

(i) Printed Pages: 3

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(ii) Questions : 7

Sub. Code :

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Exam. Code :

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B.A./B.Sc. (General) 1st Semester

1128

PHYSICS

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

Time Allowed : Three Hours]

[Maximum Marks : 22

Note :— (1) Attempt five questions in all, selecting two questions each from Section-A and B. Section-C is compulsory.

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

SECTION—A

- I. (a) Discuss composition of two SHM perpendicular to each other and periods are in the ratio 1 : 2.
- (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 displacement exceeds 10^{-2} meters. 3,1.5
- II. (a) Write and solve the differential equation for a damped LCR circuit and discuss the oscillatory discharge of the capacitor.
- (b) Find the frequency and quality factor of a circuit having $L = 2$ mH, $C = 5$ μ F and $R = 0.2$ ohm. 3,1.5

- III. What is a compound pendulum ? Derive an expression for its time period. What is the condition for time period to be a minimum ? 4.5

SECTION—B

- IV. (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. 3.5,1
- V. (a) Discuss the oscillations of two pendulums coupled through a spring of stiffness S and write the equations of motion of the system in different cases.
(b) Show that in a resonant LCR circuit, the maximum potential drop occurs across the capacitor at a frequency :

$$w = w_0 \sqrt{1 - \frac{1}{2Q^2}}$$

$$\text{where } w_0 = \frac{1}{\sqrt{LC}} \text{ and } Q = \frac{w_0 L}{R}. \quad 2.5,2$$

- VI. Write down the equation of motion of a forced oscillator being driven by an alternating force $F_0 \cos wt$. Explain its steady state behaviour and hence describe the behaviour of displacement versus driving force frequency. 4.5

SECTION—C

- VII. Attempt any **eight** parts :

- (a) Explain the role of restoring force and inertia in SHM.
(b) A mass of 1 kg is attached to a spring of stiffness constant 25 Nm^{-1} . Find the natural frequency.
(c) How the logarithmic decrement is related to quality factor ?
(d) Is energy stored in a forced oscillator ? Explain.
(e) What is meant by transient state of a forced harmonic oscillator ?
(f) What is the effect of damping on the natural frequency of an oscillator ?
(g) Why does an LC circuit usually produce damped oscillations ?
(h) Why the glass windows may be broken by the far away explosion ?
(i) Is the transformer loose or tight coupled, whose mutual inductance is 0.3 H and self inductance of primary and secondary are 0.25 H and 4.0 H respectively ?
(j) What is importance of normal modes of vibration ?

$$\frac{1}{2} \times 8 = 4$$