CBCS SCHEME

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17MAT31

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Obtain the Fourier series of $f(x) = x(2\pi - x)$ in $0 \le x \le 2\pi$. **(08 Marks)**

b. Obtain the Fourier series for the function $f(x) = \begin{cases} 1 + 4\frac{x}{3} & \text{in } -\frac{3}{2} < x \le 0 \\ 1 - 4\frac{x}{3} & \text{in } 0 \le x < \frac{3}{2} \end{cases}$ **(06 Marks)**

c. Expand $f(x) = 2x - 1$ as a Cosine half range Fourier series in $0 < x < 1$. **(06 Marks)**

OR

2 a. Obtain the constant term and the coefficients of the first Cosine and Sine terms in the Fourier expansion of 'y' from the table

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

(08 Marks)

b. Obtain the Fourier series of $f(x) = |x|$ in $-\pi \le x \le \pi$. **(06 Marks)**

c. Show that the sine half range series for the function $f(x) = \ell x - x^2$ in $0 < x < \ell$ is $\frac{8\ell^2}{\pi^3}\sum_0^\infty \frac{1}{(2n+1)^3} \text{Sin}\left(\frac{2n+1}{\ell}\right)\pi x$. **(06 Marks)**

Module-2

3 a. If $f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$, find the infinite Fourier transform of f(x) and hence evaluate $\int_0^\infty \frac{\text{Sin}\, x}{x} dx$. **(08 Marks)**

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

c. Solve by using Z-transforms: $y_{n+2} - 4y_n = 0$, given $y_0 = 0$ and $y_1 = 2$. **(06 Marks)**

OR

4 a. Find the Fourier Sine transform of $\frac{e^{-ax}}{x}, a > 0$. **(08 Marks)**

b. Find the Z-transform of Sin (3n + 5). **(06 Marks)**

c. Find the inverse Z-transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

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-3

5 a. 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

(08 Marks)

b. Fit a straight line to the following data

Year	1961	1971	1981	1991	2001
Production (in tons)	8	10	12	10	16

(06 Marks)

c. Compute the real root of $x \log_{10} x - 1.2 = 0$ by Regula – Falsi method. Carry out three iterations in (2, 3). **(06 Marks)**

OR

6 a. Obtain the lines of Regression for the following values of x and y

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

(08 Marks)

b. Fit an exponential curve of the form $y - ae^{bx}$ for the following data

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

(06 Marks)

c. Find a real root of $x \sin x + \cos x = 0$ near $x = \pi$. Correct to four decimal places, using Newton – Raphson method. **(06 Marks)**

Module-4

7 a. Given Sin 45° = 0.7071, Sin 50° = 0.7660, Sin 55° = 0.8192, Sin 60° = 0.8660, find Sin 57° using an appropriate interpolation formula. **(08 Marks)**

b. Use Newton's divided difference formula to find f(4) given the data

x	0	2	3	6
f(x)	–4	2	14	158

(06 Marks)

c. Using Simpsons 1/3rd rule, evaluate $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by dividing [0, π/2] in to 6 equal parts. **(06 Marks)**

OR

8 a. From the following table find the number of students who have obtained less than 45 marks

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

(08 Marks)

b. Using Lagrange's interpolation formula fit a polynomial of the form x = f(y)

x	2	10	17
y	1	3	4

(06 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule taking seven ordinates. **(06 Marks)**

Module-5

9 a. Verify Green's theorem in a plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where 'C' is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. **(08 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xyj$ taken round the rectangle bounded by the lines $x = \pm a$, $y = 0$ and $y = b$. **(06 Marks)**

c. Derive Euler's equation $\frac{\partial t}{\partial y} - \frac{d}{dx}\left[\frac{\partial t}{\partial y^1}\right] = 0$. **(06 Marks)**

OR

10 a. Use Gauss divergence theorem to evaluate $\iint_S \vec{F}.\hat{n}\,ds$ over the entire surface of the region above xy plane bounded by the cone $z^2 = x^2 + y^2$ the plane $z = 4$ where $\vec{F} = 4xz\,i + xy\,z^2 j + 3z\,K$. **(08 Marks)**

b. Prove that geodesics of a plane are straight lines. **(06 Marks)**

c. Find the extremal of the functional $\int_0^{\pi/2} (y^2 - y'^2 - 2y\,\text{Sin}x)\,dx$ under the end conditions $y(0) = y(\pi/2) = 0$. **(06 Marks)**

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