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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  $0 \leq x \leq 2\pi$ . (08 Marks)
- b. Obtain the Fourier series for the function  $f(x) = \begin{cases} 1 + 4\frac{x}{3} & \text{in } -\frac{3}{2} < x \leq 0 \\ 1 - 4\frac{x}{3} & \text{in } 0 \leq x < \frac{3}{2} \end{cases}$  (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

- b. Obtain the Fourier series of  $f(x) = |x|$  in  $-\pi \leq x \leq \pi$ . (06 Marks)
- c. Show that the sine half range series for the function  $f(x) = lx - x^2$  in  $0 < x < l$  is  $\frac{8l^2}{\pi^3} \sum_0^\infty \frac{1}{(2n+1)^3} \sin\left(\frac{2n+1}{l}\pi x\right)$ . (06 Marks)

### Module-2

- 3 a. If  $f(x) = \begin{cases} 1 & \text{for } |x| \leq a \\ 0 & \text{for } |x| > a \end{cases}$ , find the infinite Fourier transform of  $f(x)$  and hence evaluate  $\int_0^\infty \frac{\sin x}{x} dx$ . (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
- $\sin 45^\circ = 0.7071$
- ,
- $\sin 50^\circ = 0.7660$
- ,
- $\sin 55^\circ = 0.8192$
- ,
- $\sin 60^\circ = 0.8660$
- , find
- $\sin 57^\circ$
- 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
- $1/3^{\text{rd}}$
- rule, evaluate
- $\int_0^{\pi/2} \sqrt{\cos \theta} d\theta$
- by dividing
- $[0, \pi/2]$
- 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  $\vec{F} = (x^2 + y^2)\mathbf{i} - 2xy\mathbf{j}$  taken round the rectangle bounded by the lines  $x = \pm a$ ,  $y = 0$  and  $y = b$ . (06 Marks)
- c. Derive Euler's equation  $\frac{\partial t}{\partial y} - \frac{d}{dx} \left[ \frac{\partial t}{\partial y'} \right] = 0$ . (06 Marks)

**OR**

- 10 a. Use Gauss divergence theorem to evaluate  $\iiint_S \vec{F} \cdot \hat{n} \, ds$  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  $\vec{F} = 4xz\mathbf{i} + xyz^2\mathbf{j} + 3z\mathbf{k}$ . (08 Marks)
- b. Prove that geodesics of a plane are straight lines. (06 Marks)
- c. Find the extremal of the functional  $\int_0^{\pi/2} (y^2 - y'^2 - 2y \sin x) dx$  under the end conditions  $y(0) = y(\pi/2) = 0$ . (06 Marks)

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