

2012
B.A./B.Sc. (General) First Semester
Physics

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

Time allowed: 3 Hours

Max. Marks: 44

NOTE: Attempt five questions in all, including Question No. VII (Unit-III) which is compulsory and selecting two questions each from Unit I - II. Use non- programmable calculator is allowed.

X-X-X

UNIT – I

- I. a) Write equation of motion of mechanical harmonic oscillator. How does the displacement and velocity vary as a function of time.
b) At what distance from mean position, the kinetic energy is equal to potential energy in SHM. (6,3)
- II. What are damped vibrations? Derive expression for displacement in case of damped oscillatory motion. Discuss the case of critical damping. (9)
- III. a) Show that the damping force is independent of acceleration and depends upon velocity.
b) What is the effect of damping on the natural frequency of an oscillator? (6,3)

UNIT - II

- IV. a) Derive expression for the velocity of a force oscillator. Discuss the variation of velocity amplitude with driving force frequency and show its behaviour graphically.
b) The rms voltage of 10v is applied to a series LCR circuit having $R = 10 \text{ ohm}$, $L = 1 \text{ mH}$ and $C = 10\mu\text{F}$. Calculate the current at resonance and Q-value of the circuit at resonance. (6,3)
- V. a) Discuss the driving force frequency behaviour with velocity and displacement.
b) Find the frequency of a circuit containing inductance of $5 \times 10^{-2} \text{ H}$ and a capacitance of $5 \times 10^{-10} \text{ F}$. Find the wavelength of the radio waves to which it will respond. (6,3)

P.T.O.

(2)

- VI. a) Discuss the inductive coupling of electrical oscillators. Obtain the expression for normal mode of frequencies. Show that they are almost equal for loose coupling.
- b) Define normal mode, normal coordinates and degrees of freedom of an oscillatory system. (6.3)

UNIT - III

- VII. Attempt any eight of the following:-
- a) Why is the motion of pendulum swinging in a clock called harmonic motion?
 - b) Explain the cause of damping.
 - c) How does forced vibrations differ from resonant vibrations?
 - d) Define band width.
 - e) What is the phase relationship between displacement and acceleration in SHM?
 - f) What do you mean by relaxation time?
 - g) What is inertia controlled and mass controlled oscillator?
 - h) What are uses of torsional pendulum?
 - i) Why are ships roll heavily when the waves are of proper period?
 - j) Can there exist a circuit of zero quality? Explain. (8x1)

x-x-x