CBCS SCHEME

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17MAT31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

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. Find the Fourier series expansion of $f(x) = x - x^2$ in $(-\pi, \pi)$, hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + ----$. **(08 Marks)**

b. Find the half range cosine series for the function $f(x) = (x-1)^2$ in $0 \le x \le 1$. **(06 Marks)**

c. Express y as a Fourier series upto first harmonics given :

x	0	60°	120°	180°	240°	300°
y	7.9	7.2	3.6	0.5	0.9	6.8

(06 Marks)

OR

2 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} 1 + \frac{4x}{3} & \text{in } \frac{-3}{2} < x \le 0 \\ 1 - \frac{4x}{3} & \text{in } 0 \le x < \frac{3}{2} \end{cases}$$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ---$. **(08 Marks)**

b. If $f(x) = \begin{cases} x & \text{in } 0 < x < \pi/2 \\ \pi - x & \text{in } \pi/2 < x < \pi \end{cases}$

Show that the half range sine series as

$$f(x) = \frac{4}{\pi}\left[\sin x - \frac{\sin 3x}{3^2} - \frac{\sin 5x}{5^2} ----\right].$$ **(06 Marks)**

c. Obtain the Fourier series upto first harmonics given :

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

(06 Marks)

Module-2

3 a. Find the complex Fourier transform of the function :

$f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(08 Marks)**

b. Find the Fourier cosine transform of e^{-ax}. **(06 Marks)**

c. Solve by using z – transforms $u_{n+2} - 4u_n = 0$ given that $u_0 = 0$ and $u_1 = 2$. **(06 Marks)**

OR

4 a. Find the Fourier sine and Cosine transforms of :
$$f(x)=\begin{cases} x & 0<x<2 \\ 0 & \text{elsewhere} \end{cases}.$$
(08 Marks)

b. Find the Z – transform of : i) n^2 ii) ne^{-an}. (06 Marks)

c. Obtain the inverse Z – transform of $\dfrac{2z^2+3z}{(z+2)(z-4)}$. (06 Marks)

Module-3

5 a. Obtain the lines of regression and hence find the co-efficient 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

(08 Marks)

b. Fit a parabola $y = ax^2 + bx + c$ in the least square sense for the data :

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

(06 Marks)

c. Find the root of the equation $xe^x - \cos x = 0$ by Regula – Falsi method correct to three decimal places in (0, 1). (06 Marks)

OR

6 a. If $8x - 10y + 66 = 0$ and $40x - 18y = 214$ are the two regression lines, find the mean of x's, mean of y's and the co-efficient of correlation. Find σ_y if $\sigma_x = 3$. (08 Marks)

b. Fit an exponential curve of the form $y = ae^{bx}$ by the method of least squares for the data :

No. of petals	5	6	7	8	9	10
No. of flowers	133	55	23	7	2	2

(06 Marks)

c. Using Newton–Raphson method, find the root that lies near $x = 4.5$ of the equation $\tan x = x$ correct to four decimal places. (06 Marks)

Module-4

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

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students	31	42	51	35	31

(06 Marks)

b. Using Newton's divided difference formula construct an interpolating polynomial for the following data :

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

and hence find f(8). (08 Marks)

c. Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}^{th}$ rule. (06 Marks)

OR

8 a. In a table given below, the values of y are consecutive terms of a series of which 23.6 is the 6^{th} term. Find the first and tenth terms of the series by Newton's formulas.

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

(08 Marks)

b. Fit an interpolating polynomial of the form x = f(y) for data and hence find x(5) given :

x	2	10	17
y	1	3	4

(06 Marks)

c. Use Simpson's $\frac{1}{3}^{rd}$ rule to find $\int_0^{0.6} e^{-x^2}dx$ by taking 6 sub-intervals. (06 Marks)

Module-5

9 a. Verify Green's theorem in the plane for $\oint_c(3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the closed curve bounded by $y = \sqrt{x}$ and $y = x^2$. (08 Marks)

b. Evaluate $\int_c xydx + xy^2dy$ by Stoke's theorem where C is the square in the x – y plane with vertices (1, 0)(–1, 0)(0, 1)(0, –1). (06 Marks)

c. Prove that Catenary is the curve which when rotated about a line generates a surface of minimum area. (06 Marks)

OR

10 a. If $\vec{F} = 2xy\hat{i} + yz^2\hat{j} + xz\hat{k}$ and S is the rectangular parallelepiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate $\iint_s \vec{F}\cdot\hat{n}\,ds$. (08 Marks)

b. Derive Euler's equation in the standard form viz $\frac{\partial f}{\partial y} - \frac{d}{dx}\left[\frac{\partial f}{\partial y'}\right] = 0$. (06 Marks)

c. Find the external of the functional $I = \int_0^{\pi/2}(y^2 - y^{12} - 2y\sin x)dx$ under the end conditions y(0) = y(π/2) = 0. (06 Marks)

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