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 **Total Time: 2 Hr 30min**

CO MARK

PART A

(Answer All Questions. Each question carries 3 marks)

1. Evaluate $\lim_{x\to5}\frac{x^2+3x-10}{x+5}$. CO1 (3)
2. Find $g'(t)$ if $g(t)=\tan(5-\sin 2t)$. CO1 (3)
3. Show that $\lim_{(x,y)\to(0,0)}\frac{x^2-y^2}{x^2+y^2}$ 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^2y subject to the constraint $x+y=3$. CO4 (3)
8. The XYZ company manufacturers 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 $\lim_{x\to0}\frac{\frac{1}{x-1}+\frac{1}{x+1}}{x}$. CO1 (4)

11. a) Compute the second order partial derivatives of the function $f(x,y)=x^2y+y^2x$ 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 $\mathbf{P} = e^{x+y}$. 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 constraint s $2x - y = 0$ 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)

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