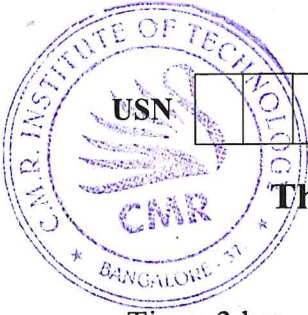


CBCS SCHEME



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15MAT31

Third Semester B.E. Degree Examination, June/July 2024 Engineering Mathematics – III

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} -\pi & \text{in } -\pi < x < 0 \\ x & \text{in } 0 < x < \pi \end{cases}$$

Hence deduce that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$.

(08 Marks)

- b. Express y as a Fourier series up to the second harmonics, given :

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

(08 Marks)

OR

- 2 a. Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \leq x \leq 2$. (08 Marks)
 b. Obtain the constant term and the first two coefficients in the only Fourier cosine series for given data :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(08 Marks)

Module-2

- 3 a. Find the Fourier Transform of

$$f(x) = \begin{cases} 1-x^2 & |x| \leq 1 \\ 0 & |x| > 1 \end{cases}$$

(06 Marks)

Hence evaluate $\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$.

- b. Find the Fourier cosine transform of

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2-x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$

(05 Marks)

- c. Find the inverse Z – transform of

$$\frac{3z^2 + 2z}{(5z-1)(5z+2)}$$

(05 Marks)

OR

- 4 a. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a > 0$. (06 Marks)
- b. Find the Z – transform of i) $\cosh n\theta$ ii) n^2 . (05 Marks)
- c. Solve the difference equation $y_{n+2} + 4y_{n+1} + 3y_n = 3^n$ with $y_0 = 0$, $y_1 = 1$. (05 Marks)

Module-3

- 5 a. Find the Correlation coefficient and equations of regression lines for the following data:

x	1	2	3	4	5
y	2	5	3	8	7

(06 Marks)

- b. Fit a straight line to the following data:

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

(05 Marks)

- c. Find a real root of the equation $xe^x = \cos x$ correct to three decimal places that lies between 0.5 and 0.6 using Regula-falsi method. (05 Marks)

OR

- 6 a. The following regression equations were obtained from a correlation table.

$$y = 0.516x + 33.73$$

$$x = 0.516y + 32.52$$

Find the value of (i) Correlation coefficient (ii) Mean of x's (iii) Mean of y's. (06 Marks)

- b. Fit a second degree parabola to the following data:

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(05 Marks)

- c. Use Newton-Raphson's method to find a real root of $x \sin x + \cos x = 0$ near $x = \pi$, carry out three iterations. (05 Marks)

Module-4

- 7 a. Give $f(40) = 184$, $f(50) = 204$, $f(60) = 226$, $f(70) = 250$, $f(80) = 276$, $f(90) = 304$. Find $f(38)$ using Newton's forward interpolation formula. (06 Marks)

- b. Find the interpolating polynomial for the data :

x	0	1	2	5
y	2	3	12	147

By using Lagrange's interpolating formula.

(05 Marks)

- c. Use Simpson's $\frac{3}{8}$ th rule to evaluate $\int_0^{0.3} (1 - 8x^3)^{1/2} dx$ considering 3 equal intervals.

(05 Marks)

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OR

- 8 a. The area of a circle (A) corresponding to diameter (D) is given below :

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105, using an appropriate interpolation formula.

(06 Marks)

b. Given the values :

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

Evaluate $f(9)$ using Newton's divided difference formula.

(05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule taking seven ordinates.

(05 Marks)

Module-5

- 9 a. Find the work done in moving a particle in the force field $\vec{F} = 3x^2 i + (2xz - y)j + z k$ along the curve defined by $x^2 = 4y$, $3x^3 = 8z$ from $x = 0$ to $x = 2$. (06 Marks)
- b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy j$ around the rectangle $x = \pm a$, $y = 0$, $y = b$. (05 Marks)
- c. Solve the Euler's equation for the functional $\int_{x_0}^{x_1} (1 + x^2 y') y' dx$. (05 Marks)

OR

- 10 a. Verify Green's theorem for $\int_e (xy + y^2) dx + x^2 dy$, where e is bounded by $y = x$ and $y = x^2$. (06 Marks)
- b. Evaluate the surface integral $\iint_s \vec{F} \cdot N ds$ where $\vec{F} = 4xi - 2y^2j + z^2k$ and s is the surface bounding the region $x^2 + y^2 = 4$, $z = 0$ and $z = 3$. (05 Marks)
- c. Show that the shortest distance between any two points in a plane is a straight line. (05 Marks)
