

School Of Mathematics
B.Tech. II Semester (Civil, Computer Science, Electrical, Electronics,
Mechanical)

Minor Exam 1: Spring 2023-2024

Entry No.: _____

Date: _____

Total No. Pages: [2]

Total No. Questions: [3]

Course Title: Engineering Mathematics II (MTL BS-102)

Time allotted : 1 Hours

Total marks: [20]

Attempt all questions.

1. Do any two of the followings each carry two marks.

(a) Find the unit tangent vector at any point on the curve $x = t^2 + 2, y = 4t - 5, z = 2t^2 - 6t$, where t is any variable. [CO 1]

(b) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, show that $\text{grad}\left(\frac{1}{r}\right) = -\frac{\vec{r}}{r^3}$. [CO 1]

(c) State divergence theorem. [CO 2]

2. Do any two of the followings each carry three marks.

(a) Show that $\text{curl}(\text{curl}\vec{V}) = \text{grad}(\text{div}\vec{V}) - \nabla^2\vec{V}$. [CO 1]

(b) Prove that $\nabla^2 f(r) = f''(r) + \frac{2}{r}f'(r)$. [CO 1]

(c) Find the directional derivative of the function $f(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}$. [CO 1]

3. Do any two of the followings each carry five marks.

(a) Evaluate $\int \int_S \vec{F} \cdot \hat{n} ds$, where $\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and S is the surface bounding the region $x^2 + y^2 = 4, z = 0, z = 3$. [CO 2]

(b) If $\vec{A} = 2xz\hat{i} - x\hat{j} + y^2\hat{k}$, evaluate $\int \int \int_V \vec{A} dv$, where V is the region bounded by the surface $x = 0, x = 2, y = 0, y = 6, z = x^2, z = 4$. [CO 2]

(c) Verify divergence theorem for $\vec{F} = (x^3 - yz)\hat{i} - 2x^2y\hat{j} - 2\hat{k}$, taken over the rectangular parallelepiped $0 \leq x \leq a, 0 \leq y \leq b, 0 \leq z \leq c$. [CO 2]