CBCS SCHEME

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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 intercal (-π , π) and hence deduce $\pi^2/8 = \sum_1^\infty 1/(2n-1)^2$. **(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 $f(x) = \dfrac{\pi - x}{2}$, $0 \le x \le 2\pi$. **(06 Marks)**

b. Obtain half range sine series of $f(x) = x^2$ in the interval (0, π). **(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 $\int_0^\infty \dfrac{\sin^2 x}{x^2} dx = \pi/2$. **(06 Marks)**

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

c. Find the Inverse Z – transform of $\dfrac{8z^2}{(2z-1)(4z-1)}$. **(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 θ 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 ⅜ 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 $\vec{F} = (3x^2 + 6y)i - 14yzj + 20xz^2k$, 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 $\vec{F} = yi + zj + xk$. Where S is the upper half of the sphere $x^2 + y^2 + z^2 = 1$ and C is it 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)**

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