

## VIBRATION AND WAVES - I (B)

### Semester-I

[Maximum Marks : 30

Time Allowed : 3 Hours]

Note : Attempt *five* questions in all, selecting *two* questions from each of the Section A and B. Section C is compulsory. (Attempt any *five* questions from this Section). Use of Non-Programmable Calculator is allowed.

#### Section - A

1. Prove that damping force is independent of acceleration and depends upon velocity.
2. What is Logarithmic Decrement for damped mechanical oscillator? Deduce its value.
3. Distinguish between centre of suspension and centre of oscillation of a compound pendulum. Are they interchangeable? Explain.
4. Show that the rate of loss of energy of a damped oscillator is equal to the rate of work done against the resistive forces. (5 marks each)

#### Section - B

5. Write down the equation of a forced oscillator being driven by an alternating force  $F_0 \cos \omega t$ . Explain the steady state behaviour of a forced oscillator.
6. Describe the behaviour of displacement versus driving force frequency in case of forced oscillator.
7. Discuss the Quality Factor of a forced oscillator.
8. Derive expression for the average power supplied to an oscillator by the external periodic force  $F = F_0 \cos \omega t$ . (5 marks each)

#### Section - C

9. (i) Describe the behaviour of damping in designing of Ballistic Galvanometers.  
(ii) The amplitude of simple harmonic oscillator is doubled. How does this effect : time period, total energy and maximum velocity of the oscillator?  
(iii) Are all periodic motions simple harmonic? Is the reverse true? Give suitable example.  
(iv) Define bandwidth and how is it related with quality factor of a forced oscillator?  
(v) What is the difference between free, forced and resonant vibration?  
(vi) What is mechanical impedance and its units?  
(vii) Is energy stored in a forced oscillator? Explain. 5×2=10