Ref.No. EE/5/T213/2017(S)

BACHELOR OF ELECTRICAL ENGINEERING(EVENING) EXAMINATION,2017

(2-ND YEAR 1st SEMESTER SUPPLE)

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 **B** using **definition of curl**, written as $\nabla \times \mathbf{B}$ 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.

b) Show that $\nabla.\mathbf{B} = 0$.

c) Establish $\nabla \times \mathbf{H} = \mathbf{J}$. **5+5+6=16**

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

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

Ex/EE/5/T/213/2017(S)

BACHELOR OF ELECTRICAL ENGINEERING EXAMINATION, 2017

(2nd Year, 1st Semester, Supplementary)

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 for neat and well-organized answers

1. a) State and prove the integral form of Gauss's Law. 2+6

   b) A point charge $Q_1 = -0.6\ \mu C$ is located at (3,3,2)m and another point charge $Q_2 = +0.4\ \mu C$ is located at (2,3,0)m. Calculate the electric field intensity at (3,1,1)m. Medium is air. 8

2. a) A metallic cylinder of 30cm diameter is charged with $0.08\mu C/m$, spread uniformly over the surface and is surrounded by a medium having a relative permittivity of 3.2. Find the electric field intensity just off the cylinder and also on the cylinder. Derive the formulae used. 8

   b) Discuss in details the boundary conditions for dielectric-dielectric boundary. 8

3. a) Explain how the electric field distribution within a single-core lead-sheathed cable can be analyzed with the help of Conformal Transformation. 8

   b) A single-core, lead sheathed cable has a conductor of 8mm radius and two layers of different insulating materials, each 6mm thick. The relative permittivities are 2 (inner dielectric) and 3.8 (outer dielectric). Calculate the electric field intensity on the conductor surface, when the potential difference between the conductor and lead sheath is 11 kV. Derive the formulae used. 8

4. a) For the two-dimensional system with equal nodal distances shown in Fig.1, write the FDM equations for the unknown node potentials. Derive the formula used. 8

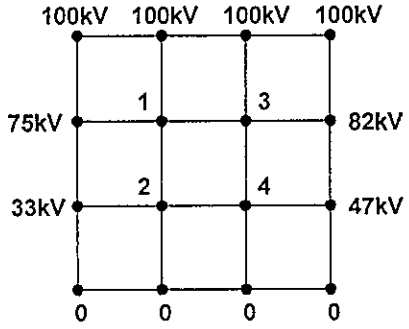

Fig.1

b) Derive an expression for volume density of energy stored in an electric field. 8

5. a) State and prove Uniqueness Theorem. 8

b) There is a ring charge of uniform charge density 0.5μC/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 0.8μC at (0,0,0)m. Find the electric field intensity at (0,0,6)m, if the medium is air. 8

—— O ——