

2316

120

Class – B.Sc. Sem II
Subject – Waves & oscillations
Paper – II (PHYSICS)

Time Allowed : 3 Hours

Maximum Marks : 35

Attempt ALL questions from Section - A and one question each from Sections B, C, D and E.

SECTION - A

1. (a) In SHM find the displacement at which K.E of the particle is equal to P.E?
- (b) What is the difference between damped and undamped oscillations?
- (c) Define logarithmic decrement.
- (d) What do you mean by bandwidth?
- (e) What is the importance of normal mode of vibration?
- (f) Write an expression for the displacement of a particle executing S.H.M given the amplitude is 0.2 m. freq. $\frac{600}{\pi}$ Hertz and initial phase is $\frac{\pi}{3}$.
- (g) Graphically represent the behaviour of peak value of current vs. driving e.m.f. frequency ω .

1×7=7

SECTION - B

2. What are the characteristics of SHM? Derive the differential equation of motion of a S.H.O. Give a comparison between mechanical and electrical

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harmonic oscillator. 7

3. (a) What is a compound pendulum? Obtain the expression for its time period. Distinguish between centre of suspension and centre of oscillation. Are they interchangeable? 4
- (b) A particle of mass 1 g moves in a potential energy given by $U = 4x + x^2$. Find the stiffness and frequency of oscillation? 3

SECTION - C

4. What are damped vibrations? Derive the equation of damped electrical oscillator. What are the solutions of this equation in different situations? 7
5. (a) Prove that damping force is proportional to velocity. 3
- (b) Define and explain the terms Relaxation time and quality factor as applied to a damped S.H.O. 4

SECTION - D

6. What is a forced oscillator? Explain the transient and steady state in a forced oscillator driven by force $F = F_0 e^{i\omega t}$. Describe velocity vs driving force frequency graphically. 7
7. Prove that average power supplied to a forced oscillator is equal to the average power dissipated. 7

SECTION - E

8. (a) Define normal co-ordinates and normal modes of an oscillatory system. Show that the solution of two coupled oscillators is the superposition of two

normal modes of oscillation. 4

(b) Differentiate between in phase and out of phase mode of vibration. 3

9. (a) Derive wave equation for transverse waves in a string.

(b) The wave equation for a travelling wave on a string is expressed as

$$y = 2.5 \sin 2\pi (t - 0.05x) \text{ cm}$$

What are the values of its amplitude, frequency, wavelength and velocity? 3
