(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 7 Sub. Code : 0 1 4 9

Exam. Code : 0 0 0 2

B.A. /B.Sc. (General) 2nd Semester

(2054)

PHYSICS

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

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

Note :— (1) Attempt **five** questions in all, selecting **two** each from Unit-I and Unit-II.

(2) Q. No. 7 of (Unit-III) is compulsory.

(3) The use of non-programmable calculator is allowed.

(4) After evaluation of answer books out of 44 marks, the marks will be given out of 22.

UNIT–I

1. (a) Derive expression for reflection and transmission coefficient at the boundary between two media. What will be their values when impedance of transmitted section is :

(i) Zero and

(ii) Infinity ? 5

(b) Two strings have linear densities in ratio 1 : 5 joined together and stretched by certain force. Calculate :

(i) Ratio of wave speed in the two strings.

(ii) Reflection and transmission coefficient of energy. 4

2. (a) What do you mean by characteristic impedance of the string ? Show that it is given by product of mass per unit length of string and wave velocity. 5

(b) Prove that average kinetic energy per unit volume is equal to average potential energy per unit volume and equal to half of total energy of progressive wave. 4

3. (a) Define the term wave velocity and group velocity. Find the relation between wave velocity and group velocity. How this relation become for a medium having normal, anomalous and no dispersion ? 4

(b) Define standing wave ratio (SWR). Derive expression for it in terms of reflection coefficient. 3

(c) Two sinusoidal waves :

$Y_1 = 0.03 \cos (7t - 10x)$ m

$Y_2 = 0.03 \cos (5t - 7x)$ m

are superimposed. Calculate group velocity. 2

UNIT—II

4. (a) Using Maxwell equations, derive the wave equation of e.m. waves in the medium having finite permeability, permittivity but no conductivity ($\sigma = 0$). 5

(b) Prove that impedance of free space to e.m. waves is 377 ohm. 4

5. (a) Prove that amplitude of electromagnetic wave decreases exponentially with distance of penetration through a conductor. 5

(b) Define the skin depth. Derive the expression for skin depth. 4

6. (a) What is the Poynting vector ? State and prove Poynting theorem. 6

(b) If a 1000 W laser beam is concentrated by lens into crossectoin area of 10^{-10} m^2, find the Poynting vector and amplitude of electric field vector. Given $\varepsilon_0 = 9 \times 10^{-12}$ SI units. 3

UNIT—III

7. Attempt any **eight** parts :

(a) The sinusoidal wave is $y = 0.3 \sin 2\pi (0.04x - 400t)$ where x, y are in meters and t in seconds. Calculate the speed of the wave.

(b) What is the impedance matching ? Give its applications.

(c) Differentiate between progressive wave and stationary wave.

(d) Where will a person hear maximum sound —at node or antinode ? Justify.

(e) Differentiate between e.m. waves and mechanical waves.

(f) Write down Maxwell equation which indicates monopole does not exist.

(g) Write down units of $\mu\varepsilon$.

(h) A plain radio wave has $E_0 = 10^{-4}$ Vm^{-1}. Calculate B_0.

(i) If e.m. wave is incident from air to glass having refractive index 1.5. Calculate Reflection and Transmission coefficient of energy. $8 \times 1 = 8$