

R15

Code No: 123BY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, March - 2017

ELECTROMAGNETIC FIELDS

(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.
 Part A is compulsory which carries 25 marks. Answer all questions in Part A.
 Part B consists of 5 Units. Answer any one full question from each unit.
 Each question carries 10 marks and may have a, b, c as sub questions.

PART-A

(25 Marks)

- 1.a) State coulomb's law of electric charges? [2]
- b) Derive an expression for field due to a hollow conducting sphere. [3]
- c) Obtain Ohm's law in point form. [2]
- d) Define electric dipole and dipole moment? [3]
- e) State Biot-Savart's law. [2]
- f) Derive an expression for MFI due to a straight current carrying filament. Use ampere circuital law. [3]
- g) What are the applications of permanent magnets? [2]
- h) Define self-inductance and Mutual inductance. [3]
- i) State Faraday's laws of electromagnetic induction. [2]
- j) Deduce an expression for Maxwell's fourth equation. [3]

PART-B

(50 Marks)

- 2.a) Find the electric Field at a point (1,-2, 1) m, if the potential is $V = 3x^2y + 2yz^2 + 2xyz$. [5+5]
 - b) Derive the expression for EFI due to a sheet of charge. [5+5]
- OR**
- 3.a) State and Explain the Gauss's law. [5+5]
 - b) Derive an expression for electric field intensity in different region of a coaxial cable. Use Gauss Law. [5+5]

- 4.a) Derive an expression for Capacitance of Spherical Capacitor. [5+5]
- b) Obtain boundary conditions between Conductor and Dielectric interface. [5+5]

OR

- 5.a) What is the behavior of conductors in an electric field? [5+5]
- b) Deduce the expression for potential due to an electric dipole? [5+5]

- 6.a) Prove $\text{div}(\mathbf{B})=0$. [5+5]
- b) Derive an expression for MFI due to square current carrying wire at its centre. [5+5]

OR

- 7.a) Obtain MFI due to a infinite sheet of surface current density $K \bar{a}_z$. [5+5]
- b) Discuss point form of Ampere's circuital law. [5+5]

- 8.a) Obtain the expression for the inductance of a toroidal ring.
b) A coil of 500 turns is wound in a closed iron ring of mean radius of 10cm and cross section area of 3cm^2 . Find the self inductance of the winding if the relative permeability of iron is 800? [5+5]

OR

- 9.a) Derive the Expressions for Scalar and Vector magnetic potentials.
b) Derive the expression for mutual inductance between a long straight wire and rectangular loop lying in the same plane. [5+5]
- 10.a) State and Explain Faraday's laws of electromagnetic induction in integral and point forms.
b) A square coil with a loop area 0.01 m^2 and 50 turns is rotated about its axis at right angle to a uniform magnetic field $B = 1\text{ T}$. Calculate the instantaneous value of emf induced in the coil when its plane is:
i) at right angle to the field
ii) in the plane of the field
iii) when the plane of coil is 45° to the field. [5+5]

OR

- 11.a) In a material for which $\sigma = 4.5\text{ V/m}$ and $\epsilon_r = 1$, the electric field intensity is $E = 300 \sin 10^9 t \text{ V/m}$. Determine the conduction and displacement current densities and the frequency at which they have equal magnitude?
b) Derive an expression for Displacement current. [5+5]

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