CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2025/Jan.2026
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 Fourier series expansion of $f(x) = |x|$ in the interval $(-\pi, \pi)$ and hence deduce $\frac{\pi^2}{8} = \sum_{1}^{\infty} \frac{1}{(2n-1)^2}$. **(08 Marks)**

b. Obtain half range Cosine series of $f(x) = \begin{cases} x, & 0 < x < \pi/2 \\ \pi - x, & \pi/2 < x < \pi \end{cases}$. **(08 Marks)**

OR

2 a. Obtain Fourier series expansion of $f(x) = \frac{\pi - x}{2}, 0 \le x \le 2\pi$. **(06 Marks)**

b. Obtain half range sine series of $f(x) = x^2$ in the interval $(0, \pi)$. **(05 Marks)**

c. Obtain the Fourier series for the following function neglecting the terms higher than first harmonic. **(05 Marks)**

x :	0	1	2	3	4	5
y :	9	18	24	28	26	20

Module-2

3 a. Find the Fourier transform of $f(x) = \begin{cases} 1-|x|, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$ and hence deduce $\int_0^\infty \frac{\sin^2 x}{x^2} dx = \pi/2$. **(06 Marks)**

b. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$. **(05 Marks)**

c. Find the Inverse Z – transform of $\frac{8z^2}{(2z-1)(4z-1)}$. **(05 Marks)**

OR

4 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 i) $\sinh n\theta$ ii) n^2. **(06 Marks)**

c. Solve the difference equation : $U_{n+2} - 5U_{n+1} + 6U_n = 2$, $U_0 = 3$, $U_1 = 7$. **(05 Marks)**

Module-3

5 a. Fit a second degree parabola $y = ax^2 + bx + c$ in the least square sense for the following data and hence estimate y at x = 6. **(06 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

b. 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)

c. Use Newton-Raphson method to find a real root of $x\sin x + \cos x = 0$ near $x = \pi$. Carryout the iterations upto four decimal places of accuracy. **(05 Marks)**

OR

6 a. Show that a real root of the equation $\tan x + \tanh x = 0$ lies between 2 and 3. Then apply the Regula Falsi method to find third approximation. **(06 Marks)**

b. Compute the coefficient of correlation and the equation of the lines of regression for the data:

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(05 Marks)

c. Fit a curve of the form $y = ae^{bx}$ for the data:

x	0	2	4
y	8.12	10	31.82

(05 Marks)

Module-4

7 a. From the following table find the number of students who have obtained:
i) Less than 45 marks
ii) Between 40 and 45 marks.

Marks	30-40	40-50	50-60	60-70	70-80
Number of students	31	42	51	35	31

(06 Marks)

b. Construct the interpolating polgnomial for the data given below using Newton's general interpolation formula for divided differences and hence find y at x = 3.

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule. Taking seven ordinates. Hence find $\log_e 2$. **(05 Marks)**

OR

8 a. Use Lagrange's interpolation formula to find f(4) given below. **(06 Marks)**

x	0	2	3	6
f(x)	-4	2	14	158

b. Use Simpson's 3/8th rule to evaluate $\int_1^4 e^{1/x} dx$. **(05 Marks)**

c. The area of a circle (A) corresponding to diameter (D) is given by

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

Find the area corresponding to diameter 105 using an appropriate interpolation formula. **(05 Marks)**

Module-5

9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ with the help of Green's theorem in a plane. **(06 Marks)**

b. Solve the variational problem $\delta\int_0^1 (12xy + y'^2)dx = 0$ under the conditions $y(0) = 3$, $y(1) = 6$. **(05 Marks)**

c. Prove that the shortest distance between two points in a plane is along the straight line joining them. **(05 Marks)**

OR

10 a. A cable hangs freely under gravity from the fixed points. Show that the shape of the curve is a catenary. **(06 Marks)**

b. Use Stoke's theorem to evaluate for $\vec{F} = (x^2 + y^2)i - 2xyj$ taken around the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$ **(05 Marks)**

c. Evaluate $\iint_S (yzi + zxj + xyk).\hat{n}ds$ where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ in the first octant. **(05 Marks)**

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