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**Question Paper Code : 80338**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Electronics and Communication Engineering

EC 6403 – ELECTROMAGNETIC FIELDS

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State coulombs law.
2. What is an electric potential? Write expression for potential due to an electric dipole.
3. Define resistance of a conductor.
4. Give Laplace's and Poisson's equations.
5. State Ampere's circuital law.
6. What is vector magnetic potential?
7. Calculate the mutual inductance of two inductively tightly coupled coils with self-inductance of 25 mH and 100 mH.
8. Give the expression for Lorentz force equation.
9. Define Phase velocity.
10. Find the displacement current density for field $E = 300 \sin 10^9 t \ V/m$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and Prove Stokes theorem. (8)

(ii) Derive the expression for energy and energy density in static electric fields. (8)

Or

(b) (i) A circular disc of radius '$a$' meter is charged uniformly with a charge of $\rho$ c/m. Find the electric field intensity at a point $h$ meter from the disc along its axis. (10)

(ii) Explain the concept of superposition principle of electric field intensity. (6)

12. (a) Derive an expression for capacitance of a coaxial cable. (16)

Or

(b) (i) Derive an expression for Polarization '$P$'. (4)

(ii) State and explain the electric boundary conditions between two dielectrics materials. (12)

13. (a) From Biot Savart's law obtain expression for magnetic field intensity and vector potential at a point $P$ and distance '$R$' from infinitely long straight current carrying conductor. (16)

Or

(b) (i) Consider two identical circular current loops of radius 3 m and opposite current 20 Amps are in parallel planes, separated on their common axis by 10 m. Find the magnetic field intensity at a point midway between the two loops. (8)

(ii) State Biot-Savart's law. Find the magnetic Field intensity at the origin due to current element $Id\vec{l} = 3\pi(\hat{a}_x + 2\hat{a}_y + 3\hat{a}_z)\,\mu\ A.m$ at (3, 4, 5) in free space. (8)

14. (a) (i) A charged particle with velocity $\vec{u}$ is moving in a medium containing uniform field $\vec{E} = E\hat{a}_x V/m$ and $\vec{B} = B\hat{a}_y\, Wb/m^2$. What should $\vec{u}$ be so that the particle experiences no net force on it? (8)

(ii) State and derive the magnetic boundary conditions between the two magnetic mediums. (8)

Or

(b) Derive the expression for inductance and magnetic flux density inside the solenoid. Calculate the inductance of the solenoid and energy stored when a current of 8 A flowing through the solenoid of 2m long, 10 cm diameter and 4000 turns. (16)

15. (a) (i) State and prove Poynting's theorem and give its physical interpretation. (8)

(ii) Derive Maxwell's equations for time varying fields. (8)

Or

(b) Derive the wave equation starting from Maxwell's equation for free space. (16)

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