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# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SECOND SEMESTER B.TECH DEGREE EXAMINATION (Regular), JULY 2022**

**(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 under damped, critically damped and over damped oscillations with the help of the displacement- time graph .

2. Distinguish transverse and longitudinal waves with examples.

3. Explain the construction and working of an  antireflection coating with figure and necessary equation?

4. Distinguish between Fresnel and Fraunhofer diffraction.

5. If an electron and a proton  have the same kinetic energy , which has shorter  de- Broglie wavelength.

6. Mention any three applications of Nanotechnology.

7. Explain threshold hearing intensity  and  pain intensity .

8. Define piezoelectric effect and explain the detection of ultrasonic waves by this method.

9. Distinguish spontaneous and stimulated emission of radiation.

10. Mention any three advantages of optical fiber communication system over conventional method.

## PART B

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

### MODULE I

11. a) Derive  the differential equation of a forced harmonic oscillator and hence obtain the expression for amplitude and phase of the oscillator.    (10)

    b) Derive the expression for resonance frequency of a forced harmonic oscillator.    (4)

### OR

12. a) Considering transverse vibration in a stretched string, derive the expression for velocity of the wave. Hence state the laws of transverse vibration .    (10)

b)   If the equation for a transverse wave in a stretched string is $y = 2\sin(\frac{2\pi x}{20} - 50\pi t)$, in SI system. Calculate the Wavelength, frequency and velocity of the wave.    (4)

## MODULE II

13. a) With the help of necessary diagram, derive Cosine law in reflected system. Hence derive the condition for constructive and destructive interference.    (10)

b)   Two pieces of plane glass plates are placed together with a piece of paper between the two at one edge. Find the angle of the wedge shaped air film in between them , if monochromatic light  of wavelength 4800Å is incident on it and bandwidth =0.0555cm.    (4)

### OR

14. a)   What is a plane transmission grating. Define  the grating  element and  explain the formation of central maximum in the diffraction pattern.  Derive the grating equation.    (10)

b) Define resolving power of an instrument. Explain the Rayleigh's criterion  for resolving power.    (4)

## MODULE III

15. a)   Point out  any three characteristics of wave function.  Derive the time dependent  Schrodinger equation for a particle moving in a potential V.    (10)

b)   For an electron in a one dimensional box of width 1Å, calculate the separation between the two lowest energy levels in electron volt.    (4)

### OR

16. a) How the surface to volume ratio affect the properties of nano materials. What is  quantum  confinement?  Classify  and  explain  different  types  of nanostructures.    (10)

b)   Explain the mechanical and optical properties of nano materials.    (4)

## MODULE IV

17. a) Explain the three  characteristics of musical sound ?  Explain any seven factors which affects the acoustics of a building and its remedial measures.    (10)

b)   A hall has a volume of 12500 m$^3$ and reverberation time of 1.5 s . If 200 cushioned chairs are additionally placed in the hall, what will be the total reverberation time of the hall ? The absorption of each  chair is 1.0 OWU.    (4)

### OR

18. a)   Define magnetostriction effect. With neat diagram , explain how ultrasonic waves are produced using a magnetostriction oscillator.    (10)

b)   A quartz crystal of thickness 0.002m is vibrating at resonance. Calculate the fundamental frequency ? Given modulus of elasticity  as $7.9 \times 10^{10}$ N/m$^2$  and density $= 2.650 \times 10^3$ Kgm/m$^3$    (4)

## MODULE V

19. a) Which are the basic components of a laser system? Explain the construction and working of a Ruby laser with an energy level diagram. (10)

    b) Explain the principle of recording of a hologram. (4)

**OR**

20. a) Explain how light is propagated in a step index fiber ? Define and derive numerical aperture of a step index fiber . (10)

    b) The numerical aperture of an optical fibre is 0.295 and refractive index of the core is 1.54. calculate the refractive index of the cladding and acceptance angle. (4)

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