Electromagnetic Engineering

Assignment-1

1. Derive a relation between spherical coordinate and cylindrical coordinate system.

2. Derive a relation between cartesian coordinate and cylindrical coordinate system.

3. Express the following vector in Cartesian coordinates:

$A = \rho(z^2 + 1)a_\rho - \rho z \cos\phi\, a_\phi$

4. Convert the following vectors to Cartesian coordinates:

(a) $C = z \sin\phi\, a_\rho - \rho \cos\phi\, a_\phi + 2\rho z a_z$

(b) $D = \sin\theta/r^2\, a_r + \cos\theta/r^2\, a_\theta$

5. Transform the following vector to cylindrical and spherical coordinates:

$E = (y^2 - x^2)a_x + xyza_y + (x^2 - Z^2)a_z$

6. Point charges Q_1 and Q_2 are, respectively, located at (4,0, -3) and (2,0, 1). If Q_2 = 4 nC, find Q_1 such that (a) The E at (5, 0, 6) has no z-component (b) The force on a test charge at (5, 0, 6) has no x-component.

7. Point charges Q_1 = 5 μC and Q_2 = - 4 μC are placed at (3, 2, 1) and (-4, 0, 6), respectively. Determine the force on Q_1.

8. Transform vector 5

$$\boldsymbol{Q} = \frac{\sqrt{\boldsymbol{x^2 + y^2}}}{\sqrt{\boldsymbol{x^2 + y^2 + z^2}}}\boldsymbol{a_x} - \frac{\boldsymbol{yz}}{\sqrt{\boldsymbol{x^2 + y^2 + z^2}}}\boldsymbol{a_z}$$

to cylindrical and spherical coordinates.

9. Convert points P(1, 3, 5), T(7, -4, 3), and S(-3, -4, -10) from Cartesian to cylindrical and 5

spherical coordinates.

10**.** Which of these is not valid at point (0, 4, 0)?

(a) $a_\phi = -a_x$;(b) $a_\theta = -a_z$;(c) $a_r = 4a_y$;(d) $a_\rho = a_y$