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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER B.TECH DEGREE EXAMINATION (S), SEPT 2022

(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. Explain resonance in forced oscillation? Give two examples.
2. State the laws of vibration in a stretched string.
3. What is the effect on the diameter of a Newton's ring if air is replaced by a liquid?
4. What is meant by grating element? Write down grating equation
5. Derive an expression for de-Broglie wave length.
6. Give three examples for altered physical properties of materials in nano size.
7. Explain the physical significance of Gauss's law in magnetism? Give two applications of ferromagnetic materials
8. Compare displacement current and conduction current
9. Explain Meissner effect and show that super conductor is a perfect diamagnet?
10. Give the principle and working of a junction photodiode.

PART B

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

MODULE I

11. a) Write the differential equation and obtain the solution for a damped harmonic oscillator. What are the conditions for a harmonic oscillator to be overdamped, critically damped and under damped? Compare the time –displacement curve in the three cases. (10)

    b) For a damped oscillator, the mass of the block is 200g.Force constant 10N/m and damping constant is 40g/s. Examine whether the motion is oscillatory or not. If oscillatory find the period (4)

OR

12. a) Derive an expression for the velocity of propagation of a transverse wave in a stretched string. (10)

    b) A wave travelling along a string is described by **Y(x,t)=0.005 sin (80.0x-3.0t)** in which the numerical constants are in SI units. Evaluate (1) Amplitude (ii) wavelength (ii) Frequency and (iv) the displacement Y of the wave at a distance x=30.0 cm and time t=20 s. (4)

MODULE II

13. a) Discuss with necessary theory the formation of Newtons ring and derive an expression to find the radius of curvature of a given plano convex lens. (10)

b) A wedge air film is enclosed between two glass plates touching at one edge and separated by a wire of 0.06×10^{-3} m diameter at a distance of 0.15 m from the edge. Calculate the fringe width. The light of wavelength 6.0×10^{-7} m from the broad source is allowed to fall normally on the film. (4)

OR

14. a) What is meant by diffraction of light? Distinguish between Fresnel and Fraunhofer class of diffraction. Explain Rayleigh's criterion for spectral resolution. (10)

b) A plane transmission grating has 15000 lines per inch. Calculate the angular separation, in the second order, between the two helium lines of wave lengths 5048Å and 5016Å. (1 inch = 2.54 cm) (4)

MODULE III

15. a) Write down the Schrodinger equation for a particle in a one-dimensional square well potential and obtain the energy Eigen values and normalized wave function. (10)

b) An electron is bound in one dimensional potential box which has the width 2.5×10^{-10}m. Assuming the height of the box to be infinite, calculate the two lowest permitted energy values of electron. (4)

OR

16. a) Write the significance of surface area to volume ratio at nanoscale and explain the quantum confinement in nanomaterials. (10)

b) Explain the mechanical and electrical properties of nanomaterials. (4)

MODULE IV

17. a) Define the terms magnetization, magnetic flux density, magnetic permeability, relative permeability and magnetic susceptibility. Obtain the relation between relative permeability and susceptibility. (10)

b) A magnetizing field of 1800 A/m produces a magnetic flux of 3×10^{-5} Wb in an iron bar of cross – sectional area 0.2 cm^2. Calculate the permeability. (4)

OR

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

b) What is divergence of a vector? Give its physical significance (4)

MODULE V

19. a) What is Superconductivity. Distinguish between Type I and Type II superconductors. Give examples. (10)

b) Explain BCS theory? Write a note on high temperature superconductors. (4)

OR

20. a) What is the principle of propagation through optical fibre? Derive an expression for numerical aperture. (10)

b) Numerical aperture of an optic fibre is 0.18 and refractive index of cladding is 1.509. Calculate refractive indices of core and acceptance angle in water (refractive index of water is 1.33) (4)

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