

CBCS SCHEME

15MAT31



Third Semester B.E. Degree Examination, June/July 2025 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. Find the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $(0, 2\pi)$. Hence deduce that :

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

(08 Marks)

- b. Find the constant term and first cosine and sine terms of the Fourier series of y from the data :

x	0	45	90	135	180	225	270	315
y	2	1.5	1	0.5	0	0.5	1	1.5

(08 Marks)

OR

- 2 a. Find the Fourier series of :

$$f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi < x \leq 0 \\ 1 - \frac{2x}{\pi}, & 0 \leq x < \pi \end{cases}$$

(05 Marks)

- b. Find the Half range cosine Fourier series of $f(x) = (x-1)^2$ in $(0, 1)$.

(05 Marks)

- c. The following table gives the variations of a periodic current A over a period T .

t (secs)	0	$T/6$	$T/3$	$T/2$	$2T/3$	$5T/6$	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is constant part of 0.75 amp in the current A and obtain the amplitude of the first harmonic.

(06 Marks)

Module-2

- 3 a. Find the Fourier cosine transform of :

$$f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4 - x, & 1 < x < 4 \\ 0, & x > 4 \end{cases}$$

(05 Marks)

- b. Find the z-transform of $\cosh n\theta$.

(05 Marks)

- c. Find the inverse Z-transform of $\frac{5z}{(2-z)(3z-1)}$.

(06 Marks)

OR

- 4 a. Find the Fourier transform of $f(x) = \begin{cases} 1-|x|; & |x| \leq 1 \\ 0; & |x| > 1 \end{cases}$. (05 Marks)
- b. Find the Fourier sine transform of $e^{-|x|}$ hence deduce that $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx = \frac{\pi}{2} e^{-m}$. (05 Marks)
- c. Solve the difference equation $u_{n+2} + u_n = 0$ by using Z-transforms. (06 Marks)

Module-3

- 5 a. Obtain the lines of regression and hence find the coefficient of correlation for the data :

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(05 Marks)

- b. Fit a parabola $y = ax^2 + bx + c$ by the method of least squares for the following data :

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

(05 Marks)

- c. Find a real root of the equation $x^3 - 2x - 5 = 0$ correct to three decimal places, using the Regula-Falsi method. (06 Marks)

OR

- 6 a. Given the equation of the regression lines $x = 19.13 - 0.87y$, $y = 11.64 - 0.5x$, Compute the mean of x's, mean of y's and the coefficient of correlation. (05 Marks)
- b. Fit a straight line $y = ax + b$ for the following data :

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

(05 Marks)

- c. Find a real root of the equation $xe^x - 2 = 0$ correct to three decimal places using Newton - Raphson method near $x = 1.0$. (06 Marks)

Module-4

- 7 a. Find $u_{0.5}$ from the data : $u_0 = 225$, $u_1 = 238$, $u_2 = 320$, $u_3 = 340$. (05 Marks)
- b. Using Newton's divided difference formula find $f(8)$ and $f(15)$ from the following data :

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

(05 Marks)

- c. Evaluate $\int_4^{5.2} \log_e x dx$, taking 6 equal parts by applying Weddle's rule. (06 Marks)

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 Newton's Backward formula. (05 Marks)

- b. Apply Lagrange's inverse interpolation formula find x when y = 6 given the data :

x	20	30	40
y	2	4.4	7.9

(05 Marks)

- c. Evaluate $\int_0^6 3x^2 dx$ by using Simpson's $(\frac{1}{3})^{rd}$ rule taking 6 equal parts. (06 Marks)

Module-5

- 9 a. Evaluate $\iiint_V \nabla \cdot \vec{F} dv$, if $\vec{F} = (2x^2 - 3z)\vec{i} - 2xy\vec{j} - 4x\vec{k}$ where V is the region bounded by the planes $x = 0, y = 0, z = 0$ and $2x + 2y + z = 4$. (05 Marks)

- b. Find the extremal of the functional $\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x) dx$. (05 Marks)

- c. Find the geodesics on a surface given that the arc length on the surface is :

$$S = \int_{x_1}^{x_2} \sqrt{x(1+y'^2)} dx.$$

(06 Marks)

OR

- 10 a. Evaluate $\int_C \vec{F} \cdot d\vec{r}$, if $\vec{F} = xy\vec{i} + yz\vec{j} + zx\vec{k}$, where C is the curve represented by $x = t, y = t^2, z = t^3, -1 \leq t \leq 1$. (05 Marks)

- b. Verify Green's theorem in a plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. (05 Marks)

- c. Solve the variational problem : $\delta \int_0^1 (x + y + y'^2) dx = 0$ under the conditions $y(0) = 1$ and $y(1) = 2$. (06 Marks)
