ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE - 2009

ELECTROMAGNETIC WAVES AND RADIATING SYSTEM

SEMESTER - 4

Time : 3 Hours] [Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Which of the following is continuity equation ?

a) $-\frac{\delta\rho}{\delta t} = -\text{div}J$ b) Curl $H = i$

c) div $D = \frac{\delta\rho}{\delta t}$ d) Div $i = 0$. ☐

ii) The electric field lines and equipotential lines

a) are parallel to each other

b) are one and the same

c) cut each other orthogonally

d) can be inclined to each other at any angle. ☐

iii) UHF radio waves propagate as

a) ground wave b) surface wave

c) sky wave d) space wave. ☐

iv) Antenna is a

a) transducer b) amplifier

c) non-radiating element d) none of these. ☐

v) The value of $\oint dI$ along a circle of radius 2 units is

a) zero b) 2π

c) 8π d) 4π. ☐

vi) The unit of Magnetic field strength (H) is

a) amp/m ^{2} b) C/m ^{2}

c) V/m d) tesla.

vii) The director of an Yagi Uda array behaves like

a) capacitive element b) inductive element

c) resistive element d) none of these.

viii) A transmission line is terminated by a pure capacitor. The VSWR in the line is

a) 1

b) infinity

c) 0

d) depends on the value of capacitor.

ix) A circularly polarised wave results, when

a) magnitudes of two waves are same

b) phases of two weves are same

c) magnitudes of two waves are same and phase difference is zero

d) magnitudes of two waves are same and phase difference is 90°.

x) The magnetic flux B and vector potential A are related as

a) $B = \nabla \times A$ b) $B = \nabla . A$

c) $A = \nabla \times B$ d) $A = \nabla . B$.

xi) Which of the following is not a Maxwell's equation ?

a) $D = \epsilon E$ b) $\nabla . D = \rho$

c) $\nabla \times E = -\frac{\delta B}{\delta t}$ d) $\nabla \times H = J + \frac{\delta D}{\delta t}$.

xii) The intrinsic impedance of free space is given by

a) 333Ω b) 377Ω

c) 233·5Ω d) None of these.

GROUP – B
(Short Answer Type Questions)

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

2. a) Explain what is meant by 'retarded vector potential'.

   b) Explain the concept of near field and far field. 2 + 3

3. Write down Integral form of Maxwell's equations for static electromagnetic field. Write down the four conditions at boundary surface between different media (two conductors). 3 + 2

4. What is the main function of an antenna ? Define radiation resistance and beam area. 2 + 3

5. Explain the characteristics of Smith chart. 5

6. Explain the following terms : $2 \times 2\frac{1}{2}$

   a) Reflection co-efficient

   b) VSWR.

GROUP – C
(Long Answer Type Questions)

Answer any *three* questions. $3 \times 15 = 45$

7. a) What is meant by the uniform plane wave ? Derive the wave equation in the terms of electric and magnetic fields. 2 + 6

   b) Deduce Poynting theorem and explain clearly every term. Calculate power flow for a plane wave. 4 + 1 + 2

8. a) Explain the directivity of an antenna with an example. 3

   b) Give the relation between directivity and gain of an antenna. What is the limit of efficiency factor of an antenna ? 3

   c) What are half power beam width (HPBW) and beam width between flint nulls (BWFN) ? 5

   d) Define radiation resistance of folded dipole antenna. Why is it beneficial for our TV reception antenna ? 4

9. a) Define characteristic impedance of a transmission line. Explain the formation of standing wave pattern on transmission line. 2 + 3

b) Deduce relation between reflection co-efficient and VSWR. 5

c) A transmission line of characteristic impedance 50Ω is terminated by resistor of 100Ω. What will be the VSWR in the line ? Calculate impedances at the voltage minimum and maximum positions. 5

10. a) Discuss the important features of sky wave propagation and explain the terms : 6

i) Virtual height

ii) Skip distance

iii) Critical frequency.

b) Explain how troposphare ducts are formed. 4

c) A HF ratio line is established for a range of 2000 km. If the reflection region of the ionosphere is at a height of 200 km and has critical frequency f_c = 6 MHz, calculate MUF. 3

d) What are different modes of propagation of electromagnetic wave ? 2

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

a) Skin depth

b) Ground wave propagation

c) Horn antenna

d) Propagation constant and in-frequency dependence.

e) Boundary conditions for electric and magnetic fields.

END