

**Second Semester FYUGP Degree (Reg/Sup/Imp) Examination
April 2026**

**KU2DSCMAT112 - DIFFERENTIAL CALCULUS, CURVE
FITTING AND COORDINATE SYSTEMS**

2024 Admission onwards

Time : 2 hours

Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Calculate the distance between $(-1, 1, 5)$ and $(2, 5, 0)$.
2. Describe three dimensional coordinate system.
3. Find y_n , if $y = \sin(ax + b)$.
4. If $\phi = x^2 + y^2 + z^2$, find $\nabla\phi$ at the point $(1, 2, 3)$.
5. If $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$, calculate $\nabla \cdot \vec{F}$.
6. Define bounded set. Give an example.
7. If $z = \sin(xy)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.
8. Find the second order derivative $\frac{\partial^2 w}{\partial x \partial y}$ if $f(x, y) = \sin xy$

Section B

Answer any 4 questions. Each carry 6 marks.

9. If $x = a(\cos t + t \sin t)$, $y = a(\sin t - t \cos t)$, find $\frac{d^2 y}{dx^2}$.
10. Find the maximum and minimum values of $f(x) = 3x^4 - 2x^3 - 6x^2 + 6x + 1$ in the interval $(0, 2)$.
11. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x^2 + y^2 - z - 3 = 0$ at the point $(2, -1, 2)$.
12. Find the level curve of the function $f(x, y) = 16 - x^2 - y^2$.
13. Show that if $f(x, y) = xe^{\frac{y^2}{2}}$, then $\frac{\partial^5 f}{\partial x^2 \partial y^3} = 0$.
14. Evaluate $\frac{dw}{dt}$ at $t = 3$, if $w = \frac{x}{z} + \frac{y}{z}$, $x = \cos^2 t$, $y = \sin^2 t$, $z = \frac{1}{t}$.

Section C

Answer any 2 questions. Each carry 14 marks.

15. Determine the parabola of the form $y = a + bx + cx^2$ which fits most closely with observations:

x	-3	-2	-1	0	1	2	3
y	4.63	2.11	0.67	0.09	0.63	2.15	4.58

16. The values of x and y obtained in an experiment are as follows.

x	2.30	3.10	4.00	4.92	5.91	7.20
y	33.0	39.1	50.3	67.2	85.6	125.0

The probable law is $y = ae^{bx}$. Test graphically the accuracy of this law and if the law holds good, find the best values of the constants.

17. (a) Find the center and radius of the sphere $x^2 + y^2 + z^2 + 3x - 4z + 1 = 0$
(b) Describe the circle of radius 1 centered at $(-3, 4, 1)$ and lying in a plane parallel to XY plane with a single equation or with a pair of equations.