1. Apply a right-handed, general orthogonal curvilinear coordinate systems to prove divergence theorem in all three coordinate systems. Also give significance of this approach.   6

2. A charge Q is distributed uniformly over the wall of a circular tube of radius b and height h. Determine V and E on its axis i) at a point outside the tube ii) at a point inside the tube   5

3. Dielectric lenses can be used to collimate electromagnetic fields. In Fig 1 the left surface of the lens is that of a circular cylinder, and the right surface is a plane. if E_1 at point $P(r_0, 45, z)$ in region1 is $5a_r - 3a_\phi$, what must be the dielectric constant of the lens in order that E_3 in region3 is parallel to $x-$axis.

OR

The polarization in a dielectric cube of side L centered at the origin is given by $P = P_0(a_x x + a_y y + a_z z)$ i) determine the surface and volume bound charge densities ii) show that the total bound charge is zero.   4

4. For a positive point charge Q located at distances d_1 and d_2, respectively, from two grounded perpendicular conducting half planes shown in Fig. 2. Find the expression for the potential and the electric field intensity at an arbitrary point $P(x, y)$ in the first quadrant.
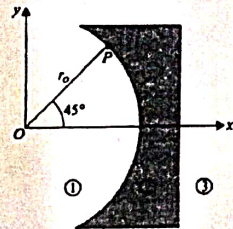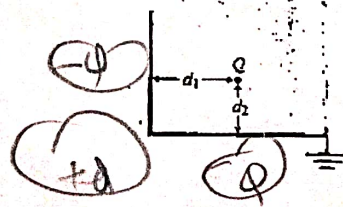
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Fig 1

Fig 2