

Total No. of Questions : 8]

[Total No. of Printed Pages : 2

Roll No 24

EC-5001 (CBGS)**B.E. V Semester**

Examination, December 2017

Choice Based Grading System (CBGS)**Electromagnetic Field Theory**

Time : Three Hours

Maximum Marks : 70

- Note:** i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Transform the vector field $G = (xz/y)a_x$ into spherical coordinates. 3
- b) State and prove the stock's theorem. 3
- c) Point charges Q_1 and Q_2 are respectively located at $(4, 0, -3)$ and $(2, 0, 1)$. If $Q_2 = 4nC$. Find Q_1 such that 8
 - i) The \vec{E} at $(5, 0, 6)$ has no z component
 - ii) The force on the test charge at $(5, 0, 6)$ has no x component.
2. a) State and prove the divergence's theorem. 7
- b) State and prove the electric boundary conditions. 7
3. a) Explain Biot-Savart's Law. 7
- b) State and prove uniqueness theorem. 7

[2]

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4. a) Define current density. Also derive expression of conduction current density and convection current density. 7
- b) State and deduce the Faraday's Law of electromagnetic induction in integral and differential form. 7
5. a) State and prove poynting vector theorem. 7
- b) Derive the equation of uniform plane wave in free space and dielectric. 7
6. a) What do you mean by circular polarization? 7
- b) Derive the expression for group velocity of a uniform plane wave propagating in a good conductor and compare with phase velocity in the conductor. 7
7. a) Define following terms: 7
 - i) Complex permittivity
 - ii) Loss tangent
 - iii) Group and phase velocity
- b) What do you mean by skin depth? Explain clearly. 7
8. a) Derive the expression for transmission coefficient and reflection coefficient of uniform plane waves with normal incidence at plane dielectric boundary. 10
- b) What do you mean by total internal reflection explain. 4

341