Code: 9A04406

1

II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
*****

1 (a) Define del operator and hence explain the physical interpretation of the operations gradient, divergence and curl.
(b) State Coulomb's law and derive an expression for electric field at a point.

2 (a) Explain with the help of an example how Poisson's and Laplace equations are used to solve the electromagnetic problems.
(b) Determine the capacitance of a charged sphere of radius 'R'.

3 (a) Discuss the definition of magnetic field intensity and permeability concept.
(b) What is magnetic flux density? How is it defined in terms of force on a current element?

4 (a) Give the word statements of Maxwell's equations.
(b) In a conducting medium do the static electric and magnetic fields both exist. Explain.

5 Obtain the relation between E & H in uniform plane wave and obtain the characteristic impedance of the non conducting medium.

6 (a) Explain about direction cosines.
(b) A uniform plane wave in air is reflected from the surface of material whose properties are unknown. Measurements of electric field is the region in front of the interface yield a 1.5 m spacing between maximum, with first maximum occurring at 0.75 m from the interface. Standing wave ratios of 5 is measured then find intrinsic impedance of the unknown material.

7 Explain the measurement of inductance and loop resistance for open wire line and coaxial cable.

8 What is Smith chart? Derive the equations for constant resistance and constant reactance circles.

*****

Code: 9A04406

2

II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Write about different types of charge distributions.
  (b) Derive an expression for the electric field due to infinite plane sheet of uniform surface charge.

2 (a) What is uniqueness theorem? Prove it with respect to static fields.
  (b) Determine the energy stored in order to distribute charge on concentric spherical shell.

3 (a) Explain the concept of scalar magnetic potential and hence define magneto motive force.
  (b) Find the magnetic vector potential due to an infinite plane current sheet of uniform density 'K'.

4 Give the expressions for Maxwell's equations for static fields and hence derive the modifications made in these equations for time varying fields.

5 Determine the phase velocity of propagation, attenuation constant, phase constant and intrinsic impedance for a forward traveling wave in a large block of copper at 1 MHz ($\sigma = 5.8 \times 10^7$, $\epsilon_r = 1$and $\mu_r = 1$). Determine phase shift between the electric and magnetic fields and the distance that the wave must travel to be attenuated by a factor of 100 (40 db).

6 Explain reflection of uniform plane wave by a perfect dielectric in the case of normal incidence and obtain the expressions for reflection and transmission coefficients.

7 The propagation constant and characteristic impedance of a line of length l are given by γ and Z_0 respectively, find its equivalent T network.

8 (a) Discuss in detail about impedance matching.
  (b) The characteristic impedance of the line R_0 is 50 Ω, and the SWR ρ = 2 when the line is loaded. When the line is shorted, the minima shift 0.15 λ toward the load. Determine the load impedance.

*****

Code: 9A04406

3

II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 Define the term electric potential in electrostatic field. Show that the potential difference between any two points is independent of path of integration.

2 Explain briefly the electric field 'E' and electric flux density 'D' and permittivity concept in a dielectric material when subjected to external field.

3 (a) Find the magnetic field due to a circular loop carrying current '**I**' at a distant point from the loop.

(b) Find the flux density at a point due to a long filamentary conductor carrying a current of 20 Amps in **z**- direction.

4 State and prove the boundary conditions for time varying fields. Do they differ forstatic fields. Explain.

5 Determine the relation between α, and β such that $E = E_m \sin \alpha x \cos(\omega t - \beta z)\, a_y$ satisfies the wave equation in loss less medium.

6 State and prove Poynting theorem.

7 (a) Discuss about primary and secondary constants of the line.

(b) Explain measurement of primary constants experimentally.

8 (a) Explain why short circuited sections are preferable to open circuited sections.

(b) Calculate the length of a piece of 50 Ω open circuited line if its input admittance is to be $j\,80 \times 10^{-3}$ s.

*****

Code: 9A04406

4

II B. Tech II Semester (R09) Regular & Supplementary Examinations, April/May 2012

ELECTROMAGNETIC THEORY & TRANSMISSION LINES

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Find the work done in moving a test charge by an infinitesimal distance in an electric field. What amount of work is done in moving it normal to the electric field?

(b) Discuss the formation of surface charge at the boundaries of a conductor placed in static electric field.

2 Describe the phenomenon of polarization and hence discuss the effect of polarization in dielectric materials.

3 (a) Explain in detail the Ampere's law of force.

(b) Two identical circular loops each carrying current of 100 Amps are placed at a distance of 0.01 m. Find the force of attraction / repulsion between them.

4 (a) Discuss in detail the common analogies of electric and magnetic fields.

(b) Region between the two coaxial cones has a potential V_1 at $\boldsymbol{\theta}_1$ (edge of inner cone) and V= 0 at $\boldsymbol{\theta}_2$ (edge of outer cone). The cone vertices are insulated at r = 0. Solve Laplace's equation to get potential at a cone at any angle $\boldsymbol{\theta}$.

5 (a) Dry ground has a conductivity of 5×10^{-4} mhos/m and a relative dielectric constant of 10 at a frequency of 500 MHz. Compute: (i) the intrinsic impedance (ii) the propagation constant (iii) the phase velocity.

(b) Copper has a conductivity of 5.8×10^{7} mhos/m and is considered an ideal material for shielding. A shield is made of copper with a thickness of 1 mm. If a uniform plane wave is incident on the copper shield, compute the absorption loss in decibels by the copper at f = 10 MHz.

6 Explain about instantaneous, average, and complex Poynting vectors.

7 Explain in detail about different types of loading.

8 (a) Describe the procedure for locating the voltage maxima and minima on transmission line and derive the relevant equations.

(b) A 70 Ω lossless line has s =1.6 and θ = 300^0. If the line is 0.6 λ long, calculate the distance of the first minimum voltage from the load.

*****