B   **820A4**   Total Pages: **3**

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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 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. Derive the equation for resonant frequency of a forced harmonic oscillator.
2. Derive the one-dimensional transverse wave equation.

3. With a proper diagram, obtain the equation for the minimum thickness of an anti-reflection film to be coated on a glass surface.
4. Distinguish Fresnel and Fraunhofer diffraction.
5. Explain quantum mechanical tunneling with an example.
6. Explain optical and mechanical properties of nanostructured materials.
7. What is reverberation and reverberation time.
8. Explain the terms magnetostriction effect and piezoelectric effect?
9. Write any 3 industrial applications of lasers.
10. Explain with suitable figure how transmission of light takes place on fiber optic cables?

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

MODULE I

11. a) Obtain the differential equation of motion for a damped harmonic oscillator. With suitable graph discuss in detail the under damped, critically damped and overdamped conditions.   (10)

     b) Calculate the resonating frequency, relaxation time and Q-factor of the circuit containing 24 μF capacity, 6mH inductance and 12 Ω resistance.   (4)

OR

12. a) Obtain an expression for the fundamental frequency of a transverse wave in a stretched string.   (10)

     b) A wave is travelling through a 75 m long wire whose mass is 45 kg. If the wire is under tension of 1400 N, compute the speed of the wave.   (4)

MODULE II

13. a) With necessary diagram, write the formation of interference pattern in an air wedge and derive an expression for the diameter of a thin wire. (10)

   b) A fringe width of 0.2 cm is formed between an air wedge using sodium light of wavelength is 5665 Å. Calculate the angle of the wedge (4)

OR

14. a) Write any three differences between interference and diffraction. What is a plane transmission grating? Derive the grating equation. (10)

   b) What is the higher order spectrum which may be obtained with a light of wavelength 565 nm using a plane transmission grating having 2500 lines per cm. (4)

MODULE III

15. a) Obtain Schrodinger's time dependent equation from a plane wave equation by using de-Broglie's formula and Einstein's relation for photon energy. (10)

   b) Write any 3 properties of wave function. What is normalized wave function. (4)

OR

16. a) What is the importance of surface to volume ratio in nanomaterials? Explain the quantum confinement in nanomaterials. (10)

   b) Mention any 4 applications of Nanotechnology. (4)

MODULE IV

17. a) Distinguish between noise and musical sounds. Explain any six factors affecting the acoustics of a hall and it's remedial measures. (10)

   b) A hall has a dimension of $16 \times 12 \times 10$ m³ and is found to have a reverberation time of 4 sec. What is the total absorption of all the surfaces of the hall. (4)

OR

18. a) What is acoustic grating? Explain with figure how an acoustic grating is used to determine the velocity of ultrasonic waves in liquid. (10)

   b) Determine the fundamental frequency of ultrasonic wave produced by a piezoelectric crystal of thickness 2 mm. Given density of quartz crystal is 2650 kg/m³ and Young's modulus of quartz is 7.9×10^{10} Nm⁻². (4)

MODULE V

19. a) With a completely labelled figure and energy level diagram explain the construction and working of Ruby laser (10)

b)   Explain the recording and reconstruction of a hologram   (4)

OR

20.   a)   Derive the expression for numerical aperture in a step index
fiber. With figure explain the working of an intensity modulated   (10)
sensor.

b)   The numerical aperture of an optic fibre is 0.2 when surrounded
by air. Determine the refractive index of the core if the cladding   (4)
index is 1.59.

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