

## PHYSICS PAPER-B

(Vibrations, Waves and E.M. Theory-I)

**Time Allowed : Three Hours**

**Maximum Marks : 45**

- Note :**
- (i) Attempt five questions in all, selecting two each from Unit I and II and Unit III is compulsory.
  - (ii) All questions carry equal marks.
  - (iii) Use of Non-programmable scientific calculator is allowed.

### UNIT-I

1. (a) Show that the total energy of a body executing S.H.M. is directly proportional to the square of the amplitude. 6
- (b) Two particles undergoing S.H.M. are matched in frequencies and amplitude, but they differ in phase by  $\frac{\pi}{2}$  radian. When shall they have the same displacement? 3
2. What is a Compound Pendulum? Derive an expression for its time period. What is the condition for time period to be minimum? 9

3. (a) Derive an expression for the displacement in case of damped oscillatory motion. Discuss the effect of damping on natural frequency. 6
- (b) In an oscillatory circuit  $L = 0.2 \text{ H}$  and  $C = .0012 \text{ } \mu\text{F}$ . Find the maximum value of the resistance to be connected in series, so that the circuit may oscillate. 3

### UNIT-II

4. Explain the behaviour of velocity in magnitude and phase versus driving force frequency in case of a forced oscillator. 9
5. (a) Show that the average work done per second against the resistive or damping force is equal to the power supplied to the oscillator by driving agency. 7
- (b) How do you justify the loss of energy in damped electrical oscillations? 2
6. (a) Find an expression for the quality factor in terms of the resonance absorption band width. 6
- (b) A root mean squares voltage of  $100 \text{ V}$  is applied to series LCR circuit having  $R = 10 \Omega$ ,  $L = 10 \text{ mH}$  and  $C = 1 \text{ } \mu\text{F}$ . Calculate :  
 (i) Natural frequency  
 (ii) Band width of circuit. 3

### UNIT-III

7. Attempt any six parts
- (a) Velocity of particle executing SHM is maximum at a particular instant. What can be said about acceleration at that instant?
- (b) What are dimensions of damping constant and stiffness constant?
- (c) What is logarithmic constant?
- (d) What does  $\theta$ -factor signify?
- (e) What determines the natural frequency of an electrical oscillator?
- (f) What is Hooke's law?
- (g) How do you define stiffness constant?  $6 \times 1^{1/2} =$