

Roll No

EX-302

B.E. III Semester

Examination, December 2016

Electro-Magnetic Theory

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) Write mathematical equations for gradient, curl, divergence in spherical co-ordinate systems.
- b) Define electric field intensity.
- c) What are equipotential surfaces? Derive a mathematical equation.
- d) State and prove Gauss's law.

OR

Throughout a region of $8\text{mm} < r < 10\text{mm}$ a uniform volume charge density of $40\mu\text{C}/\text{m}^3$ is present. Let charge density is zero for $0 < r < 8\text{mm}$. Find electric flux density at $r = 10\text{mm}$ and at $r = 20\text{mm}$ if there is no charge at $r > 10\text{mm}$.

Unit - II

2. a) Define electric dipole moment.
- b) Derive Laplace's of Poisson's equation.
- c) Derive equations for energy density in static electric field.
- d) Derive Boundary conditions for static electric field.

OR

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Derive equations for capacitance of two concentric conducting spheres.

Unit - III

3. a) Write Biot-Savart's law.
- b) Write Amperes circuital law.
- c) Define magnetic flux density and magnetic field intensity.
- d) Derive equations for magnetic boundary conditions.

OR

Derive equations for energy stored and energy density in a magnetic field.

Unit - IV

4. a) Define scalar magnetic potential.
- b) Define vector magnetic potential.
- c) Define self and mutual inductances.
- d) Derive Maxwell's equation in
 - i) Differential form
 - ii) Integral form
 - iii) Free space
 - iv) Harmonically time varying fields

OR

Obtain the vector magnetic potential A in the region surrounding an infinitely long, straight and filamentary

current I or show that $\vec{A} = \frac{-\mu_0 I}{2\pi} \log r \vec{a}_z$ in the magnetic vector potential for a_z directional current I amp, flowing in an infinite long conductor where r is a distance perpendicular to the direction of the conductor.

Unit - V

5. a) Define uniform plane waves.
- b) What do you mean by polarization of waves?
- c) Define surface impedance.
- d) Derive mathematical equations for reflection at the surface of a conductive medium.

OR

State and prove Poynting theorem.

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