Ref.No. Ex/EE/5/T/213/2018

BACHELOR OF ELECTRICAL ENGINEERING (PART TIME) EXAMINATION,2018

(2nd YEAR 1-ST 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 C using definition of curl, written as $\nabla \times \mathbf{C}$ 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) Establish and explain $\nabla \times \mathbf{H} = \mathbf{J}$.

b) Establish Maxwell equation $\nabla \times \mathbf{H} = \mathbf{J} + \partial \mathbf{D}/\partial t$ and show the pictorial view of this relation. **8+8=16**

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

b) Using Biot-Savart Law find **H** on the axis at a distance **1cm** from the plane of a circular current loop of radius **10 cm** carrying current of **100 A**. Derive the formula if used any. **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 any wave equation 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) Wave Guide,

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

c) Maxwell equation $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$ and its **physical significance.**

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BACHELOR OF ENGINEERING

IN ELECTRICAL ENGINEERING EXAMINATION (PART TIME), 2018

(2nd Year, 1st Semester)

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 neat and well organized answer script

1. a) Discuss in details the boundary conditions for dielectric-dielectric boundary. 10

   b) With respect to Fig. 1, calculate the unknown node voltages using FDM. Consider air as the medium. 6

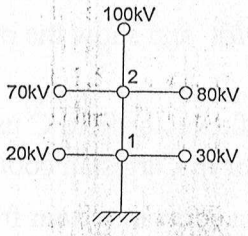

Fig. 1

2. Derive an expression for the capacitance of a co-axial cylindrical system with a single dielectric medium. The inner cylinder is at a potential of V and the outer cylinder is grounded. 16

3. a) The potential field in a medium having relative permittivity of 3.8 is given by $\phi = 4x^2 - 5y^3 + 3z$ volts. Find the absolute value electric flux density at the point (4,1,5) m. 6

   b) A point charge $Q_1 = -0.9\ \mu C$ is located at (3,5,2)m and another point charge $Q_2 = +0.6\ \mu C$ is located at (4,0,3)m. Calculate the x-component of electric field intensity at (2,2,3) m. ε_r of the dielectric medium is 2.1. 10

4. Derive the expression for electric field intensity due to a uniformly charged ring, at a point lying on the axis of the ring. Also find the expression for electric field intensity due to a uniformly charged disc,at a point lying on the axis of the disc. 16

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5. a) What do you understand by the term electric dipole? Find the expression of electric field intensity at any point due to an electric dipole. 10

b) The electric flux density in free space is given by $\vec{D} = e^{-y}\left[(\cos x)\hat{i} - (\sin x)\hat{j}\right]$
Prove that the field region is charge free, i.e. no free charge is present in the field region. 6

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