Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ECE)/ SEM-4/EC-404/2010

2010

ELECTROMAGNETIC WAVE AND RADIATING SYSTEMS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Which of the following is zero ?

a) Grad div A b) div gradient V

c) div curl A d) Curl curl A.

ii) Maxwell's equation Curl $H = J + \delta D/\delta t$ represents

a) Magnetic vector potential A

b) Gauss' law in magnetism

c) Generalised Ampere's circuital law

d) Biot-Savart law.

iii) A transmission line is called a distortionless line when

a) $R/L = G/C$ b) $R/G = C/L$

c) $RG = L/C$ d) $R/G = LC$.

iv) The intrinsic wave impedance of a medium with permeability μ and permittivity ϵ is

a) $\sqrt{\frac{\mu}{\epsilon}}$ b) $\sqrt{\frac{\epsilon}{\mu}}$

c) $\sqrt{\frac{1}{\mu\epsilon}}$ d) $\sqrt{\mu\epsilon}$.

v) Which of the following layers persists at night ?

a) *D* layer b) *E* layer

c) *F*1 layer d) *F* 2 layer.

vi) For a good plane conductor, skin depth varies

a) directly as square root of frequency

b) inversely as square root of frequency

c) directely as a function of frequency

d) inversely with frequency.

vii) Poynting vector for EM wave has unit

a) watt/m b) W/m^2

c) W^2/m d) $(W/m)^2$.

viii) The direction of propagation of electromagnetic wave is obtained from

a) $E \times H$ b) $E - H$

c) E d) E/H.

ix) Ohm's law is obeyed by

a) conduction current

b) convection current

c) conduction current and convection current

d) none of these.

x) Hertz dipole is a dipole with length

a) $\lambda/2$ b) $\lambda/4$

c) $3\lambda/4$ d) $\lambda/6$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Establish the relation, $\nabla \times H = J + \delta D/\delta t$, where symbols have their usual meanings.

3. Define the following terms :

   a) VSWR

   b) Reflection co-efficient for transmission line.

4. Explain the concept of skin depth and find out an expression for that.

5. Derive the relation between antenna aperture and effective height of an antenna. 2 + 3

6. a) What is Smith chart ? What are the various applications of Smith chart in transmission line ?

   b) Define characteristic impedance of lossless transmission line. 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Write down Maxwell's equations for time varying electromagnetic fields : when the media are homogeneous, source-free, loss-less, isotropic and linear.

   b) Obtain an expression of wave equation of a conducting medium.

   c) What do you mean by perfect conductor ?

   d) Explain Maxwell's fourth equation of modified Ampere's circuital law. What is displacement current ?

   4 + 4 + 2 + 5

8. a) Obtain Poynting theorem for conservatism of energy in an electromagnetic field and discuss the physical significance of each term in resulting equation.

   b) Explain boundary conditions for an interface separating dielectric ϵ_{r_1} and dielectric ϵ_{r_2}. 10 + 5

9. a) Find an expression of radiation resistance of a short electric dipole with uniform current distribution.

   b) Derive an expression for the input impedence of Z_{in} of a lossless transmission line in terms of relevant parameters when the line is terminated in load impedance of Z_l. 8 + 7

10. a) How does sky wave propagation take place ?

    b) Explain skip-distance and virtual height in sky wave.

    c) Explain the difference between critical frequency and MUF. 3 × 5

11. Write short notes on any *three* of the following : 3 × 5

    a) Yagi-Uda antenna

    b) Quarter wavelength transmission line

    c) Half wave dipole antenna

    d) Boundery condition of magnetic field

    e) MUF.