Reg No:..................
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K25FY2462 C

Second Semester FYUGP Mathematics Examination APRIL 2025 (2024 Admission onwards)
KU2DSCMAT112 (DIFFERENTIAL CALCULUS, CURVE FITTING AND COORDINATE SYSTEMS)

(DATE OF EXAM : 02-05-2025)

Time : 120 min　　　　Maximum Marks : 70

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

1. Find the third derivative of $y = \ln(1 + x)$. 3

2. Find y_n, if $y = \cos(ax + b)$. 3

3. How can $y = ae^{bx}$ be reduced to a linear form? Explain the transformation required. 3

4. Explain how the method of least squares is used to determine the best-fitting straight line. 3

5. What is the criterion used in the method of least squares to determine the best-fitting curve? 3

6. Determine the points satisfying the equations $x^2 + y^2 = 4$ and $z = 3$. 3

7. Give the geometric interpretation of the following inequalities/equation.
   (a) $x^2 + y^2 + z^2 > 4$.
   (b) $x^2 + y^2 + z^2 = 4, z \leq 0$.

   3

8. What does $\rho = 3$ represent in spherical coordinates? 3

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

9. Verify if the values of x and y, related as shown in the following table, obey the law $y = a + b\sqrt{x}$. If so, find graphically the values of a and b. 6

x	500	1000	2000	4000	6000
y	0.20	0.33	0.38	0.45	0.51

10. If p is the pull required to lift the weight by means of a pulley block, find a linear law of the form $p = a + bw$, connecting p and w using the following data.
    Compute p, when $w = 150$ lb. 6

w (lb)	50	70	100	120
p (lb)	12	15	21	25

11. Find the best possible curve of the form $y = a + bx$, using method of least squares, for the data:

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

6

12. Determine the center and radius of the sphere $x^2 + y^2 + z^2 + 6y + 8z = 0$. 6

13. Graph the set of points whose polar coordinates satisfy

    (a) $0 \leq r \leq 1,\ \frac{\pi}{4} \leq \theta \leq \frac{3\pi}{4}$

    (b) $-1 \leq r \leq 3,\ \theta = \frac{\pi}{3}$.

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14. Plot the point $\left(2, \dfrac{\pi}{6}\right)$ and find all polar coordinates of it. 6

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

15. (a) (a) Evaluate $\dfrac{\partial z}{\partial u}$ if $z = \tan^{-1}\frac{x}{y},\ x = u\cos v,\ y = u\sin v,\ (u, v) = (1.3, \frac{\pi}{6})$.

    (b) (b) Evaluate $\dfrac{\partial w}{\partial u}$ and $\dfrac{\partial w}{\partial v}$ if $w = 4e^x \ln y,\ x = \ln(u\cos v),\ y = u\sin v,\ (u, v) = (2, \frac{\pi}{4})$.

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16. (a) (a) State the mixed derivative theorem and verify that $w_{xy} = w_{yx}$, if $w = x\sin y + y\sin x + xy$.

    (b) (b) Find $\dfrac{\partial^2 w}{\partial x \partial y}$ if $w = xy + \dfrac{e^y}{y^2+1}$.

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17. If $y = x\log\left(\dfrac{x-1}{x+1}\right)$, then show that $y_n = (-1)^{n-2}(n-2)!\left[\dfrac{x-n}{(x-1)^n} - \dfrac{x+n}{(x+1)^n}\right]$.
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