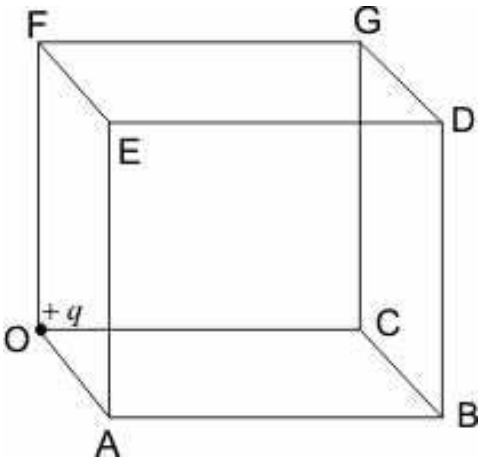
Gauss's Law
Assignment 2

Question 1
Consider the figure given below



A positive charge +q is placed at corner of the cube. Find the electric flux through the right face BCGDB of the cube.

Question 2
Consider a sphere of radius r having charge q C distributed uniformly over the sphere. This sphere is now covered with a hollow conducting sphere of radius R>r.

(a) Find the electric field at point P away from the centre O of the sphere such that r<OP<R.
(b) Find the surface charge density on the outer surface of the hollow sphere if charge q' C is placed on the hollow sphere.

Question 3

(a) Find the electric field inside the uniformly charged sphere of radius R and volume charge density ρ using Gauss's law.
(b) Use Gauss's law to find the electric field outside, at a point on the surface and at any point inside a spherical shell of radius R, carrying a uniform surface charge density σ.

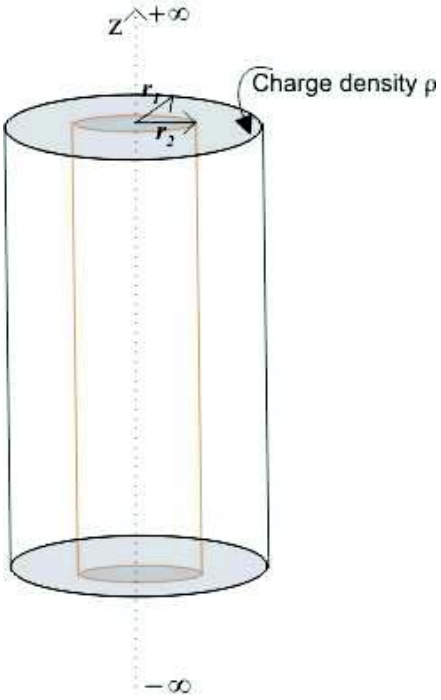
Question 4
(a) Show that the normal component of electrostatic field has a discontinuity from one side of a charged surface to another given by

$$(\mathbf{E}_2 - \mathbf{E}_1) \bullet \hat{n} = \frac{\sigma}{\varepsilon_0}$$

Where $\hat{n}$ a unit vector is normal to the surface at a point and σ is the surface charge density at that point. (The direction of $\hat{n}$ is from side 1 to side 2.)
(b) Show that the tangential component of electrostatic field is continuous from one side of a charged surface to another.

Question 5

Consider a cylinder as given below in the figure



Volume between radius r_1 and r_2 contains uniform charge density ρ C/m^3. Use Gauss's law to find electric field in all regions.