CBCS SCHEME

USN | | | | | | | | | | | 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 :

$$\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+----.$$ **(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 :

$$f(x)=\begin{cases}1+\frac{2x}{\pi}, & -\pi<x\le 0\\ 1-\frac{2x}{\pi}, & 0\le x<\pi\end{cases}.$$ **(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 $f(x) = \begin{cases} 1-|x|; & |x| \le 1 \\ 0; & |x| > 1 \end{cases}$. (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 $\int_0^6 3x^2dx$ by using Simpson's $(1/3)^{rd}$ rule taking 6 equal parts. **(06 Marks)**

Module-5

9 a. Evaluate $\iiint_V \nabla\cdot\vec{F}\,dv$, if $\vec{F}=(2x^2-3z)i-2xyj-4xk$ 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 $\vec{F}=xyi+yzj+zxk$, where C is the curve represented by $x = t$, $y = t^2$, $z=t^3$, $-1\le t\le 1$. **(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)**

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