Electromagnetic Field Theory

Assignment 1 – CLO1

Total Marks: 20   **Due Date: 9/10/24**

1. What is the BAC-CAB Rule? **(3)**
2. Discuss one phenomenon in detail that cannot be described using circuit theory. **(3)**
3. **(a)** Give the rectangular coordinates of the point $C(p = 4.4, \varphi = -115, z = 2)$. **(b)** Give the cylindrical coordinates of the point $D(x -3.1, y = 2.6, z = -3)$. **(c)** Specify the distance from C to D. **(3)**
4. Transform to cylindrical coordinates: **(a)** $F = 10a_x - 8a_y + 6a_z$ at point $P (10, -8, 6)$. **(b)** $G = (2x+y)a_x-(y-4x)a_y$ at point $Q(p, \varphi, z)$. **(c)** Find the rectangular components of the vector $H = 20a_p, - 10a_\varphi, + 3a_z$, at $P(x = 5, y = 2, z = -1)$. **(3)**
5. Demonstrate the ambiguity that results when the cross product is used to find the angle between two vectors by finding the angle between $A=3a_x-2a_y+4a_z$ and $B=2a_x+a_y-2a_z$. Does this ambiguity exist when the dot product is used? **(3)**
6. Find **(a)** The vector component of $F = 10a_x - 6a_y + 5a_z$ that is parallel to $G = 1a_x + 2a_y + 3a_z$; **(b)** The vector component of F that is perpendicular to G; **(c)** The vector component of G that is perpendicular to F. **(3)**
7. Express the unit vector a_x in spherical components at the point: **(a)** $r = 2, \theta=1$ rad, $\phi= 0.8$rad; **(b)** $x = 3, y = 2, z = -1$; **(c)** $\rho = 2.5, \phi = 0.7$ rad, $z = 1.5$. **(3)**
8. Express in cylindrical components: **(a)** the vector from $C(3, 2, -7)$ to $D(-1, -4, 2)$; **(b)** a unit vector at D directed toward C; **(c)** a unit vector at D directed toward the origin. **(3)**
9. Calculate the volume of parallelepiped formed by the vectors $A = 2a_x - a_y + 2a_z$, $B = -a_x +8a_y + 5a_z$, $C = 5a_x - 2a_y -2a_z$. **(3)**
10. Explain the difference between scalar field and vector field. **(3)**