



Reg. No. :

Name :

**Fourth Semester B.Tech. Degree Examination, July 2015
(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 $\bar{A} = \frac{10}{\sqrt{2}} (\bar{a}_x + \bar{a}_z)$ and $\bar{B} = 3 (\bar{a}_y + \bar{a}_z)$ express the projection of \bar{B} on \bar{A} as a vector in the direction of \bar{A} .
2. If $V = \frac{20}{x^2 + y^2 + z^2}$. Find \bar{E} .
3. Starting from Gauss's law derive Maxwell's first equation in electrostatics.
4. Find the gradient of a scalar field 'f' where $f(x, y, z) = x^2y + e^z$. Also find the magnitude of the gradient at the point $(1, 5, -2)$.
5. Explain current, current density and point form of Ohm's law.
6. Derive an expression for energy density in an electrostatic field.
7. If $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$ find $\text{div } \bar{r}$ and $\text{curl } \bar{r}$.
8. Explain Stoke's theorem.
9. What is meant by standing wave ratio of uniform plane waves ?
10. If the magnitude of \bar{H} in a plane wave is 2 A/m find the magnitude of \bar{E} for the wave in free space. **(10×4=40 Marks)**



PART – B

Module – I

11. a) A charge $Q_2 = 121 \times 10^{-9} \text{ C}$ is located in vacuum at $P_2 (-0.03, 0.01, 0.04)$. Find the force on Q_2 due to $Q_1 = 110 \mu\text{C}$ at $P_1 (0.03, 0.08, -0.02)$. 8
- b) Find the electric field intensity due to a straight uniformly charged wire with a linear density of ' λ ' coulombs per metre length at a point 'P' distant 'h' above the wire. Also find the intensity when 'P' is on the perpendicular bisector of the wire. 12

OR

12. a) 1) What is an electric dipole? 2
- 2) A dipole at the origin in free space has a moment of $400 \pi \epsilon_0 (0.6 \bar{a}_x - 0.75 \bar{a}_y + 0.8 \bar{a}_z)$ c.m. Find the potential at $P_A (0, 0, 5)$ and $P_B (0, 5, 0)$. 8
- b) Obtain the boundary conditions for perfect dielectric materials. 10

Module – II

13. a) State and prove Ampere's circuital law. 10
- b) Measurements made in the atmosphere show that there is an electric field which varies widely from time to time particularly during thunderstorms. Its average values on the surface of the earth and at a height of 1500 m were found to be 100 v/m and 25 v/m respectively. Calculate 1) the mean space charge in the atmosphere between zero and 1500 m altitude. 2) surface charge density on the earth. 10

OR



14. a) Explain the concept of scalar and vector magnetic potentials. 10
- b) Two long straight parallel wires X and Y separated by a distance of 2.5 cm in air carry currents of 5 A and 2.5 A respectively in opposite directions. Calculate the magnitude and direction of the force on a 10 cm length of the wire Y. Derive the expression used. 10

Module – III

15. a) Using Maxwell's equations obtain the wave equations for a conducting medium. 10
- b) Derive transmission line equations. 10
- OR
16. a) State Poynting's theorem and give its physical significance. 10
- b) Define skin depth and derive an expression for it. 10
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