

T.E. SEM V ELEC. C-Scheme June 2025

Time: 3 Hours

Marks:80

10/06/25.

Note:

1. Question No.1 is compulsory.
2. Solve ANY THREE questions from the remaining five questions.
3. Figure to the right indicates full marks.
4. Assume suitable data wherever required, but justify the same.

Q.1. Attempt any 4

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- a) Define scalar and vector quantity with example. 5
- b) Derive the relation between $\vec{E}$ and electric potential V. 5
- c) "The line integral of the magnetic field around some closed loop is equal to the sum of the currents which pass through the loop". Justify the statement. 5
- d) State and explain coulomb's law in electrostatics. Hence define unit charge. 5
- e) Define Biot-Savarts law. 5

Q.2. Attempt All

- a) A Charge $Q_1 = -20\mu C$ is placed at P(-6,4,6) m and a charge $Q_2 = 50\mu C$ is placed at R(5,8,-2) m in free space. Calculate the exerted force on Q_2 by Q_1 in vector form. 10
- b) Given $\vec{E} = E_m \sin(\omega t - \beta z) \vec{a}_y$ in free space, find $\vec{D}$, $\vec{B}$ and $\vec{H}$ at Y=0. 10

Q.3. Attempt All

- a) Use Biot-Savart's Law for any finite current carrying conductor to find magnetic field intensity. 10
- b) Show that the $\vec{E}$ due to infinite sheet of charge at a point is independent of the distance of that point from the plane containing the charge. 10

Q.4. Attempt All

- a) Derive point & integral form of Faraday's Law. 10
- b) Derive the wave equation in terms of time varying electric & magnetic field. 10

Q.5. Attempt All

- a) Draw rectangular, cylindrical and spherical co-ordinate system and explain differential element dl, differential surface ds and differential volume dv for all coordinate system. 10
- b) Explain Lorentz's force equation for moving charge. Enlist it's application. 10

Q.6. Attempt All

- a) Derive the Poisson's and Laplace equation. In Cartesian co-ordinate a potential is a function of x only. At $x = -2$ cm, $V = 25$ V and $E = -1.5 \times 10^3 \vec{a}_x$ V/m throughout the region. Find V at $x=5$ cm. 10
- b) Discuss the phenomenon of electric polarization in dielectric medium. 10