Code No: RT21025 **R13** SET - 1

II B. Tech I Semester Supplementary Examinations, May/June - 2017
ELECTRO MAGENETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What are the Properties of potential function (4M)
   b) Show that the displacement current in the dielectric of a parallel plate capacitor is equal to the conduction current in the Leads. (4M)
   c) Derive the Maxwell's second equation (4M)
   d) A long conductor with current 5A is coincident with positive z-direction. If B = (4i +5j). Find the force per unit length. (4M)
   e) Define the self and mutual inductances (3M)
   f) Write the integral and point forms of Faraday's laws (3M)

PART -B

2. a) Derive the Laplace's equation in three coordinates form (8M)
   b) Find the electric field at point (2, 2, 2) due to two point charges Q_1 (4 x 10^{-9}C) and Q_2 (3 x 10^{-9}C) located with coordinates (0, 2, 2) and (2, 0, 2) respectively in free space. (8M)

3. a) Define polarization? Explain different types of polarization? (8M)
   b) Find the maximum charge that can be held on the isolated sphere 2m diameter, the sphere being in air with dielectric strength 40 kV/cm. What would be the maximum charge if this sphere were in oil of ε_r = 3.5 and dielectric strength of 75 kV/cm. (8M)

4. a) Derive an expression for the magnetic flux density at center of a circular current loop. (8M)
   b) A circuit carrying a direct current of 5A forms a regular hexagon inscribed in a circle of radius 1m. Calculate the magnetic flux density at the centre of the hexagon. Assume the medium to be free space. (8M)

5. a) Derive the Lorentz force equation in magnetic field (8M)
   b) Two long parallel conductors carrying currents 100A and 150A respectively. If the conductors are separated by 20mm. Find the force/meter length of each conductor, if the current flow is in opposite direction? (8M)

6. a) Obtain an expression for the self inductance of a toroid of a circular cross section, with N closely spaced turns. (8M)
   b) Derive the expression for energy density in solenoid (8M)

7. a) State the Poynting Theorem and derive the necessary expressions (8M)
   b) Find displacement current density for the following magnetic field. Assume the conduction current density to be zero. $H_x = 0, H_y = 0, H_z = H_0 \sin(\omega t - \beta x)$ (8M)
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