Daffodil International University

Department of Electrical and Electronic Engineering

Faculty of Engineering

Final Examination, Fall – 2025

Course Code: 0541-211 Course Title: Coordinate Geometry and vector analysis

Section: A ,B ,C,D,E,F,G,H Level-Term: L1-T1 Teacher's Initial: IJM,SS

Full Marks: 40 Exam Date: December 24, 2025 Time: 2 Hours

[The second right most column indicates the Cos with respective Bloom's Level. The right most column indicates the assigned marks]

Q1. **(a) Demonstrate** Directional derivative of a scalar field. CO-2 (C2) **[02]**

(b) Using the cross product , **Recognize** a unit vector perpendicular to the plane of **[03]**
$\mathbf{A}=2\mathbf{i}-6\mathbf{j}-3\mathbf{k}$ and $\mathbf{B}=4\mathbf{i}+3\mathbf{j}-\mathbf{k}$.

Q2. CO-2

(a) Recognize the direction in which the directional derivative of (C2) **[05]**
$\emptyset = x^2z+xy+y^2\ln(1+z)$ *is a maximum* from the point (2, 0, 1). And **identify** the magnitude of the maximum.

(b) Identify the constant 'a' so that the following vector field is solenoidal **[03]**

$\mathbf{V}=(2x-y+4z)\mathbf{i}+(-x+3y-2z)\mathbf{j}+(5x+2y+az)\mathbf{k}$.

Q3. **(a)** A Particle moves along a curve whose parametric equations are CO-3
$x=20t$, $y=21\cos(t^2)$, $z=21\sin(t^2)$, where 't' is the time. **Determine** its velocity and (C3) **[06]**
acceleration at any time t. Also find the magnitude of velocity and acceleration at $t=1$

(b) Calculate the work done by the external force on moving 120C charge from point **[06]**
A (4,3, 2) to B (3,2,1) in the electric field given by $\mathbf{E}=4\mathbf{i}-3\mathbf{j}+2\mathbf{k}$

Q4. The acceleration of a particle at any time $t\geq 0$ is given by CO-3 **[07]**
$\boldsymbol{a} = 12cos2t\boldsymbol{i} - 8sin2t\boldsymbol{j} + 16t\boldsymbol{k}$. If the velocity **v** and displacement **r** are zero at $t=0$, (C3)
Interpret v and **r** at any time.

Q5. **(a) Compute** the value of the constant 'a' so that **[04]**
$\boldsymbol{V} = (axy-z^3)\mathbf{i} + (a-2)x^2\boldsymbol{j} + (1-a)xz^2\boldsymbol{k}$ is irrotational. CO-3 (C3)

(b) Suppose $\boldsymbol{A} = \boldsymbol{i} + 2\boldsymbol{j} + 3\boldsymbol{k}$, $\boldsymbol{B} = 3\boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k}$, $\boldsymbol{C} = 2\boldsymbol{i} + 4\boldsymbol{j} - \boldsymbol{k}$. **Calculate** the volume of the parallelepiped whose sides are denoted by the three vectors $\boldsymbol{A}$, $\boldsymbol{B}$ and $\boldsymbol{C}$. **[04]**