Daffodil International University

Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Spring – 2025

Course Code: 0541-211 | Course Title: Coordinate Geometry and vector analysis
Section: A ,B ,C D,E | Level-Term: L1-T1 | Teacher's Initial: IJM
Full Marks: 40 | Exam Date: June 19, 2025 | Time: 2 Hours

[Notes: Answer all the Questions]

Q1. (a). Define a **vector field** and explain its significance in electrical engineering, particularly in **electromagnetic field analysis.** **CO3 (C3)** **[02]**

(b) **Compute** the value of the constants α, β and γ so that $V = (-4x - 3y + \alpha z)\,\boldsymbol{i} + (\beta x + 3y + 5z)\,\boldsymbol{j} + (4x + \gamma y + 3z)\,\boldsymbol{k}$ is irrotational. **[03]**

Q2. (a) **Develop** a unit normal vector to the surface of **A=*2i-6j-3k* and B=*4i+3j-k*** **CO2 (C3)** **[05]**

(b) **Constract** the *directional* derivative of $\emptyset = 4xz^2 - 3x^2y^2z$ at (2,-1,2) in the *direction 2i-3j+6k.* **[03]**

Q3. **CO-2 (C3)**

(a) If $\mathbf{A}=5t^2\boldsymbol{i} + t^2\boldsymbol{j} - t^3\boldsymbol{k}$ **B**=*sini i-cost j* **Differentiate** (1) *d/dt(A.B)* **[05]**
(2) d/dt(A× B) *(3) d/dt(A.A)*

(b) The acceleration a of a particle at any time t≥ 0 is given **by** **[05]**
$\vec{a} = e^{-t}\boldsymbol{i} - 6(1+t)\boldsymbol{j} + 3sint\boldsymbol{k}$ if the velocity $\vec{v}$ and displacement $\vec{r}$ are zero at t=0 ,**Express** $\vec{v}$ and $\vec{r}$ at any time **t.**

Q4. *(a)***Interpret** 1. $\int_0^{\pi/2}(3sinu\boldsymbol{i} + 2cosu\boldsymbol{j})du$ 2. $\int\{(3t^2 - t)\boldsymbol{i} + (2 - 6t)\boldsymbol{j} - \frac{1}{e^t + e^{-t}}\boldsymbol{k}\}\,dt$ **CO-2 (C3)** **[04]**

(b) A Particle moves along a curve whose parametric equations are $x = \ln t^2$, **[05]**
$y = 2cos3t, z = 2sin3t$,where t is the time.(a)**Determine** its velocity and acceleration at any time t (b)find the magnitude of velocity and acceleration **at t=1**

Q5. (a) Suppose $\boldsymbol{A} = \boldsymbol{i} - 2\boldsymbol{j} - 3\boldsymbol{k}$, $\boldsymbol{B} = 2\boldsymbol{i} + \boldsymbol{j} - \boldsymbol{k}$, $\boldsymbol{C} = \boldsymbol{i} + 3\boldsymbol{j} - 2\boldsymbol{k}$. **CO-3 (C3)** **[04]**
Calculate the volume of the parallelepiped whose sides are denoted by the three vectors $\boldsymbol{A}$, $\boldsymbol{B}$ and $\boldsymbol{C}$.

(b) Suppose $F = -3x^2\boldsymbol{i} + 5xy\boldsymbol{j}$ *and C be the curve* $y = 2x^2$ in the xy plane **Compute** the line integral $\int \boldsymbol{F}.\boldsymbol{dr}$ *(along curve C)* from $P_1(0,0)$ to $P_2(1,2)$. **[04]**