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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December - 2018
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)   Define electro static field and mention any two sources.   [2]
  b)   Find the potential at R_A = 5m with respect to R_B = 15m due to point change
       Q = 500 µc at the original and zero reference at infinity.   [3]
  c)   What are Conductors and Insulators? Give examples.   [2]
  d)   Derive Ohm' law in point form.   [3]
  e)   Deduce the Relation between magnetic flux, magnetic flux density.   [2]
  f)   Find the magnetic field intensity due to a current carrying conductor with finite
       length.   [3]
  g)   Explain Lorentz force equation.   [2]
  h)   Derive Neuman's formula for mutual inductance.   [3]
  i)   State Faraday's law of electromagnetic induction.   [2]
  j)   Determine the e.m.f induced about the path r=0.5, z=0, t=0. If B=0.01sin377t.   [3]

PART-B

(50 Marks)

2.a)   Three equal positive charges of 4×10^{-9} coulomb each are located at three corners of a
       square, side 20cm. determine the electric field intensity at the vacant corner point of
       the square.
  b)   State and explain Maxwell's first law.   [5+5]

OR

3.a)   What is an electric dipole? Obtain expression for torque experienced by an electric
       dipole in a uniform electric field.
  b)   Derive the expression for Potential gradient.   [5+5]

4.a)   Derive the expression for the energy stored in the charged condenser.
  b)   The capacitance of a parallel plate condenser is 0.2µF. Potential difference between
       the plates is 2V. Calculate the energy stored by the charged condenser.   [5+5]

OR

5.a)   Differentiate static electric and magnetic fields.
  b)   Derive Equation of continuity. What is its significance?   [5+5]

6.a)   Find the Magnetic Field Intensity due to a straight current carrying filament.
  b)   Find the magnetic field intensity at the centre O of a square loop of sides equal to 5M
       and carrying 10A of current.   [5+5]

7.a) State Ampere's circuital law and prove the same.

OR

b) In the region $0 < r < 0.5$m, in cylindrical co-ordinates, the current density is $J = 4.5e^{-2r}\hat{a}_z \left(A/m^2 \right)$ and J = 0 elsewhere. Use Amperes law to find H.   [5+5]

8.a) Derive an expression for magnetic field strength H, due to a current carrying conductor of finite length placed along the y-axis, at a point P in x-z plane and $\hat{r}$ distant from the origin.

b) What is scalar magnetic potential? Give its limitations.   [5+5]

OR

9.a) A toroid with cross section of radius 2cm has a silicon steel core of mean length 28cm and an air gap of length 1mm. Assume the air-gap area is 10% greater than the adjacent core and find the mmf required to establish an air-gap flux of 1.5 mwb.

b) Explain the concept self and mutual inductances.   [5+5]

10. Write Maxwell's equation for static fields. Explain how they are modified for time varying electric and magnetic fields.   [10]

OR

11.a) Generalize Ampere's law for time varying fields.

b) In a material for which σ = 5.0 s/m and ∈r = 1, the electric field intensity is E = 250 Sin1010t (V/m). Find the conduction and displacement current densities and the frequency at which they have equal magnitudes.   [5+5]

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