Field and Waves(ECPC-204) **Test-I (MM:20)** **Dated:19.9.2024**

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 $\mathbf{E}_1$ at point $P(r_0, 45, z)$ in region1 is $5\mathbf{a}_r - 3\mathbf{a}_\phi$, what must be the dielectric constant of the lens in order that $\mathbf{E}_3$ in region3 is parallel to $x-$axis.

OR

The polarization in a dielectric cube of side L centered at the origin is given by $\mathbf{P} = P_0(\mathbf{a}_x x + \mathbf{a}_y y + \mathbf{a}_z z)$ 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. 5

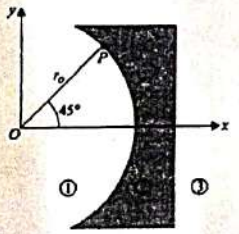

Fig 1

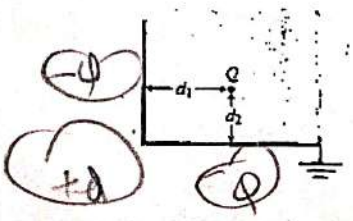

Fig 2