

THIRD SEMESTER UG INTERNAL EXAMINATION, SEPTEMBER 2025

Minor Course in Mathematics

MAT3MN201 – CALCULUS OF SEVERAL VARIABLES

Malabar Christian College, Calicut

Time :One Hour

Maximum: 35 Marks

Name:	Marks Scored	Section A	Total Marks
Class:		Section B	
		Section C	

Section A

(Each question carries 3 marks, Maximum marks for section - 7)

1. Show that  $u(x, y) = e^x \cos y$  is harmonic in the  $xy$ -plane.
2. Evaluate  $\int_1^2 \int_0^1 3x^2 y \, dx \, dy$ .
3. Suppose  $z$  is a differentiable function of  $x$  and  $y$  that is defined implicitly by  $x^2 + y^3 - z + 2xy^2 = 5$ . Find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$ .

Section B

(Each question carries 6 marks, Maximum marks for section - 18)

4. Let  $f(x, y) = x^2 + y^2 - 4x - 6y + 17$ . Find the critical point of  $f$  and show that  $f$  has a relative minimum at that point.
5. Let  $f(x, y, z) = xe^{yz}$ . Compute  $f_{xzy}$  and  $f_{yxz}$ .
6. Evaluate  $\iint_R (1 - 2xy^2) \, dA$ , where  $R = \{(x, y) / 0 \leq x \leq 2, -1 \leq y \leq 1\}$
7. Find the Curl of  $F(x, y, z) = xyl + xzj + xyz^2k$  at  $(-1, 2, 1)$ .

Section C

(Answer any 1 Question, each question carries 10 marks)

8. Find  $\lim_{(x,y) \rightarrow (0,0)} \frac{2x^2y}{x^2+y^2}$  if it exists.
9. Find an approximation for  $\iint_R (x - 4y) \, dA$ , where  $R = \{(x, y) / 0 \leq x \leq 2, 0 \leq y \leq 1\}$ , using the Reimann sum of  $f(x, y) = x - 4y$  over  $R$  with  $m = n = 2$  and taking the evaluation point  $(x_{ij}^*, y_{ij}^*)$  to be the center of  $R_{ij}$ .