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Name......................................

Reg. No................................

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2008

EE 04 502—ELECTROMAGNETIC FIELD THEORY

(2004 Admissions)

Time : Three Hours

Maximum : 100 Marks

Answer all questions.

I. (a) State and explain Gauss's law in differential form.

 (b) Define the term potential and establish the gradient relationship between potential and electric field intensity.

 (c) What is Ampere's circuit law ? Explain its application.

 (d) Derive the integral form of Faraday's law of electromagnetic induction.

 (e) Explain the significance of displacement current.

 (f) State and prove poynting theorem.

 (g) Explain with necessary theory the construction of Smith chart.

 (h) Derive an expression for the characteristic impedance of a transmission line.

(8 × 5 = 40 marks)

II. (a) Transform the vector $4a_x - 2a_y - 4a_z$ into spherical coordinates at a point

 $p(x = -2, y = -3, z = 4)$.

(8 marks)

 (b) Derive an expression for electro static energy stored in a spherical capacitor. (7 marks)

Or

 (c) Given the electric field intensity $E = \dfrac{10}{x^2 + y^2}\left(xa_x + ya_y\right)$. Let the potential be

 $10v$ at (3, 4, 5). Find v at (6, − 8, 7).

(7 marks)

 (d) Derive an expression for potential and electric field intensity at a point due to a dipole.

(8 marks)

Turn over

III. (a) Define vector magnetic potential and show that $B = \nabla \times A$ where B is the magnetic flux density and A is the vector magnetic potential at any point.

(7 marks)

(b) Explain the terms self inductance and mutual inductance.

(8 marks)

Or

(c) Using Biot-Savart law, derive an expression for inductance unit length of a long waxial cable with radii of inner and outer conductors are a and b ($b > a$) respectively.

(8 marks)

(d) An iron ring 0.2 m in diameter and 10 sq.m area of the core, is uniformly wound with 250 turns of wire. If B is the core is to be 1 tesla and $\mu_r = 500$. What is the exciting current required ? Also determine the stored energy.

(7 marks)

IV. (a) State and explain Maxwell's equations in integral form and differential form. (15 marks)

Or

(b) Derive the wave equation for a wave propagating in a conducting medium. (10 marks)

(c) What is polarization of electromagnetic wave ? (5 marks)

V. (a) Compare open stubmatching with short stubmatching. (5 marks)

(b) Derive boundary relations for static electric field in the general form across a common boundary separated by two different perfect dielectric media.

(10 marks)

Or

(c) Compare the advantages and disadvantages of co-axial cable with 2 wire transmission line.

(5 marks)

(d) Explain voltage reflection coefficient.

(10 marks)

(4 × 15 = 60 marks)