

Q.P Code D134140	Total Pages 2	Name 672204
		Register No.
THIRD SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025		
(CUFYUGP)		
MAT3MN201 Calculus Of Several Variables		
2024 Admission Onwards		
Maximum Time :2 Hours		Maximum Marks :70

Section A

All Question can be answered. Each Question carries 3 marks (Ceiling: 24 Marks)

1	Find parametric equations for the tangent line to the curve with the given parametric equations $x = 1 + t, y = t^2 - 4, z = \sqrt{t}$ at the point with the indicated value of $t = 4$.
2	Find the domain and the range of the function $f(u, v) = \frac{uv}{u - v}$.
3	Find the gradient vector field of the scalar function $f(x, y, z) = \tan^{-1}(xyz)$.
4	Find the divergence of $F(x, y, z) = xyz\mathbf{i} + x^2y^2z\mathbf{j} + xy^2\mathbf{k}$ at the point $(1, -1, 2)$
5	Evaluate the integral $\int_2^4 \int_0^{\sqrt{4-x^2}} e^{\sqrt{x^2+y^2}} dx dy$ by changing to polar coordinates.
6	Find the area of the part of the surface with equation $z = 2x + y^2$ that lies directly above the triangular region R in the xy - plane with vertices $(0, 0), (1, 1)$, and $(0, 1)$.
7	Evaluate $\int_0^{\pi/2} \int_0^2 \int_0^{\sqrt{1-z^2}} y \cos x dy dz dx$
8	Evaluate $\oint_C x^2 dx + (xy + y^2) dy$, where C is the boundary of the region R bounded by the graphs of $y = x$ and $y = x^2$ and is oriented in a positive direction
9	State Stokes' Theorem
10	Compute $\oint_C \mathbf{F} \cdot d\mathbf{r}$ using Stokes' Theorem; where $\mathbf{F} = -y\mathbf{i} + x\mathbf{j}$ and Curve C : Circle $x^2 + y^2 = 1$ in the xy -plane, counterclockwise.

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Section B

All Question can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)

11	Show that $\lim_{(x,y) \rightarrow (0,0)} \frac{3xy}{3x^2 + y^2}$ doesnot exist.
12	Let $2 \cos(x + 2y) + \sin yz - 1 = 0$. Use implicit differentiation to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.
13	Show that $\mathbf{curl}(fF) = f\mathbf{curl} F + (\nabla f) \times F$
14	Find the value of the constant c such that the vector field $G(x, y, z) = (2x + 3y + z^2)i + (cy - z)j + (x - y + 2z)k$ is the curl of some vector field F .
15	Evaluate $\iint_R (1 + 2x + 2y)dA$, where $R = \{(x, y); 0 \leq y \leq 1, y \leq x \leq 2y\}$
16	Evaluate $\iiint_T \sqrt{x^2 + y^2} dV$, where T is the solid bounded by the cylinder $x^2 + y^2 = 1$ and the planes $z = 1$ and $z = 3$.
17	Verify the Divergence Theorem for the vector field $F(x, y, z) = 2xyi - y^2j + 3yzk$ and region T is the cube bounded by the planes $x = 0, x = 2, y = 0, y = 2, z = 0$, and $z = 2$
18	Evaluate $\iint_S f(x, y, z) dS$ if $f(x, y, z) = xy$; S is the part of the plane $3x + 2y + z = 6$ in the first octant

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks)

19	<ol style="list-style-type: none"> Find the points on the sphere $x^2 + y^2 + z^2 = 14$ at which the tangent plane is parallel to the plane $x + 2y + 3z = 12$ Find the directional derivative of the function $f(x, y, z) = x \sin(2y + 3z)$ at the point $P = (0, \pi/4, -\pi/12)$ in the direction from P to the point $Q = (3, \pi/2, -\pi/4)$.
20	Evaluate $\int_C (xydx - yzdy + x^2dz)$ where C consists of the line segment from $(0, 0, 0)$ to $(1, 1, 0)$ and the line segment from $(1, 1, 0)$ to $(2, 3, 5)$