



# CBCS SCHEME

15MAT31

## Third Semester B.E. Degree Examination, Jan./Feb. 2021 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

$$\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} \quad (08 \text{ Marks})$$

- b. Obtain half range cosine series of

$$f(x) = \begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x < \pi \end{cases} \quad (08 \text{ Marks})$$

OR

- 2 a. Obtain Fourier series expansion of

$$f(x) = \frac{\pi - x}{2}, \quad 0 \leq x \leq 2\pi. \quad (06 \text{ Marks})$$

- 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  $f(x) = \begin{cases} 1 - |x|, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$  and hence deduce  $\int_0^{\infty} \frac{\sin^2 x}{x^2} dx = \frac{\pi}{2}$ . (06 Marks)

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

- c. Find the Inverse Z - transform of

$$\frac{8z^2}{(2z-1)(4z-1)} \quad (05 \text{ Marks})$$

OR

- 4 a. Find the Fourier Cosine transform of

$$f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4 - x, & 1 < x < 4 \\ 0, & x > 4 \end{cases} \quad (05 \text{ Marks})$$

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

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

(06 Marks)

- b. Fit a second degree parabola  $y = ax^2 + bx + c$  for the following data :

x	0	1	2	3	4	5	6
y	14	18	27	29	36	40	46

(05 Marks)

- c. Using Newton Raphson method, find a real root of  $x \sin x + \cos x = 0$  near  $x = \pi$ , corrected to four decimal places. (05 Marks)

**OR**

- 6 a. Obtain the lines of regression and hence find coefficient of correlation for the following data

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

(06 Marks)

- b. By the method of Least square, find a straight line that best fits the following data :

x	5	10	15	20	25
y	16	19	23	26	30

(05 Marks)

- c. Using Regula – Falsi method to find a real root of  $x \log_{10} x - 1.2 = 0$ , carry out 3-iterations. (05 Marks)

**Module-4**

- 7 a. Find the interpolating formula  $f(x)$ , satisfying  $f(0) = 0$ ,  $f(2) = 4$ ,  $f(4) = 56$ ,  $f(6) = 204$ ,  $f(8) = 496$ ,  $f(10) = 980$  and hence find  $f(3)$ . (06 Marks)

- b. Use Newton's divided difference formula to find  $f(9)$ , given

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

(05 Marks)

- c. Evaluate  $\int_0^1 \frac{x}{1+x^2} dx$  by applying Simpson's  $\frac{3}{8}$ th rule, taking 7 ordinates. (05 Marks)

**OR**

- 8 a. Using Newton's backward interpolation formula, find  $f(105)$ , given

x	80	85	90	95	100
f(x)	5026	5674	6362	7088	7854

(06 Marks)

- b. Apply Lagrange formula to find root of the equation  $f(x) = 0$ , given  $f(30) = -30$ ,  $f(34) = -13$ ,  $f(38) = 3$  and  $f(42) = 18$ . (05 Marks)

- c. Evaluate  $\int_0^{0.3} \sqrt{1-8x^3} dx$ , taking 6 – equal strips by applying Weddle's rule. (05 Marks)

**Module-5**

- 9 a. If  $\vec{F} = (3x^2 + 6y)\mathbf{i} - 14yz\mathbf{j} + 20xz^2\mathbf{k}$ , evaluate  $\int \vec{F} \cdot d\vec{r}$  from (0, 0, 0) to (1, 1, 1) along the curve given by  $x = t$ ,  $y = t^2$ ,  $z = t^3$ . (06 Marks)
- b. Find the extremal of the functional  $\int_0^{\pi/2} (y^2 - y'^2 - 2y \sin x) dx$ ,  $y(0) = y(\pi/2) = 0$ . (05 Marks)
- c. Prove that geodesics on a plane are straight lines. (05 Marks)
- OR**
- 10 a. Find the area between the parabolas  $y^2 = 4ax$  and  $x^2 = 4ay$  with the help of Green's theorem in a plane. (06 Marks)
- b. Verify Stoke's theorem for  $\vec{F} = y\mathbf{i} + z\mathbf{j} + x\mathbf{k}$ . Where S is the upper half of the sphere  $x^2 + y^2 + z^2 = 1$  and C is its boundary. (05 Marks)
- c. A heavy chain hangs freely under the gravity between two fixed points. Show that the shape of the chain is a Catenary. (05 Marks)

\*\*\*\*\*