Student Exam No: _____

GANPAT UNIVERSITY

B. TECH. SEMESTER V (ELECTRONICS & COMMUNICATION ENGINEERING)
REGULAR EXAMINATION, NOV-DEC 2014
2EC502 ELECTROMAGNETIC THEORY & WAVE PROPAGATION

[Max. Time: 3 Hrs.] **[Max. Marks: 70]**

Instructions:

1. Attempt all questions.
2. Answers to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

SECTION-I

Que.-1 (A) Derive the equation of $\bar{E}$ for the Electric Dipole. 4

(B) Given points A(2,5,-1), B(3,-2,4) and C(-2,3,1) and: 4
- **(a)** $\overline{R_{AB}} \cdot \overline{R_{AC}}$
- **(b)** The angle between $\overline{R_{AB}}$ and $\overline{R_{AC}}$
- **(c)** The length of projection of $\overline{R_{AB}}$ on $\overline{R_{AC}}$
- **(d)** The vector projection of $\overline{R_{AB}}$ on $\overline{R_{AC}}$

(C) Transform $\bar{A} = 4\,\overline{a_x} - 2\overline{a_y} - 4\overline{a_z}$ in spherical Co ordinate system. Also evaluate it at P(x=2, y=3, z=5). 4

OR

Que.-1 (A) What is the line charge density? Derive the expression of electric field intensity due to the line charge configuration. 4

(B) An infinitely long uniform line charge is located at y=3, Z=5. If ρ_l= 30nC/m. Find $\bar{E}$ at 4
- **(a)** The origin
- **(b)** $P_A(0,6,1)$

(C) Two point charges of 6 nC are located at the points (2,-3,-4) m. and a charge of 8 nC is located at (-2,3,4) m. Find electric field intensity at (3,3,3) m. 4

Que.-2 (A) Find the flux density at a point A(6,4,-5) caused by 4
- **(i)** A point charge of **40mc** at the origin
- **(ii)** A uniform line charge $\boldsymbol{\rho_l = 10\ \mu c/m}$ on the Z-axis
- **(iii)** A uniform charge density $\boldsymbol{\rho_s = 30\ \mu c/m^2}$ at a plane X=8

(B) Show that electrostatic energy stored in a parallel plate capacitor is given by $\frac{1}{2}cv^2$ joules 3

(C) Let $\bar{D} = (8x + 4x^2)\overline{a_x} - 2y\overline{a_y} + 2z\overline{a_z}$ c/m^2 evaluate both sides of the divergence theorem for the region defined by $-a < x, y, z < a$ 4

OR

Que.-2 (A) Explain 4
1. Electric Flux 2. Electric flux density
3. Surface charge density 4. Work done

(B) Define the Current Density and also explain the continuity equation for current in detail. 3

(C) Let $\bar{E} = \left(-\frac{6y}{x^2}\right)\overline{a_x} + \left(\frac{6}{x}\right))\overline{a_y} + 5\overline{a_z}$ V/m and calculate 4

(a) V_{PQ} given P (-7,2,1) and Q (4,1,2)

(b) V_P if V=0 at Q.

Que.-3 (A) Derive the equation of the energy density which is stored in the electrostatic field. 4

(B) Four infinite uniform sheets of charge are located as follows: 20 pC/m^2 at y=7, -8 pC/m^2 at y=3, 6 pC/m^2 at y=-1 and -18 pC/m^2 at y=-4. Find $\bar{E}$ at the point : 4

(C) Derive the boundary condition at a conductor free space boundary. 4

SECTION-II

Que.-4 (A) Derive an expression for the Displacement current density for a time varying field. 3

(B) Derive the Lorentz Force equation. 3

(C) State and prove stokes theorem.

OR

Que.-4 (A) Prove the relation, $\nabla \times \bar{H} = \bar{J}$ 6

(B) State Poynting theorem and derive an expression for the value of instantaneous power flow in a definite given volume. 6

Que.-5 (A) Describe the relation between the vector components when the vector is going from one medium to another. 5

(B) Derive the solution of the Wave equation for a lossy medium. 3

(C) What is Vector Magnetic potential? Mention any one use of it. 3

OR

Que.-5 (A) Derive all the Maxwell's equations for a free space medium. 5

(B) What is Skin effect? Explain in detail. 3

(C) What is the Gauss law for the magnetic field? 3

Que.-6 (A) Answer the following: 6

(i) How the Depth of penetration and the frequency does are related?

(ii) What does the equations of Magnetic boundary conditions signifies?

(iii) Define a Wave front.

(iv) What does the Poynting vector signifies?

(v) Write down the basic motor equations.

(vi) What does the Maxwell's equation describe about?

(B) The electric field vector in free space is given by $\bar{E} = E_m \sin\alpha \cos(\omega t - \beta z)\, \bar{a}_y$ (V/m). Find the corresponding $\bar{H}$. 4

(C) Mention few characteristics of E layer of the Ionosphere. 2

End of Paper