MID-SEMESTER EXAMINATION, MARCH-2020
CALCULUS-II (MTH-2001)

Programme: B.Tech.   **Semester: 2nd**
Full Marks: 30   **Time: 2 Hours**

Subject/Course Learning Outcome	*Taxonomy Level	Ques. Nos.	Marks
Use the knowledge of three dimensions and vectors to describe the region, lines, planes and surfaces.	L1, L1, L1	1 (a)(b)(c)	
	L1, L1, L5	2 (a)(b)(c)	2 X 9=18
	L1, L1, L3	3 (a)(b)(c)	
Compute the length of the curve, curvature, tangent, normal vector and tangent plane.	L1, L1, L1	4 (a)(b)(c)	2 X 3=6
Apply the concept of function of several variables to find the limit, continuity and partial derivatives.	L1, L1, L1	5 (a)(b)(c)	2 X 3=6

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

Answer all questions. Each question carries equal mark.

1. (a) Find the region of $\Re^3$ represented by the inequality $x^2 + y^2 + z^2 \leq 2z$. [2]

   (b) Find the center and radius of the sphere $2x^2 + 2y^2 + 2z^2 = 8x - 24z + 1$. [2]

   (c) Find the direction cosines and direction angles of the vector $\vec{a} = 6\hat{i} + 3\hat{j} - 2\hat{k}$. [2]

2. (a) Find a vector that has the same direction as the [2]
vector $\vec{a} = -2\hat{i} + 4\hat{j} + 2\hat{k}$ but has length 6.

(b) Find a nonzero vector $\vec{v}$ that is orthogonal to the [2]
plane through the
vertices

$P\ (1,0,1),\ Q\ (-2,1,3)\ and\ R\ (4,2,5).$

(c) Find the area of the parallelogram with [2]
vertices

$A\ (-2,1),\ B\ (0,4),C\ (4,2)\ and\ D\ (2,\ -1).$

3. (a) Find the angle between the [2]
planes $2x - 3y + 4z = 5\ and\ x + 6y + 4z = 3.$

(b) Find an equation of the plane through the point [2]
$(4,0,-3)$ and with normal vector $\langle 0,1,2 \rangle$.

(c) Sketch the region bounded by the [2]
surfaces

$z = \sqrt{x^2 + y^2}\ and\ x^2 + y^2 = 1\ for\ 1 \le z \le 2$

4. (a) Find the domain of the vector [2]
function $\vec{r}(t) = \left\langle \sqrt{4 - t^2},\ e^{-3t},\ \ln\ (t+1) \right\rangle.$

(b) A projectile is fired with muzzle speed 150 m/s and [2]
angle of elevation 45 degree from a position 10m
above ground level. Find, where does the projectile
hit the ground ?

(c) Find the length of the [2]
curve $\vec{r}(t) = \sqrt{2}\,t\hat{i} + e^t\hat{j} + e^{-t}\hat{k}, 0 \le t \le 1.$

5. (a) Find the domain and range of the function $f(x, y) = \cos(x + 2y)$.

(b) Find the limit if it exists $\displaystyle\lim_{(x,y) \to (0,0)} \frac{x^2 y^3}{2x^2 + y^2}$.

(c) Find the first partial derivatives of the function $f(x, y) = \dfrac{x}{(x + y)^2}$.

End of Questions