

17/12/23 (mon)

(i) Printed Pages : 3

Roll No. ....

(ii) Questions : 7

Sub. Code : 

0	0	4	7
---	---	---	---

Exam. Code : 

0	0	0	1
---	---	---	---

B.A./B.Sc. (General) 1<sup>st</sup> Semester

(2123)

PHYSICS

Paper-B : Vibrations, Waves & E.M. Theory-I

Time Allowed : Three Hours]

[Maximum Marks : 44

**Note :—** (1) Attempt **five** questions in all, selecting **two** questions each from Units-I and II. Unit-III is compulsory.

(2) Use of non-programmable calculator is allowed.

### UNIT—I

1. What is compound pendulum ? Derive an expression for its time period. What is the condition for time period to be minimum ?

9

2. (a) Write equation of motion of mechanical Harmonic oscillator. How does the displacement and velocity vary as a function of time ?

(b) Calculate the displacement to amplitude ratio for a SHM, when kinetic energy is 90% of total energy.

6,3



3. (a) Prove that damping force is independent of acceleration and depends upon velocity.
- (b) Show that the rate of loss of energy of a damped oscillator is equal to the rate of work done against the resistive forces.
- 6,3

## UNIT—II

4. (a) Find expression for the quality factor of a forced oscillator in terms of resonance absorption band width.
- (b) What is mechanical impedance of a forced oscillator ? Write expression for it, explaining the meaning of each term.
- 7,2
5. (a) Two LC circuits are coupled by mutual inductance. Discuss the behaviour of the coupled system and find the frequency of oscillation of the system. What is the effect if coupling is loose or tight ?
- (b) Show that the total energy dissipated over one cycle in a forced oscillator is proportional to the square of amplitude.
- 6,3
6. Write down the equation of motion of a forced oscillator being driven by an alternating force  $F_0 \cos \omega t$ . Explain its steady state behaviour and hence describe the behaviour of displacement versus driving force frequency.
- 9



### UNIT—III

7. Attempt any **Eight** parts :

- (a) What is inertia controlled and mass controlled oscillator ?
- (b) Define normal mode and normal coordinates of an oscillatory system.
- (c) Explain the cause of damping.
- (d) A mass of 2 kg is attached to a spring of stiffness constant  $72 \text{ N s}^{-1}$ . Find its natural frequency.
- (e) Are all periodic motions SHM ? Explain.
- (f) What are free oscillations and resonant oscillations ?
- (g) Define logarithmic decrement and quality factor of a damped oscillator.
- (h) Is energy stored in a forced oscillator ? Explain.
- (i) Explain the role of restoring force and inertia in SHM.
- (j) Why do the ships roll heavily, when the waves are of proper period ?

1×8