[Total No. of Questions - 9] [Total No. of Printed Pages - 3] (2125)

15189

B. Tech 5th Semester Examination

Electromagnetic Field Theory (EE, EEE) (NS)

EE-314

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

SECTION - A

1. (a) State and prove Stoke's and Divergence Theorem. (10)

   (b) Solve the Laplace's equation for the potential field in a homogenous region between two concentric conducting spheres with radius 'a' and 'b' where b>a, V=0 at r=b and V=Vo at r=a. Find the capacitance between two concentric spheres. (10)

2. (a) A uniformly distributed line charge, 2m long, with a total charge of 4 nC is in alignment with z axis, the mid point of the line being 2 m above the origin. Find the electric field E at a point along X axis 2 m away from the origin. Repeat for concentrated charge of 4 nC on the z axis 2 m from the origin, Compare the results. (10)

   (b) Derive the expression for energy stored and energy density in electrostatic fields. (10)

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SECTION - B

3. (a) Show by means of Biot Savarts law that the flux density produced by an infinitely long straight wire carrying a current I at any point distant a normal to the wire is given by μ_0 μr $I/2\pi a$. (14)

   (b) State and prove the equations of continuity. (6)

4. (a) Derive a general expression for the magnetic flux density B at any point along the axis of a long solenoid. Sketch the variation of B from point to point along the axis. (12)

   (b) Explain the methods used for measurement of magnetic circuits on CROs. (8)

SECTION - C

5. (a) Derive the Maxwell's equation in phasor integral and phasor differential form. (10)

   (b) Justify the inconsistency of Ampere's circuital law and derive the proof of modified form of ampere's circuital law. (10)

6. (a) State pointing theorem and derive an expression for pointing theorem. (10)

   (b) Obtain the expression for the reflection coefficient and transmission coefficient for a wave normally incident on the surface of a dielectric. (10)

SECTION - D

7. (a) Derive the expressions for the voltage and current at any point on the transmission line in terms of propagation constant, length and characteristic impedance of the line. Hence deduce an expression for input impedance in terms of reflection coefficient. (12)

   (b) A 50 ohm line feeds an inductive load Z = 35+j35 ohm. Design a double stub tuner to match this load to the line (make use of a Smith's chart). (8)

8. (a) A loss less line with Z_0 = 300 ohm is operated at 200 MHz. The line is terminated with a load Z_L to produce VSWR = 4.48, the first voltage minimum occurs at 6cm from the load end. Determine two stubbing positions nearest to the load and the corresponding lengths of short-circuited stubs having a characteristic impedance of 300 ohm for matching. (12)

(b) A loss less line has a standing-wave ratio of 4. The Ro is 150 ohm and the maximum voltage measured on the line is 135 V. Find the power being delivered to the load. Derive the equation used. (8)

SECTION - E

9. (a) How can a vector field be expressed as the gradient of scalar field?

(b) State the conditions for a vector A to be (a) solenoidal (b) irrotational.

(c) Distinguish between displacement and conduction currents.

(d) Define the terms: magnetic moment and magnetic permeability.

(e) Write the expression for the magnetic force between an electromagnet and an armature to be attracted.

(f) Write the maxwell's equations from Gauss's law in integral form.

(g) Define skin depth or depth of penetration of a conductor.

(h) What are Helmholtz equations or represent equation of electromagnetic wave in the phasor form?

(i) An air-filled coaxial transmission line has outer and inner conductor radii equal to 6 cm and 3 cm, respectively. Calculate the values of (a) inductance per unit length, (b) capacitance per unit length and (c) characteristic impedance of the line.

(j) State the reasons, which necessitate the use of stub matching in practice. (2×10=20)