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Reg. No. : ....

Name : ....

Fourth Semester B.Tech. Degree Examination, May 2014
(2008 Scheme)
Branch : ELECTRICAL AND ELECTRONICS
08.403 : Engineering Electro-Magnetics (E)

Time: 3 Hours Max. Marks: 100

Instruction : *Answer **all** questions from Part **A** and **one full** question from **each** Module of Part **B**.*

PART – A

1. Given $\overline{F} = (y-1)\,\overline{a}_x + 2x\overline{a}_y$, find the vector at (2, 2, 1) and its projection on $\overline{B}$ where $\overline{B} = 5\overline{a}_x + \overline{a}_y + 2\overline{a}_z$.

2. A field vector is given by $\overline{F} = \frac{1}{r}\overline{u}_r$ in cylindrical and spherical co-ordinate system. Determine $\overline{F}$ in each case in Cartesian form at the point (1, 1, 1).

3. Derive Maxwell's first equation in electrostatics starting from Gauss's law.

4. Distinguish between divergence and curl.

5. Explain potential, potential difference and potential gradient.

6. Derive the capacitance of a coaxial cable.

7. Obtain Poisson's and Laplace's equations from fundamentals.

8. Two ferromagnetic materials are separated by a plane boundary. Medium 1 has a relative permeability of 500 and medium 2 has 5000. If the direction of magnetic field in medium 2 is at an angle of 88° with respect to the normal to the boundary, find the angle between field direction and normal in medium 1.

9. State and explain uniqueness theorem for time varying fields.

10. If the magnitude of $\overline{H}$ in a plane wave is 1 A/m find the magnitude of $\overline{E}$ for the wave in free space.

(10×4=40 Marks)

P.T.O.

PART – B

Module – I

11. a) Three point charges in free space are located as follows :
$+5 \times 10^{-8}$ coulomb at (0, 0)m
$+4 \times 10^{-8}$ coulomb at (3, 0)m
-6×10^{-8} coulomb at (0, 4)m
1) Find the potential, electric field intensity and flux density at (3, 4)m. 6
2) What is the total electric flux over a sphere of 5m radius with centre at (0, 0) ? 4

b) State Gauss's law and show how divergence of a vector can be obtained by applying the law. 10

OR

12. a) What is an electric dipole ? Find expressions for the potential and electric field at a point 'P' due to a dipole. 10

b) Obtain the boundary conditions at a conductor-free space boundary. 10

Module – II

13. a) Develop an expression for the magnetic field at any point on the line through the centre at a distance 'h' from the centre and perpendicular to the plane of a circular loop of radius 'a' with current 'I'. 10

b) Derive an expression for energy density in a magnetic field. 10

OR

14. a) Find $\nabla \times \overline{H}$ if $\overline{H} = y^2 z\, \overline{a}_x + 2(x+1)yz\, \overline{a}_y - (x+1)z^2\, \overline{a}_z$. 10

b) Explain the concept of scalar and vector magnetic potentials. 10

Module – III

15. a) Show that the displacement current through a condenser is equal to the conduction current or current flowing in the external circuit. 10

b) Derive Maxwell's first equation in point form for a time varying field. 10

OR

16. a) Obtain the wave equations for a conducting medium from Maxwell's equations. 10

b) Derive transmission line equations. 10
