| Q.P Code D134140 | Total Pages 2 | Name 672203 |
|---|---|---|
| | | 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 $f(u, v) = \dfrac{uv}{u - v}$. |
| 3 | Find the gradient vector field of the scalar function $f(x, y, z) = \tan^{-1}(xyz)$. |
| 4 | Find the divergence of $F(x, y, z) = xyzi + x^2y^2zj + xy^2k$ at the point $(1, -1, 2)$ |
| 5 | Evaluate the integral $\int_{2}^{2}\int_{0}^{\sqrt{4-x^2}} e^{\sqrt{x^2+y^2}}dxdy$ 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 $\int_0^{\pi/2}\int_0^2\int_0^{\sqrt{1-z^2}} y\cos x \; dydzdx$ |
| 8 | Evaluate $\oint_C x^2dx + (xy + y^2)dy$, 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. |

672203

## Section B

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

| | |
|---|---|
| 11 | Show that $\lim_{(x,y)\to(0,0)} \frac{3xy}{3x^2+y^2}$ 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 $\textbf{curl}(fF) = f\textbf{curl}\ F + (\nabla f)\times F$ |
| 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 $R = \{(x,y); 0\le y\le 1, y\le x\le 2y\}$ |
| 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 | 1. Find the points on the sphere $x^2+y^2+z^2=14$ at which the tangent plane is parallel to the plane $x+2y+3z=12$<br>2. 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) |

672203