2018

CBCS

3rd Semester

ELECTRONICS

PAPER—C7T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Electromagnetic Theory

Answer *all* questions

1. Answer any *five* questions :   5×2

   (a) What are isotropic and anisotropic materials ?

   (b) Show that electric field is conservative force field.

(c) What is loss tangent ?

(d) What is motional EMF ?

(e) A rectangular waveguide have dimension of width
a = 5 cm and height b = 2 cm. Find cut off frequency
for dominant TE mode of propagation.

(f) In a region $\vec{E}$ and $\vec{H}$ fields are given by
$\vec{E} = 50(j\hat{x} + 2\hat{y} - j\hat{z})e^{jwt}$
$\vec{H} = (-\hat{x} + j\hat{y} + \hat{z})e^{jwt}$
Find the average power flow density.   2

(g) What are the values of v_g and v_p at cut off frequency
for propagation wave inside a rectangular waveguide.

2

(h) Find the phase velocity of wave propagation through
a dielectric medium of dielectric constant $\epsilon_r = 9.2$

2. Answer any *four* questions :   4×5

(a) Deduce Poissosis equation and Laplace equation.

Find an expression for electric field between two parallel plane conductor using Laplace's equation.

2+3

(b) Write down four Maxwell's equations in differential form and convert them into integral form. 2+3

(c) Deduce an expression for skin depth. What is surface resistance ? 2+3

(d) In a conducting medium the magnetic field is given by $\vec{H} = y^2z\hat{x} + 2(x + 1)yz\ \hat{y} - (x+1)z^2\hat{z}$ A/m

Find conduction current density at point $(2,\ 0,\ -1)$. Also find current enclosed by the square loop $y = 1$, $0 \le x \le 1, 0 \le z \le 1$ 5

(e) Deduce expression for cut off frequency (ω_e) propagation constant (β), group velocity (v_g) and phase velocity (u_p) for TE mode of wave propagation inside a rectangular waveguide. 5

(f) (i) Why rectangular waveguide behaves like dispersive medium ?

(ii) Can TEM mode propagate through rectangular waveguide ? Explain.

(iii) Can TEM mode propagate through two parallel plane guided wave ? Explain.

3. Answer any *one* question : 1×10

(a) (i) State and prove Poynting theorem.

(ii) Find average power density (Pace) uniform plane wave whose Electric and Magnetic fields are given by

$$\vec{E} = E_0 e^{jwt} \hat{x}$$
$$\vec{H} = \frac{E_0}{\eta} e^{jwt} \hat{y} \qquad (2+5)+3$$

(b) (i) Find expression for propagation constant (γ), phase velocity (v_p) and intrinsic impedance of the medium (η) for wave propagation through good dielectric and good conductor.

(ii) What is dissipation factor (D) ? Distinguish good conductor and good dielectric in terms of dissipation factor. (4+4)+(1+1)