SECTION – A

Q.1) Gauss’ law is valid for
(i) (a) Any closed surface (b) only regular closed surfaces (c) only open surface (d) only irregular open surfaces

(ii) Electric field inside between two equally and oppositely charged plates of charge densities \( \sigma \) and \(-\sigma\) is
   (a) \( \varepsilon_0 \sigma \) (b) \( \frac{\sigma}{2\varepsilon_0} \) (c) \( \frac{\sigma}{\varepsilon_0} \) (d) \( \frac{2\sigma^2}{\varepsilon_0} \)

(iii) Electric field intensity due to an infinitely long straight uniformly charged wire at a distance \( r \) from the wire varies as
   (a) \( r \) (b) \( r^{-1} \) (c) \( r^2 \) (d) \( r^{-2} \)

(iv) A hollow insulated conducting sphere is given a positive charge of 10 \( \mu \)C. what will be the electric field at the centre of the sphere, if its radius is 2m?
   (a) Zero (b) 5 \( \mu \)Cm\(^{-2}\) (c) 20 \( \mu \)Cm\(^{-2}\) (d) 32 \( \mu \)Cm\(^{-2}\)

Q.2) A sphere \( S_1 \) of radius \( r_1 \) encloses a total charge \( Q \). If there is another concentric sphere \( S_2 \) of radius \( r_2 (>r_1) \) and there be no additional charges between \( S_1 \) and \( S_2 \), find the ratio of electric flux through \( S_1 \) and \( S_2 \).

(ii) A surface encloses an electric dipole. What can you say about the net electric flux through this surface?

(iii) Two plane sheet of charge densities \( +\sigma \) and \(-\sigma\) are kept in air as shown in figure. What are the electric field intensities at point A and B?

- A
- B
SECTION –B

Q.3) Define electric flux. Write its S.I. unit. A charge q is enclosed by a spherical surface of radius R. if the radius is reduced to half, how would the electric flux through the surface change?

Q.4) A large plane sheet of charge having surface charge density 5 x 10^{-6} Cm^{-2} lies in XY plane. Find the electric flux through a circular area of radius 0.1 m. If the normal to the circular area makes an angle of 60^\circ with Z-axis.

Q.5) An infinite line charge produces a field of 9 x 10^4 NC^{-1} at a distance of 5 cm. calculate the linear charge density.

Q.6) (i) What is the importance of Gaussian surface?
(ii) When electric flux through a closed surface is negative, what type of charge it contains?

SECTION-C

Q.7) Derive an expression for electric field intensity at a point near an infinitely long straight charged wire.

Q.8) A plastic rod of length 2.2 m and radius 3.6 mm carries a negative charge of 3.8 x 10^{-7} C spread uniformly over its surface. What is the electric field near the mid-point of the rod, at a point on its surface?

SECTION- D

Q.9) A thin conducting spherical shell of radius R has charge Q spread uniformly over its surface. Using Gauss’ law, derive an expression for an electric field at a point outside the shell. Draw a graph of electric field E(r) with distance r from the centre of the shell for 0\leq r \leq \infty.