

**B.E. CIVIL ENGINEERING
FIRST YEAR, FIRST SEMESTER
SUPPLEMENTARY EXAM 2024**

Time : Three Hours

Full Marks : 100

CO-1 : Answer any Two Questions

1. a) Describe interference of light using Young's double slit experiment and calculate the fringe width.
b) Deduce an expression for the displacement of fringes when a thin plate of glass is introduced in the path of one of the interference beam in this experiment. Show how this method is used for finding the refractive index of glass.
c) Two coherent sources, whose intensity ratio is 9:4, produce interference fringes. Find out the ratio of maximum to minimum intensity of the fringe system.

6+6+3=15

2. a) Explain the phenomenon of diffraction of light. How does it differ from the interference of light?
b) What is Fraunhofer diffraction? Find the expression for intensity due to a single slit and find the positions of maxima and minima.

4+11=15

3. a) What is meant by polarization of light?

Explain the terms (i) plane of polarization and (ii) plane of vibration

- b) Explain Brewster's law. Show that when light is incident on a transparent substance at polarizing angle, the reflected and refracted rays are at right angles to each other.
- c) The refractive index of water is 1.33 . Calculate the polarizing angle of water.

6+6+3=15

CO-2 : Answer any Two Questions

4. a) A weighted glass tube is floating in liquid with 0.02 m length immersed. It is pushed down a certain distance and released. Prove that it will move with simple harmonic motion and find its period of vibration.
b) Write down the differential equation of forced vibration with damping by explaining each term and solve for condition of amplitude resonance.

7+8=15

5. a) Why is damping usually taken to be proportional to instantaneous velocity? Explain with detail mathematical calculation.
b) What are Lissajous figures? Find the condition of circular Lissajous figures formed by superposition of two mutually perpendicular S.H.Ms.
c) A block is resting on a piston which is moving vertically with simple harmonic motion of period 1.0 Sec. At what amplitude of motion will the block and piston separate?

7+4+4=15

[Turn over

6. a) Establish a relation between Young's modulus and modulus of Rigidity with the help of necessary diagram showing the nature of stresses and strains.
b) What do you mean by Internal bending moment? Deduce its general equation.

8+7=15

CO-3 : Answer any One Questions

7. a) What do you mean by echo and reverberation? Explain the difference. What is reverberation time and on which factors do the reverberation time depend?
b) What are the basic assumptions and conclusion of Sabine's law? (3+3) +4=10
8. a) Derive expressions for the decay of the acoustic energy density with time in a room and deduce the expression of reverberation time ?
b) Why absorption coefficient of open window is considered as unity? Find the reverberation time of a hall of volume 1200 m³ and having total absorption 960 m² of open window. 6+(1+3)=10

CO-4 : Answer any Two Questions

9. a) Explain the concept of wave-particle duality?
b) What is De' Broglie hypothesis? Why the De' Broglie wave associated with a moving car is not observable?
c) Prove that De' Broglie wavelength λ of electron passing through a potential V is given by

$$\lambda = \frac{h}{\sqrt{2meV}}$$

3+5+7=15

10. a) State Bohr's postulate of hydrogen atom. How does this theory explain the various spectral series observed in the spectrum of hydrogen atom?
b) What are the shortcomings of Bohr's theory?

11+4=15

11. a) What is Compton effect. What assumptions were made by Compton in dealing with the scattering of a photon from an electron? Derive an expression for the wavelength of the scattered photon in terms of the wavelength of incident radiation and scattering angle.
b) Photons of wavelength 0.0124 Å are scattered by free electrons at angles 90° and 180°. Calculate the wavelengths of the scattered photons.

11+4=15