K25FY2769 pages: 2 Reg No:..................
Name :..................

First Semester FYUGP Degree Supplementary Examination January 2025

KU1DSCMAT111 - BASIC MATHEMATICS I

2024 Admission onwards

Time : 2 hours Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Define a one-to-one function. Give an example.
2. Using horizontal line test, show that $y = x^3$ is one-to-one
3. Use Sandwich theorem to obtain $\lim_{\theta \to 0} \cos\theta = 1$.
4. Determine the integral $\int (x^3 + x)^5 (3x^2 + 1)\, dx$.
5. Determine the integral $\int \sqrt{2x+1}\, dx$.
6. Compute $\int_0^1 \frac{1}{x^2+1}\, dx$.
7. Verify whether the matrix $\begin{bmatrix} 2 & 1 & 0 \\ 4 & 3 & 2 \\ 6 & 5 & -1 \end{bmatrix}$ is symmetric or not.
8. Find the transpose of
$$\begin{bmatrix} 1 & 5 & 6 & 3 \\ 2 & 5 & 7 & 8 \\ 5 & 9 & 2 & 4 \end{bmatrix}.$$

Section B

Answer any 4 questions. Each carry 6 marks.

9. If $f(x) = x^3 + 1$, find $f^{-1}(x)$ and identify its domain and range
10. Compute the value of the limit $\lim_{u \to 1} \frac{u^4 - 1}{u^3 - 1}$.
11. Simplify: $\ln(\cosh x + \sinh x) + \ln(\cosh x - \sinh x)$.
12. Determine the integrals

(a) $\int \sin^2 x\, dx$

(b) $\int \cos^2 x\, dx$.

13. Evaluate $\int_0^{\ln 2} \frac{e^x}{1+e^x}\, dx$.

14. Using integration, calculate the area of the triangle the equations of whose sides are $y = x$, $y = 0$ and $x = 2$.

Section C

Answer any 2 questions. Each carry 14 marks.

15. If $f(x,y) = x\cos y + ye^x$, determine the second order derivatives $\frac{\partial^2 f}{\partial x^2}, \frac{\partial^2 f}{\partial y \partial x}, \frac{\partial^2 f}{\partial y^2}$ and $\frac{\partial^2 f}{\partial x \partial y}$.

16. (a) Suppose u and v are functions of x that are differentiable at $x = 0$ and that $u(0) = 5, u'(0) = -3, v(0) = -1, v'(0) = 2$. Find the values of the following derivatives at $x = 0$.
(i) $\frac{d}{dx}(uv)$ (ii) $\frac{d}{dx}(7v - 2u)$.

(b) Calculate the derivative $\frac{d}{dx}\left(\cos^{-1}(x^2)\right)$.

17. If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, find A^{-1} and verify that $A^3 = A^{-1}$.