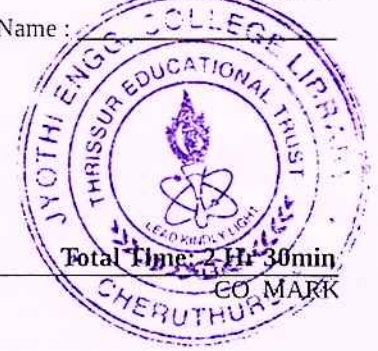


Reg No.: _____

Name : _____



Jyothi Engineering College(Autonomous)
 B. Tech Degree S1 (S) Examination, June 2026 (2025 Scheme)
25MAT101 - MATHEMATICS FOR INFORMATION SCIENCE-1



Total Mark: 60

PART A

(Answer All Questions. Each question carries 3 marks)

1. Evaluate $\lim_{x \rightarrow 5} \frac{x^2 + 3x - 10}{x + 5}$. CO1 (3)
2. Find $g'(t)$ if $g(t) = \tan(5 - \sin 2t)$. CO1 (3)
3. Show that $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 - y^2}{x^2 + y^2}$ does not exist. CO2 (3)
4. Show that the function satisfies Laplace Equation $f(x, y, z) = x^2 + y^2 - 2z^2$. CO2 (3)
5. Let $w = xyz$, $x = s$, $y = t$, $z = s + t$, Find $\frac{\partial w}{\partial s}$. CO3 (3)
6. The temperature T at a point (x, y, z) in a solid is given by: $T = x^2 + y^2 + z^2$. A particle moves through the solid, and its position depends on time t : $x = t$, $y = \sin t$, $z = e^t$. Find the rate of change of the temperature with respect to time. CO3 (3)
7. Use the method of Lagrange Multipliers to find the maximum value of $f(x, y) = x^2 y$ subject to the constraint $x + y = 3$. CO4 (3)
8. The XYZ company manufactures two different types of products, A and B. Each product is processed in 3 different departments: Casting, Machining and finally Inspection. The capacities of the departments are limited to 45 hrs., 35 hrs., and 30 hrs. per week respectively. Product A requires 10 hrs. in casting department, 12 hrs. in machining and 6 hrs. in inspection, whereas product B requires 7 hrs., 6 hrs., and 8 hrs. respectively. The profit contribution for a unit of product A and B is Rs. 50 and Rs 40 respectively. Formulate the problem. CO4 (3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

9. a) Discuss the concavity and points of Inflection of $f(x) = \frac{x^2}{4} - 2x^2 + 4$ CO1 (5)
 b) Find the linearisation of $f(x) = \sqrt{x^2 + 9}$ at $x = -4$. CO1 (4)
- OR**
10. a) Using Product Rule find y' if $y = (x^3 + 1) \left(x + 5 + \frac{1}{x} \right)$ CO1 (5)
 b) Find $\lim_{x \rightarrow 0} \frac{\frac{1}{x-1} + \frac{1}{x+1}}{x}$. CO1 (4)
11. a) Compute the second order partial derivatives of the function $f(x, y) = x^2 y + y^2 x$ and Verify the mixed derivative theorem. CO2 (5)
 b) Find and sketch the level curves of the function $f(x, y) = \sqrt{9 - x^2 - y^2}$ for $c = 0, 1, 2$. CO2 (4)

OR

12. a) If z is a function of x and y where $x = e^u - e^{-v}$ and $y = e^{-u} - e^v$, show that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}$. CO2 (5)

b) The population density P in a city depends on the coordinates (x, y) according to the function $P = e^{x+y}$. A person moves along the path $x = t, y = t^2$. Find the rate of change of the population density with respect to t . CO2 (4)

13. a) Use the second partial derivative test to classify the critical points of $f(x, y) = x^3 + y^3 - 3xy$. CO3 (5)

b) The mosquito population M in a garden depends on larvicide x (litres) and mosquito-eating fish y : $M(x, y) = x^2 + y^2 - 8x - 10y + 50$. Find the values of x and y that minimize the mosquito population. CO3 (4)

OR

14. a) Examine the function $f = x^3 + y^3 - 3xy + 1$ for extreme values. CO3 (5)

b) The height of a hill is given by $h(x, y) = 100 - 2x^2 - y^2$. CO3 (4)

(a) Find the gradient at $(2, 3)$.

(b) In which direction is the slope the steepest?

15. Maximize $f(x, y, z) = x^2 + y^2 + z^2$ subject to the constraints $2x - y = 0$ and $y + z = 0$. CO4 (9)

OR

16. Find the point closest to the origin on the lines of intersection of the planes $y + 2z = 12$ and $x + y = 6$. CO4 (9)
