GALGOTIAS UNIVERSITY

ADMISSION NUMBER												

School of Computing Science and Engineering

Bachelor of Technology in Computer Science and Engineering
Mid Term Examination - May 2024

Duration : 90 Minutes
Max Marks : 50

Sem II - C1UC222B - Engineering Mathematics-II

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Position vector of a moving particle is given by $\boldsymbol{r}(t) = x(t)i + y(t)j + z(t)k$, where $x(t) = t^2, y(t) = 2t,\ z(t) = 4$. Find the velocity and acceleration of the particle at (1,2,4). K2 (2)

2) Let $T: \mathbb{R}^2 \to \mathbb{R}$ be a mapping defined by $T(x, y) = x + y$. Show that T defines a linear transformation on $\mathbb{R}^2$. K1 (3)

3) Define orthogonal set in $\mathbb{R}^3$. K2 (4)
Show that the set $\{v_1, v_2, v_3\}$ is an orthogonal set in $\mathbb{R}^3$ if v_1= (2,1,-1), v_2=(0,1,1), v_3=(1,-1,1).

4) Find a unit normal vector to the surface $xy^2 + 2yz = 8$ at the point $(3, -2, 1)$. K2 (6)

5) Let $T : \mathbb{R}^3 \to \mathbb{R}^3$ be defined as $T(a, b, c) = (0, a, b)$. Prove that $T \neq \hat{0}, T^2 \neq \hat{0}$ but $T^3 = \hat{0}$ K3 (6)

6) Show that the vector field $F = 2x(y^2 + z^3)i + 2x^2y\,j + 3z^2x^2\,k$ is conservative. Find its potential function. K3 (9)

7) Classify the following mappings whether they are linear or non-linear: K4 (8)

1. $T : \mathbb{R}^2 \to \mathbb{R}^2$ defined by $T(x, y) = (1 + x, y)$;
2. $T: \mathbb{R}^2 \to \mathbb{R}$ defined by $T(x, y) = |x - y|$.

8) Consider the vectors $u_1 = (1, 1, 1),\ u_2 = (1,2,3)$ and $u_3 = (2, -1,1)$ in $\mathbb{R}^3$. Express $w = (1, -2, 5)$ as a linear combination of u_1, u_2 and u_3. K4 (12)

OR

Evaluate $\oint_C 3x^2y\,dx - 2xy^2\,dy$, where *C* is the boundary of the region $x^2 + y^2 \leq 16, x \geq 0, y \geq 0$ by Green's theorem. [Hint: Parametric representation of C is $x = 4\cos t, y = 4\sin t;\ 0 \leq t \leq 2\pi$.] K4 (12)