Reg No:..................

Name :..................

K25FY2462 B

Second Semester FYUGP Mathematics Examination
APRIL 2025 (2024 Admission onwards)
KU2DSCMAT112 (DIFFERENTIAL CALCULUS, CURVE FITTIG AND COORDINATE SYSTEMS)
(DATE OF EXAM: 30-4-2025)

Time : 120 min Maximum Marks : 70

Part A (Answer any 6 questions. Each carries 3 marks)

1. If $z = \sin(xy)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$. 3
2. Define an interior point of region in the space. 3
3. Find the second order derivative $\frac{\partial^2 w}{\partial x \partial y}$ if $f(x, y) = x + y + xy$ 3
4. Describe how to convert the power law $y = ax^b$ to a linear form. 3
5. How can $y = ax^n + b\log x$ be reduced to a linear form? Explain the transformation required. 3
6. Explain how the method of least squares is used to determine the best-fitting straight line. 3
7. Compute the distance between $(1, 4, 5)$ and $(4, -2, 7)$. 3
8. Define the Cartesian coordinate system in three dimensions. 3

Part B (Answer any 4 questions. Each carries 6 marks)

9. Find the domain and range of the following functions.
   (a) $w = \frac{1}{x^2 + y^2 + z^2}$
   (b) $w = xy \ln z$.
   6
10. Verify that $w_{xy} = w_{yx}$ if $w = \ln(2x + 3y)$. 6
11. Find all second derivatives of the function $r(x, y) = \ln(x + y)$. 6
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. 6

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

13. If P is the pull required to lift a load W by means of a pulley block, by the method of least squares, find a linear law of the form $P = mW + c$ connecting P and W, where P and W are taken in kg.wt., using the following data.

P	12	15	21	25
W	50	70	100	120

Compute P when $W = 150$ kg.wt. 6

14. Using the method of least squares, fit a straight line to the following data and find expected production in 2006. 6

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

Part C (Answer any 2 question(s). Each carries 14 marks)

15. (a) Find the nth derivative of $y = e^{ax}\sin(bx + c)$ where a, b and c are constants.
    (b) Find n^{th} derivative of $\frac{x+3}{(x-1)(x+2)}$.
    14
16. (a) If $x = \sin t, y = \sin pt$, then prove that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + p^2y = 0$.
    (b) If $y = \sin(\sin x)$, then prove that $\frac{d^2y}{dx^2} + \tan x\frac{dy}{dx} + y\cos^2 x = 0$.
    14
17. (a) Convert the equations
    (i) $x^2 + y^2 + z^2 - 2x - 4y + 6z = 11$
    (ii) $x^2 + y^2 + (z - 1)^2 = 1$
    from Cartesian to spherical coordinates.
    (b) Convert the equation
    (i) $x^2 + y^2 = z$
    (ii) $x^2 + (y - 1)^2 = 1$
    from Cartesian to cylindrical coordinates.
    14