BACHELOR OF ELECTRICAL ENGINEERING EXAMINATION,2018(OLD)

(2nd YEAR 2nd SEMESTER)

FIELD THEORY

Time:3 hours Full Marks:100

(50 marks for each part)

Use separate Answer-script for each part

PART-I

Answer any **three** questions. Two marks for neatness. All **symbols** have their usual significance

1. a) Derive the **expression for curl** of a vector field **D** using **definition of curl**, written as $\nabla \times \mathbf{D}$ where ∇ is the vector differential operator in Cartesian coordinates.

b) Establish the **Stoke's Theorem**. What is the **physical significance** of the curl of a vector field? **8+8=16**

2. a) What is significance of $\nabla . \mathbf{J} = 0$ in static field and draw it.

b) Explain $\nabla \times \mathbf{H} = \mathbf{J}$ and draw it. **8+8=16**

3. a) Establish Maxwell equation $\nabla \times \mathbf{H} = \mathbf{J} + \partial \mathbf{D}/\partial t$.

b) Using Vector Magnetic Potential deduce " Biot-Savart Law". **8+8=16**

4. a) What do you mean by electromagnetic(E.M.) wave? Derive electromagnetic wave equations.

Using E.M. wave equation in free space, obtain an analytical solution of the wave equation of Electric Field (E) considering it as a plane wave and also draw the wave propagation.

b) Establish "Poynting Theorem" **10+6=16**

5. Write short notes on any two: **8+8=16**

a) Boundary relation for magnetic field when it passes through two different magnetic media having permeabilities μ_1 and μ_2.

b) Expression for self-inductance for a co-axial cable having solid inner conductor.

c) Establish $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$ and show the pictorial view of this relation.

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Ex/EE/T/223/2018(Old)

BACHELOR OF ENGINEERING IN

ELECTRICAL ENGINEERING EXAMINATION, 2018

(2nd Year, 2nd Semester, Old Syllabus)

FIELD THEORY

Time: Three Hours | Full Marks: 100

(50 marks for each part)

Use a separate Answer-script for each Part

PART-II

Answer ***any three*** questions

Two marks are reserved for neatness and well organized answer script

1. a) Deduce an expression for electric field intensity at a point on the axis of a uniformly charged ring. 8

   b) There is a ring charge of uniform charge density 0.5 nC/m at the z=0 plane with its center at (0,0,0)m. The radius of the ring charge is 10cm. There is also a point charge of 0.8 nC at (0,0,0)m. Find the electric field intensity at (0,0,6)m, if the medium is air. 8

2. a) Derive the FDM equations for node potentials in 2-D system with equal nodal distances. 12

   b) For the two-dimensional system with equal nodal distances shown in Fig.1, write the FDM equations for the unknown node potentials. 4

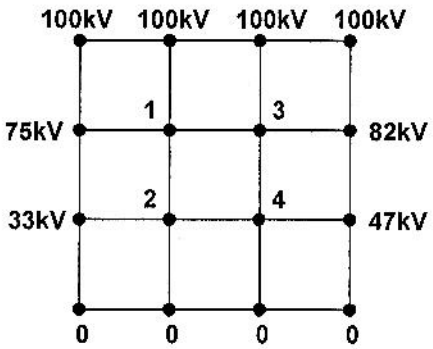

Fig.1.

3. a) What is polarization of dielectric materials? How permittivity depends on polarization of a dielectric material? 8

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b) The flux lines of an electric field pass from air into glass, making an angle 30° with the normal to the plane surface separating air and glass at the air-side of the surface. The relative permittivity of glass is 5.0. The field intensity in air is 200 V/m. Calculate the flux density in glass and also the angle, which the flux lines make with the normal on the glass side. 8

4. a) Prove "Uniqueness Theorem". 8

b) Find the expression for the electric field intensity at any point within a coaxial cable with a dielectric having thicknesses t_1 and permittivity ε_{r1}. The radius and the potential of the inner conductor are r and V, respectively. Assume the outer sheath to be earthed. 8

5. a) How mechanical pressure is produced at charged conductor surface? Derive its expression. 8

b) Find the electric field intensity of a hollow copper sphere (i) just off the sphere, (ii) on the sphere and (iii) inside the sphere. Assume that the sphere is surrounded by air. 8

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