



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

Course Code: 0541-211

Section: A, B, C, D, E

Full Marks: 40

Course Title: Coordinate Geometry and vector analysis

Level-Term: L1-T1

Exam Date: June 19, 2025

Teacher's Initial: IJM

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 [02]
(C3)
- (b) Compute the value of the constants α, β and γ so that $V = (-4x - 3y + \alpha z)\mathbf{i} + (\beta x + 3y + 5z)\mathbf{j} + (4x + \gamma y + 3z)\mathbf{k}$ is irrotational. [03]
- Q2. (a) Develop a unit normal vector to the surface of $A=2\mathbf{i}-6\mathbf{j}-3\mathbf{k}$ and $B=4\mathbf{i}+3\mathbf{j}-\mathbf{k}$ CO2 [05]
(C3)
- (b) Construct the directional derivative of $\phi = 4xz^2 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction $2\mathbf{i}-3\mathbf{j}+6\mathbf{k}$. [03]
- Q3. (a) If $A=5t^2\mathbf{i} + t^2\mathbf{j} - t^3\mathbf{k}$ $B=\sin t\mathbf{i} - \cos t\mathbf{j}$ Differentiate (1) $d/dt(A \cdot B)$ CO-2 [05]
(C3)
(2) $d/dt(A \times B)$ (3) $d/dt(A \cdot A)$
- (b) The acceleration $\mathbf{a}$ of a particle at any time $t \geq 0$ is given by $\mathbf{a} = e^{-t}\mathbf{i} - 6(1+t)\mathbf{j} + 3\sin t\mathbf{k}$ if the velocity $\mathbf{v}$ and displacement $\mathbf{r}$ are zero at $t=0$. Express $\mathbf{v}$ and $\mathbf{r}$ at any time t . [05]
- Q4. (a) Interpret $\int_0^{\pi/2} (3\sin u\mathbf{i} + 2\cos u\mathbf{j}) du$ 2. $\int \{(3t^2 - t)\mathbf{i} + (2 - 6t)\mathbf{j} - \frac{1}{e^t + e^{-t}}\mathbf{k}\} dt$ CO-2 [04]
(C3)
- (b) A Particle moves along a curve whose parametric equations are $x = \ln t^2$, $y = 2\cos 3t$, $z = 2\sin 3t$, where t is the time. (a) Determine its velocity and acceleration at any time t (b) find the magnitude of velocity and acceleration at $t=1$ [05]
- Q5. (a) Suppose $A = \mathbf{i} - 2\mathbf{j} - 3\mathbf{k}$, $B = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$, $C = \mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$. Calculate the volume of the parallelepiped whose sides are denoted by the three vectors A, B and C . CO-3 [04]
(C3)
- (b) Suppose $F = -3x^2\mathbf{i} + 5xy\mathbf{j}$ and C be the curve $y = 2x^2$ in the xy plane. Compute the line integral $\int F \cdot d\mathbf{r}$ (along curve C) from $P_1(0,0)$ to $P_2(1,2)$. [04]