

B.Tech II Year II Semester (R13) Supplementary Examinations May/June 2017

ELECTROMAGNETIC FIELDS

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Give the limitations of Gauss's law.
 - Write the Poisson's equation.
 - What is polarization?
 - What is the difference between conductor and dielectric?
 - State Lorentz force equation.
 - State Biot – Savart's law.
 - Define self and mutual inductance.
 - What is the difference between solenoid and toroid?
 - State Maxwell's fourth equation.
 - State Faraday's laws of electromagnetic induction.

PART – B
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 (a) State and explain Gauss's law of electromagnetic in integral form.
(b) The non uniform field $E = y\mathbf{a}_x + x\mathbf{a}_y + 2z\mathbf{a}_z$, determine the work expended in carrying 2 C from B(1, 0, 1) to A(0.8, 0.6, 1) along the shorter arc of the circle, $x^2 + y^2 = 1$, $z = 1$.

OR

- 3 (a) Derive Laplace's equation from fundamentals.
(b) The radii of two concentric spheres differ by 4 cm. The capacity of the spherical condenser is 53.33 pF. If the outer sphere is earthed, what are the radii of the spheres? Assume air as the dielectric.

UNIT – II

- 4 (a) State and prove the boundary conditions at the dielectric surface.
(b) Write short notes on conduction and convection.

OR

- 5 (a) Derive an expression for energy density in a static electric field.
(b) State and explain Ohm's law in point form.

UNIT – III

- 6 (a) Derive Maxwell's second equation $\text{div}(\mathbf{B}) = 0$.
(b) Define a magnetic dipole. What is the magnetic moment? Describe how a differential current loop behaves like a magnetic dipole.

OR

- 7 (a) State and explain Ampere's circuital law. Describe any two applications of Ampere's circuital law.
(b) Evaluate the inductance of a solenoid of 2800 turns wound uniformly over a length 0.6 m on a cylindrical paper tube 4 cm in diameter. The medium is air.

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UNIT – IV

- 8 (a) Derive an expression for mutual inductance, use Neumann's formulae.
(b) Current in a coil is increased from zero to 15 amps at a uniform rate in 6 seconds. It is found that this coil develops self induced e.m.f of 150 volts whereas an e.m.f of 25 volt is produced in a neighboring coil. Compute self inductance of the first coil and the mutual inductance between the two coils.

OR

- 9 (a) Describe the scalar magnetic potential and list its limitations.
(b) Find the vector magnetic potential for an infinitely long solenoid with T turns per unit length, radius ' a ' and current I .

UNIT – V

- 10 (a) Explain the significance of displacement current.
(b) State and prove Pointing theorem. Explain the terms: Instantaneous, Average and Complex pointing vectors.

OR

- 11 (a) Write and explain the differential and integral forms of Maxwell's equation.
(b) A square coil rotates at a constant speed of 500 rpm about an axis perpendicular to a stationary uniform field of magnetic induction 0.75 Tesla. The coil has mean dimension of 15 cm x 15 cm and is wound with 100 turns. Determine dynamically induced e.m.f in the coil when the plane of the coil is: (i) In the same plane as the field. (ii) At right angles to the field. (iii) Inclined 60° to the field.

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