K26FY1380 Pages: 2 Reg No:.....
Name:.....

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. Find y_5, if $y = \log(ax + b)$.
2. When a function is said to have a maximum value at $x = a$ and minimum value at $x = a$?
3. State the conditions for continuity of a function of two variables at a point.
4. If $u = f(x, y)$ where $x = r\cos\theta$ and $y = r\sin\theta$, express $\dfrac{\partial u}{\partial r}$ in terms of $\dfrac{\partial u}{\partial x}$ and $\dfrac{\partial u}{\partial y}$.
5. Evaluate $\dfrac{dw}{dt}$ if $w = x^2 + y^2,\ x = \cos t,\ y = \sin t,\ t = \pi$.
6. How can $y = ax^n + b\log x$ be reduced to a linear form? Explain the transformation required.
7. Describe how to convert $y = ax^n$ to a linear form? Explain the transformation required.
8. Explain how the method of least squares is used to determine the best-fitting straight line.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Describe the level surface of the function $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$.
10. Let $f(x, y) = 2x + 3y - 4$. Find the slope of the line tangent to this surface at the point $(2, -1)$ and lying in the plane $x = 2$.
11. Find all second order derivatives of the function $h(x, y) = xe^y + y + 1$.
12. R is the resistance to maintain a train at speed V. Find a law of the time $R = a + bV^2$ connecting R and V using the following data.

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V (Miles)	10	20	30	40	50
R (lb/ton)	8	10	15	21	30

x	1	2	3	4	5
y	14	27	40	55	68

13. By the method of least squares, fit the straight line that best fits the following data.

14. Using the method of least squares, fit a straight line to the following data and find expected production in 2006.

Year x	1961	1971	1981	1991	2001
Production y	8	10	12	19	16

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Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Find the perimeter of the triangle with vertices $A(-1, 2, 1), B(1, -1, 3)$ and $C(3, 4, 5)$.

    (b) Derive an equation for the set of all points equidistant from the point $(0, 0, 2)$ and the xy-plane.

16. (a) (a) Find cartesian equations for the following

    (i) $r^2 \cos\theta \sin\theta = 4$

    (ii) $r = 1 - \cos\theta$.

    (b) (b) Find polar equations for the following

    (i) $\dfrac{x^2}{9} + \dfrac{y^2}{4} = 1$

    (ii) $(x-3)^2 + (y+1)^2 = 4$.

17. (a) If $x = \sin t, y = \sin pt$, then prove that $(1-x^2)\dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} + p^2 y = 0$.

    (b) If $y = \sin(\sin x)$, then prove that $\dfrac{d^2y}{dx^2} + \tan x \dfrac{dy}{dx} + y\cos^2 x = 0$.