

(i) Printed Pages : 3

Roll No. ....

(ii) Questions : 7

Sub. Code :

1	1	8	2	5
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Exam. Code :

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Bachelor of Science (FYUP) 3<sup>rd</sup> Semester

(2125)

PHYSICS

Paper : Vibrations, Waves & E.M. Theory

Time Allowed : Three Hours]

[Maximum Marks : 60

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

### UNIT-I

- I. (a) What is a compound pendulum? Derive an equation of motion of a compound pendulum. What is the condition for time period to be minimum? 8
- (b) At a time when the displacement is half the amplitude, what fraction of the total energy is kinetic and what fraction is potential in S.H.M.? 4
- II. (a) What are damped vibrations? Derive expression for displacement in case of damped oscillatory motion. Discuss the case of critical damping. 8
- (b) A condenser of capacity  $1 \mu\text{F}$ , an inductance of  $0.2 \text{ H}$  and a resistance of  $800 \Omega$  are in series. Is the circuit oscillatory? If Yes, find the frequency of oscillation. 4

- III. (a) What are forced vibrations? Derive an expression for the amplitude of forced vibrations of a mechanical system in steady state. 8
- (b) A damped oscillator consisting of mass 0.2 kg, damping constant 4 Ns/m, spring constant 80 N/m is driven by a force  $F = (16 \cos 30t)$  N. Calculate the average power supplied. 4

## UNIT-II

- IV. (a) What are longitudinal and transverse waves? Derive the wave equation for a transverse wave in a string. 8
- (b) Waves are propagating through a medium at a speed of 960 m/s. If 60 waves pass by any point in one second, what are wavelength and time period? 4
- V. (a) State Maxwell's equations in free space. Derive a wave equation using these equations and show that electromagnetic waves are transverse in nature. 10
- (b) Show that the impedance of free space for e.m. waves is  $377 \Omega$ . 2
- VI. (a) What is skin depth of a conducting medium for e.m. waves? Prove that it is inversely proportional to the square root of frequency and conductivity of a conducting medium. 8
- (b) Discuss the phenomena of reflection of waves at the boundary for normal incidence. 4

## UNIT-III

VII. Attempt any **SIX** questions:

1. Distinguish between simple harmonic motion and a periodic motion.
2. What is meant by logarithmic decrement and quality factor of a damped oscillator?
3. Distinguish between damped and forced oscillations.
4. What are the basic properties of a medium for the propagation and formation of waves?
5. Show that  $y = x^2 + c^2t^2$  is the solution of one-dimensional equation.
6. A good conductor has small reflection and high optical reflectivity. Explain why.
7. High frequency e.m. waves propagate only small distance in a conductor. Explain.
8. Light is generally characterized by electric vector, although it also possesses the magnetic vector. Explain why.

2×6=12