

Second Semester FYUGP Degree (Sup/Imp) Examination

April 2026

KU2DSCMAT117 - CALCULUS AND MATRIX ALGEBRA II

2024 Admission-onwards

Time : 2 hours

Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. If A and B are non-singular, show that $(AB)^{-1} = B^{-1}A^{-1}$.
2. If A is non-singular, show that $(A^T)^{-1} = (A^{-1})^T$.
3. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ if $f(x, y) = e^{x+y+1}$.
4. If $F(x, y, z)$ is a differentiable function and $F(x, y, z) = 0$ defines z as a differentiable function of x and y , then express $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ in terms of partial derivatives of F .
5. State chain rule for functions of one independent variable and two intermediate variables.
6. Evaluate $\int_0^{\frac{\pi}{2}} \sin^9 x \, dx$.
7. Evaluate $\int_0^{\frac{\pi}{2}} \sin^5 x \, dx$.
8. Evaluate $\int_0^{\frac{\pi}{2}} \sin^3 x \cos^4 x \, dx$.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Determine the domain and range of $z = \frac{1}{xy}$.
10. Determine the domain of $f(x, y) = \sqrt{y - x - 2}$.
11. Find f_{yxyz} if $f(x, y, z) = 1 - 2xy^2z + x^2y$.
12. Evaluate $\int \sin^5 x \, dx$.

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13. Evaluate $\int \sin^2 x \cos^6 x \, dx$.

14. Evaluate $\int \tan^4 x \, dx$.

Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Verify Lagrange's Mean Value Theorem for $f(x) = \sin x$ in $[0, \pi]$.
(b) Prove that $x > \tan^{-1} x > \frac{x}{1+x^2}$, $0 < x < \frac{\pi}{2}$.
16. Determine the n^{th} derivative of $e^{ax} \cos(bx + c)$.
17. Solve the system of equations

$$\begin{aligned} x_1 &= 1 \\ 2x_1 + 2x_2 &= 2 \\ x_1 + 3x_3 &= 3. \end{aligned}$$