K25FY3588 Pages: 2 Reg No:.....
Name:.....

Third Semester FYUGP Degree (Reg) Examination November 2025

KU3DSCMAT212 - BASIC MATHEMATICAL METHODS

2024 Admission onwards

Time : 2 hours Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Write the trapezoidal rule for evaluating $\int_a^b f(x)dx$.
2. Evaluate $\int_0^2 \frac{dx}{x^2+2x+10}$ by trapezoidal rule, taking $h = 2$.
3. Give an example of a periodic function which has no fundamental period.
4. Verify whether the function $f(x) = \sin(x^2)$ is even or odd.
5. State the Fourier series representation of an odd function in $(-L, L)$.
6. Solve the ODE: $\frac{dy}{dx} = \frac{1}{1+x^2}$ by integration.
7. Write the condition for exactness of the ODE: $M(x, y)dx + N(x, y)dy = 0$.
8. Give an example for a second order linear differential equation.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Find the Fourier series expansion for $f(x) = x^2$ in $-\pi \leq x \leq \pi$ and $f(x + 2\pi) = f(x)$.
10. If the Fourier series of the function $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $0 < x < 2\pi$ is

$$f(x) = \frac{\pi^2}{12} + \sum_{n=1}^{\infty} \frac{\cos nx}{n^2},$$

then find the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$.

11. Find the Fourier series expansion of the even function $f(x) = \frac{x^2}{2}$ in $-1 < x < 1$ with period $p = 2$.
12. Solve the differential equation $y' = (x + 1)e^{-x}y^2$.

13. Find the general solution of $y'' + 2y' + 5y = 0$.

14. Verify that $y_1 = \cos 2.5x$ and $y_2 = \sin 2.5x$ are solutions of the ODE: $4y'' + 25y = 0$ and then solve the initial value problem $4y'' + 25y = 0,\ \ y(0) = 3,\ \ y'(0) = -2.5$.

Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Define three elementary row operations for matrices. Give an example for each.

    (b) Solve the following linear system by Gauss Elimination method:
    $x_1 - x_2 + x_3 = 0$
    $-x_1 + x_2 - x_3 = 0$
    $10x_2 + 25x_3 = 90$
    $20x_1 + 10x_2 = 80.$

16. (a) State Cramer's rule for a linear system of equations.

    (b) Solve the following system of equations by Cramer's rule:
    $3y - 4z = 16$
    $2x - 5y + 7z = -27$
    $-x - 9z = 9.$

17. Obtain the approximate value of $y(1.4)$ for the initial value problem $y' = x^2 + y^2, y(1) = 2$, by (i) Euler-Cauchy method and (ii) modified Euler-Cauchy method, taking $h = 0.2$.