(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) 1st Semester

(2122)

PHYSICS

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

Time Allowed : Three Hours] **[Maximum Marks : 44**

Note :— (i) Attempt **FIVE** questions in all, selecting **TWO** questions each from Unit I and II. Unit III is compulsory.

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

UNIT—I

1. (a) Show that total energy of a body executing SHM is directly proportional to square of the frequency.

   (b) A body stands on a platform which vibrates simple harmonically in a vertical direction at a frequency of 5 Hz. Show that the body loses contact with the platform, when the displacement exceeds 10^{-2} meters. 6,3

2. (a) Prove that damping force is independent of acceleration and depends upon velocity.

(b) What is torsional pendulum ? Work out the time period of torsional pendulum. 5,4

3. (a) What is logarithmic decrement and quality factor of a damped SHO ? Deduce their expressions.

(b) What is the effect of damping on the natural frequency of an oscillator ? 6,3

UNIT—II

4. (a) Distinguish between transient and steady state of a forced oscillator. Explain the transient and steady state behaviour of a mechanical oscillator driven by a force $F = F_0 e^{i\omega t}$.

(b) Show that the maximum displacement amplitude of a forced oscillator having damping constant r driven by the force $F = F_0 \text{Cos}\omega t$ is given by

$$A_{max} = \frac{F_0}{\omega' r} \text{ where } \omega' = \sqrt{\frac{S}{m} - \frac{r^2}{4m^2}}$$ 6,3

5. (a) Explain the transfer of energy between two electrical circuits which are inductively coupled.

(b) Differentiate in phase and out of phase mode of vibrations. 6,3

6. (a) Derive expression for average power supplied by the driving force and average power dissipated by the damping force for a forced damped oscillator.

(b) Show that the total energy dissipated over one cycle in a forced oscillator is proportional to the square of amplitude. 6,3

UNIT—III

7. Attempt any **eight** parts :

(a) Why does the LC circuit usually produce damped oscillations ?

(b) How the Q–value determine the sharpness of absorption curve ?

(c) Explain the role of restoring force and inertia in SHM.

(d) The frequency in SHM is 100 Hz. What is its time period ?

(e) Which factors determine the natural frequency of SHO ?

(f) Why the glass windows may be broken by a far away explosion ?

(g) The amplitude of SHO is doubled. How does this affect the total energy of oscillator ?

(h) The self inductance of primary and secondary is 0.28 H and 0.36 H respectively and the mutual inductance is 0.3 H. Is the transformer loose or tight coupled ?

(i) What is importance of driving force in a forced oscillator ?

(j) What do you mean by inductive coupling ? $1 \times 8 = 8$