CBCS Scheme

USN | | | | | | | | | | | 15MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Expand $f(x) = x - x^2$ as a Fourier series in the interval $(-\pi, \pi)$. **(08 Marks)**

b. Obtain the half-range cosine series for the function $f(x) = x(l - x)$ in the interval $0 \le x \le l$. **(08 Marks)**

OR

2 a. Obtain the Fourier series of $f(x) = \dfrac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $\dfrac{\pi}{4} = 1 - \dfrac{1}{3} + \dfrac{1}{5} - \dfrac{1}{7} + \ldots\ldots$ **(06 Marks)**

b. Find the half-range sine series for the function

$$f(x) = \begin{cases} \dfrac{1}{4} - x & \text{in} \quad 0 < x < 1/2 \\ x - \dfrac{3}{4} & \text{in} \quad 1/2 < x < 1 \end{cases}$$ **(05 Marks)**

c. Compute the constant term and the coefficient of the 1st sine and cosine terms in the Fourier series of y as given in the following table:

x:	0	1	2	3	4	5
y:	4	8	15	7	6	2

(05 Marks)

Module-2

3 a. If $f(x) = \begin{cases} 1 - x^2; & |x| < 1 \\ 0; & |x| \ge 1 \end{cases}$. Find the Fourier transform of f(x) and hence find the value of $\displaystyle\int_0^\infty \frac{x\cos x - \sin x}{x^3}\,dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of

$$f(x) = \begin{cases} x, & 0 < x < 2 \\ 0, & \text{elsewhere} \end{cases}.$$ **(05 Marks)**

c. Solve using Z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0$, $y_1 = 2$. **(05 Marks)**

OR

4 a. Obtain the inverse Fourier sine transform of $F_S(\alpha) = \dfrac{e^{-a\alpha}}{\alpha}$, $a > 0$. **(06 Marks)**

b. Find the Z-transform of $2n + \sin\left(\dfrac{n\pi}{4}\right) + 1$. **(05 Marks)**

c. If $U(z) = \dfrac{z}{z^2 + 7z + 10}$, find the inverse Z-transform. **(05 Marks)**

Module-3

5 a. Obtain the coefficient of correlation for the following data:

x :	10	14	18	22	26	30
y :	18	12	24	6	30	36

(06 Marks)

b. By the method of least square find the straight line that best fits the following data:

x :	1	2	3	4	5
y :	14	27	40	55	68

(05 Marks)

c. Use Newton-Raphson method to find a root of the equation $\tan x - x = 0$ near $x = 4.5$. Carry out two iterations. **(05 Marks)**

OR

6 a. Find the regression line of y on x for the following data:

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

Estimate the value of y when x = 10. **(06 Marks)**

b. Fit a second degree parabola to the following data:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

c. Solve $xe^x - 2 = 0$ using Regula – Falsi method. **(05 Marks)**

Module-4

7 a. From the data given in the following table. Find the number of students who obtained less than 70 marks.

Marks :	0-19	20-39	40-59	60-79	80-99
Number of students :	41	62	65	50	17

(06 Marks)

b. Find the equation of the polynomial which passes through the points (4, -43), (7, 83), (9, 327) and (12, 1053). Using Newton's divided difference interpolation. **(05 Marks)**

c. Compute the value of $\int_{0.2}^{1.4}(\sin x - \log x + e^x)\,dx$ using Simpson's $\frac{3}{8}^{th}$ rule taking six parts.

(05 Marks)

OR

8 a. Using Newton's backward interpolation formula find the interpolating polynomial for the function given by the following table:

x :	10	11	12	13
f(x) :	22	24	28	34

Hence fine f(12.5). **(06 Marks)**

b. The following table gives the premium payable at ages in years completed. Interpolate the premium payable at age 35 completed. Using Lagrange's formula.

Age completed :	25	30	40	60
Premium in Rs. :	50	55	70	95

(05 Marks)

c. Evaluate $\int_{4}^{5.2}\log_e x\ dx$ taking 6 equal strips by applying Waddles rule. **(05 Marks)**

Module-5

9 a. Verify Green's theorem for $\oint (xy + y^2)dx + x^2 dy$ where c is the closed curve of the region bounded by y = x and y = xz. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy\, j$ taken round the rectangle bounded by the lines $x = \pm a$, $y = 0$ and $y = b$. **(05 Marks)**

c. A heavy cable hangs freely under gravity between two fixed points. Show that the shape of the cable is a catenary. **(05 Marks)**

OR

10 a. Use divergence theorem to evaluate $\iint_S \vec{F}\hat{n}\, ds$ over the entire surface of the region above XoY plane bounded by the cone $z^2 = x^2 + y^2$, the plane z = 4 where $\vec{F} = 4xz^1\hat{i} + xyz^2\hat{j} + 3z\hat{k}$. **(06 Marks)**

b. Find the extremal of the functional $\int_{x_1}^{x_2} \left[(y')^2 - y^2 + 2y \sec x\right] dx$. **(05 Marks)**

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

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