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SAINTGITS COLLEGE OF ENGINEERING
KOTTAYAM, KERALA

(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER B.TECH DEGREE EXAMINATION(R), FEBRUARY 2022

Course Code: 20PHT110

Course Name: ENGINEERING PHYSICS B

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

PART A

(Answer all questions. Each question carries3 marks)

1. Define the term Sharpness of Resonance. Explain why Sonometer has high sharpness of resonance when compared to a resonance column?
2. State three laws of transverse vibrations of a stretched string.
3. Why does the colours of the oil film on the surface of water continuously change?
4. Write any three differences between Fresnel and Fraunhofer diffraction.
5. An electron is confined to move in a one-dimensional potential well of length 1 Å. Find the zero-point energy of the electron (m_e=9.1 x 10^{-31}kg)
6. Mention any six applications of nanomaterials.
7. Explain the terms threshold of hearing intensity and threshold of pain intensity.
8. Explain thermal and piezoelectric methods for the detection of ultrasonic waves.
9. What is the difference between spontaneous emission and stimulated emission?
10. Discuss any three advantages of optical fibre over conventional transmission lines.

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 a forced harmonic oscillator. Define Q factor of a forced harmonic oscillator. List any four points to compare electrical oscillator with a mechanical oscillator. (10)

    b) Find the natural frequency of a circuit containing inductance of 100 μH and a capacitance of 0.0020 μF. To which wavelength, its response will be maximum? (4)

OR

12. a) Obtain an expression for velocity of transverse vibrations in a stretched string. (10)

    b) The equation of a transverse wave is given by (4)

    $y = 1.1 \times 10^{-3} \sin\left(\frac{2\pi}{4}x - 20\pi t\right)$, where x is measured in meters and t in seconds. Evaluate (i) Wavelength (ii) Frequency and (iii) Velocity of the wave.

MODULE II

13. a) Deduce the theory of interference of wedge-shaped film and obtain an expression for the fringe width. Describe a procedure to determine the diameter of a thin wire. (10)

b) The diameter of the 10^{th} and 20^{th} Newton's rings formed with a plano-convex lens and optically plane glass plate are 0.415 cm and 0.616 cm, respectively. If the wavelength of the interfering light is 589.3 nm, calculate the radius of curvature of the lens. (4)

OR

14. a) What is diffraction grating? Explain diffraction due to a plane transmission grating. Obtain the grating equation. (10)

b) What is the highest order of the spectrum that may be seen with monochromatic light of wavelength 6100 Å, by means of a diffraction grating with 6×10^5 lines per meter? (4)

MODULE III

15. a) Assuming the time independent Schrödinger wave equation, derive the normalized wave function for a particle in a one-dimensional potential well of infinite height. (10)

b) Uncertainty in time of an excited atom is about 10^{-9} s. What are the uncertainties in energy and in frequency of the radiation? (4)

OR

16. a) Explain surface to volume ratio of nanomaterials. Classify nanomaterials based on dimensions. (10)

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

MODULE IV

17. a) Explain the terms reverberation and sound absorption. Explain the factors affecting the acoustics of a building and their corrective measures? (10)

b) Volume of a room is 600 m^3. The total wall area of the room is 400 m^2, the floor area is 100 m^2 and the ceiling area is 100 m^2. The absorption coefficients of the walls, ceilings and the floor are 0.03, 0.8, and 0.06 respectively. Calculate the reverberation time. (4)

OR

18. a) What is piezoelectric effect? How is it used for the generation of ultrasonic waves? (10)

b) Calculate the thickness of a quartz crystal required to produce ultrasonic waves of frequency 2 MHz, Young's Modulus and density of quartz are 5×10^{12} N/m^2 and 3500 kg/m^3. (4)

MODULE V

19. a) Explain the working of ruby laser with energy level diagram. (10)

b) Explain the construction of hologram using laser. (4)

OR

20. a) Differentiate step index and graded index fibre. Obtain the expression for numerical aperture of a step index fibre. (10)

b) Calculate the numerical aperture and the acceptance angle of an optical fiber if the refractive index of the core and the cladding are 1.45 and 1.40 respectively. (4)

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