800 Å is reflected normally on a film of refractive index 1.40. What is the least thickness of the film that appear 1) dark and 2) bright ( 4)

**OR**

14. a) What is plane diffraction grating. Describe how would you use it to determine the wavelength of light. Discuss the Rayleigh criterion for limit of resolution? (10)

    b) How many orders will be visible if the wavelength of the incident radiation is 5000 Å and the number of lines on the grating is 2620 lines per cm? (4 )

**MODULE III**

15. a) Derive the expression for energy eigen values and wave function of a particle trapped in a one dimensional infinite square well potential. (10 )

    b) Explain any four characteristics of a wave function? (4 )

**OR**

16. a) What are Nano materials? Why do these materials exhibit properties different from those of their classical counter parts? Explain zero dimensional, one dimensional and two dimensional Nano materials. (10 )

    b) Outline mechanical and optical properties of Nano materials. (4 )

**MODULE IV**

17. a) Differentiate para,dia and ferro magnetic materials. Describe hysteresis loop. (10 )

    b) A magnetizing field of 1500 A/m produces a magnetic flux of $3\times10^{-5}$ Wb in an iron bar of cross-sectional area 0.4 $cm^2$. Calculate the permeability. (4 )

**OR**

18. a) Derive Maxwell's equations in free space. (10 )

    b) Derive the fee space electromagnetic wave equations and show that the velocity of the electromagnetic wave is $\frac{1}{\sqrt{\mu_o \varepsilon_o}}$ (4 )

## MODULE V

19. a) Explain how light is propagated in a step index fibre. Define numerical aperture and acceptance angle. Derive the expression for numerical aperture. (10 )

    b) Calculate the numerical aperture, acceptance angle and the critical angle of a fiber. Given refractive index of the core is 1.54 and that of cladding is 1.46. (4 )

**OR**

20. a) What is superconductivity? Explain Meisssner effect. Distinguish between type I and type II superconductors. (10)

    b) How is superconductivity explained on the basis of the BCS theory? Explain any two applications of superconductors? (4 )

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