H.T.No. | | | | | | | | | | |

Code No: EC1517 **GEC-R14**

II B. Tech II Semester Regular Examinations, April 2017

ELECTROMAGNETIC FIELD THEORY

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. List the conditions for applying Gauss's to a charge distribution.
2. Differentiate between Potential and Potential Difference.
3. List the properties of conductor placed in an Electric field.
4. State Biot-Savart's law for magneto static field.
5. State Faraday's laws.
6. Define the skin depth and write an expression for it for a good conductor.

PART-B

4 × 12 = 48M

1. a) Derive the expression for electric field strength due to uniform charged sphere using Gauss's law. (6M)

   b) Four like charges of 30μc each are located at the four corners of a square, the diagonal of which measures 8m. Find the force on the 150μc charge located at 3m above the center of the square. (6M)

2. a) Derive the expression continuity equation of current in integral form. (6M)

   b) If $V = 2x^2y + 20z - \frac{4}{(x^2+y^2)}$Volts. Find **E** and ρ_v at P(6,-2.5,3). (6M)

3. a) Derive an expression for the capacitance due to concentric spherical conductors with inner radius a and outer radius b. (6M)

   b) Two homogeneous isotropic dielectrics meet on plane z=0. For Z>0, $\varepsilon_{r1}=4$, and for z<0, $\varepsilon_{r2}=3$. A uniform electric field $\mathbf{E}_1 = 5\mathbf{a_x} - 2\mathbf{a_y} + 3\mathbf{a_z}$ KV/m exists for Z≥0. Find (6M)

   i) $\mathbf{E}_2$ for Z≤0

   ii) The angles $\mathbf{E_1}$ and $\mathbf{E_2}$ make with the interface.

4. a) Obtain the expression for Magnetic field strength in all the regions if a cylindrical conductor carries a DC current of I and its radius is R m. Plot the variation of H against the distance r from the Centre of the conductor. (6M)

b) In cylindrical co-ordinates $\mathbf{A} = 50r^2\mathbf{a_z}$ wb/m is a vector magnetic potential, in a certain region of free space. Find **H**, **B** and **J**. (6M)

5. a) Derive the expression for the relationship between **H** and **J** and displacement current ($\mathbf{J_d}$). (6M)

   b) Given that $\mathbf{H_1} = -2\mathbf{a_x} + 6\mathbf{a_y} + 4\mathbf{a_z}$ A/m in a region $y - x - 2 \leq 0$, where $\mu_1 = 5\ \mu_0$, calculate $\mathbf{B_1}$. (6M)

6. a) State and prove poynting theorm for uniform electromagnetic wave. (6M)

   b) In free space $\mathbf{E}(z,t) = 50\cos(\omega t - \beta z)\ \mathbf{a_x}$ (v/m). Find the direction of progation of wave, amplitude and magnetic field component $\mathbf{H}(z,t)$. (6M)

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