

BACHELOR OF ELECTRICAL ENGINEERING EXAMINATION, 2017(Old)

(2-ND YEAR, 2-nd 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 \mathbf{C} , written as $\nabla \times \mathbf{C}$ where ∇ is the vector differential operator in cartesian coordinate.
- b) Establish the Stoke's Theorem.
- c) What is the physical significance of the curl of a vector field? **8+5+3=16**
2. a) State and explain Lorentz Force equation.
- b) Find \mathbf{H} on the axis at a distance 2m from the plane of the loop of a circular current loop of radius 10 cm and Carrying Current 50A.
- c) What is significance of $\nabla \cdot \mathbf{J} = 0$. **5+6+5=16**
3. a) Establish that $\nabla \times \mathbf{H} = \mathbf{J}$
- b) Show that $\nabla \cdot \mathbf{B} = 0$
- c) Find the curl \mathbf{H} at the origin, where $\mathbf{H} = (2y)\mathbf{i} - (x^2 + z^2)\mathbf{j} + (3y)\mathbf{k}$ A/m **6+6+4=16**
4. a) Establish $\nabla \times \mathbf{E} = -\partial \mathbf{B} / \partial t$
- b) Establish $\nabla \times \mathbf{H} = \mathbf{J} + \partial \mathbf{D} / \partial t$. What is displacement current? **6+10=16**
5. a) What is plane electromagnetic wave ? Using E.M. wave equation in free space, explain its propagation by obtaining an analytical solution of the wave equation.
- b) Establish "Poynting Theorem" **10+6=16**

[Turn over

B.E. Electrical Engineering, 2nd Year, 2nd Semester Examination, 2017 (Old)**Field Theory****Part II**

Time : 3 Hrs.

Full Marks : 100 (50 for each part)

Answer any three questions. Two marks for neat and well organized answer-script.

1. Derive an expression for the energy contained in an electric field with distributed space charges. 16

2. Derive the boundary conditions for an electric field in two different dielectric media adjacent to each other. Consider presence of surface charge on the boundary and mention the theorems, wherever applied in course of the derivation. 16

3. State the Uniqueness Theorem. Show how the Uniqueness Theorem can be made use of to find an expression for the capacitance per unit length of an overhead horizontal conductor. 16

4. Discuss with a detailed example, Conformal Transformation as applied in computing electric field problems. 16

5. Explain analytically how the permittivity of a dielectric is linked to the polarization of the molecules, on application of an external electric field. 16