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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2023

(2020 SCHEME)

Course Code : 20PHT110

Course Name: Engineering Physics B

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Compare free, damped and forced oscillations.
2. Derive one dimensional wave equation.
3. How do you test the optical planeness of a surface using an air wedge setup?
4. Derive the Grating equation.
5. Why does the light emitted by an atom has finite width?
6. Explain the mechanical properties of nanomaterials.
7. Write any three medical applications of ultrasonic waves.
8. The absorption coefficient of an open window is unity. Why?
9. Write any 3 differences between spontaneous and stimulated emission.
10. Draw the labeled block diagram of a fiber optic communication system.

PART B

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

MODULE I

11. a) Derive the differential equation of a damped harmonic oscillator and deduce the general solution. Explain the three different cases of oscillations with displacement – time graphs. (10)

    b) Define amplitude resonance. Derive the expression for the resonant frequency. (4)

OR

12. a) With suitable diagram, derive the expression for velocity and fundamental frequency of the wave produced in a stretched string. (10)

    b) A simple harmonic wave is represented by $Y = 8\,sin2\pi(0.05x - \frac{t}{0.05})$ where x is in cm and t in sec. Find the wavelength, frequency and velocity of the wave. (4)

MODULE II

13. a) Define fringe width. Derive the expression for the fringe width of the interference pattern formed by an air wedge. (10)

b) Using Newton's rings arrangement, the interference pattern is formed with a liquid film between the lens and glass plate. Wavelength of light used is 589 nm. If the radius of curvature of the curved surface is 100 cm and diameter of the 5^{th} dark ring is 0.3 cm, calculate the refractive index of the liquid. (4)

OR

14. a) *i.* Define resolving power and dispersive power of grating with relevant equations. *ii.* Explain Rayleigh's criterion for limit of resolution. *iii.* Write any 4 differences between Fresnel and Fraunhofer types of diffraction. (10)

b) Only two spectral lines are visible on either side of the central maximum when 400 nm light is passed through a diffraction grating. What is the number of lines per centimeter for the grating? (4)

MODULE III

15. a) Write any three characteristics of the wave function. Derive the time dependent Schrodinger equation. (10)

b) Explain quantum mechanical tunneling. (4)

OR

16. a) Why are nano materials different from their bulk counterpart. On the basis of quantum confinement, classify nano materials and explain each one of them. (10)

b) Write any four applications of nanomaterials. (4)

MODULE IV

17. a) Explain the production of ultrasonic waves by magnetostriction oscillator. Explain the piezoelectric and thermal detection methods of ultrasonic waves. (10)

b) For a quartz crystal of length 0.06 m, calculate the fundamental frequency of vibration in a piezoelectric oscillator. (4)
(Given Young's Modulus of the crystal = 8×10^{10} N/m^2, density of the crystal = 2650 kg/m^3.)

OR

18. a) Differentiate threshold hearing intensity and threshold pain intensity. Explain any 7 factors which affect the acoustics of a building. (10)

b) A hall has a volume 12500 m^3 and reverberation time of 1.5 s. If 200 cushioned chairs are additionally placed in the hall, what will be the new reverberation time of the hall? The absorption of each chair is 1 OWU. (4)

MODULE V

19. a) What are the basic requirements of a laser. With a neat diagram, explain the construction and working of a Helium – Neon laser. (10)

b) What are the advantages of holography over Photography. (4)

OR

20. a) Explain the principle of light propagation in an optical fibre. Derive the expression for numerical aperture of the optical fiber. (10)

b) Explain the working of intensity modulated and phase modulated sensors. (4)

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