D 27174 (Pages 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

EC 2K 502—ELECTROMAGNETIC FIELD THEORY

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) What is an electric dipole ? Explain obtain the expression for its resultant potential.

(b) State and derive Divergence theorem and Stokes theorem.

(c) Obtain the retarded form of scalar and vector magnetic potentials.

(d) Explain the characteristics of an Ideal transmission line.

(e) Derive Standard wave equations from Maxwell's equations.

(f) Define uniform planewave. What is its significance ?

(g) Define Brewster angle. Obtain an expression for it.

(h) Differentiate phase velocity and group velocity. Show their relation in Brillouin diagram.

(8 × 5 = 40 marks)

II. (a) (i) Derive an expression for capacitance of set of concentric cylinders/conductors. (8 marks)

(ii) Find the potential in the far field for the linear quadrupole having three point charges located on the Z-axis. Assume charges 2Q at Z = O, – Q at Z = a and – Q at Z = – a. (7 marks)

Or

(b) (i) Verify that the expression for the potential due to an electric dipole satisfies the Laplace equation. (8 marks)

(ii) Obtain expressions for Inductance of solenoids and toroids. (7 marks)

III. (a) (i) Explain ampere's work law in the differential vector form. (8 marks)

(ii) Derive an expression for energy stored in an magnetic field. (7 marks)

Or

(b) (i) Explain the analogies between electric and magnetic fields. (8 marks)

(ii) Verify within a conductor carrying a current 'I' the magnetic field strength at a distance 'r' from the centre of the wire is given by $H = Ir/2\pi R^2$; R – radius of the wire. The current density is constant across the cross-section of the conductor. (7 marks)

IV. (a) (i) State and derive Poynting theorem. (8 marks)

(ii) Obtain Maxwell's equations for Sinusoidal Oscillations. (7 marks)

Or

Turn over

(b) Consider a source (J, P) in a medium whose properties are represented by μ, ε and σ. Beginning with Maxwell's equations in phasor form, derive the differential equations

$\nabla^2 A - \gamma^2 A = -\mu J$; $\nabla^2 v - \gamma^2 v = -P/\varepsilon$ in which $\gamma^2 = j\omega\mu(\sigma + j\omega\varepsilon)$.

(15 marks)

(a) (i) Define and explain Surface Impedance. (8 marks)

(ii) Determine the reflection co-efficients for an electromagnetic wave incident normally on (i) a sheet of copper ; (ii) a sheet of iron. Use F = 1 MHz. Assume $\sigma = 1 \times 10^6$ ℧/m, μ = 1 000μv. for the iron.

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Or

(b) Write technical notes on :

1 Applications of Smith chart. (8 marks)

2 Standing wave ratio and reflection co-efficient relation. (7 marks)

[4 × 15 = 60 marks]