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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.

Module-1

1 a. Find the Fourier series expansion of f(x) = x in (-7T, 7). hence deduce that

$\frac{n^2}{12}$ $\frac{1}{1^2}$ $\frac{1}{2^{-7''}}$ $\frac{1}{3^2}$ $\frac{1}{4^-}$. **(08 Marks)**

b. Find the half range cosine series for the function $f(x) = (x - 1)^2$ in $0 < x < 1$. **(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 :

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

Hence deduce that $\frac{\text{it}'}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots$. **(08 Marks)**

b. If $f(x) = \begin{cases} x & \text{in } 0 < x < \frac{71}{2} \\ \text{IT} - x & \text{in } \frac{r}{2} < x < 7\text{C} \end{cases}$

Show that the half range sine series as

$f(x) \cdot \frac{4}{n}\left[\sin x \quad \frac{\sin 3x}{3^2} \quad \frac{\sin 5x}{5^2} \quad - \right.$ **(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 :

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

b. Find the Fourier cosine transform of e^{x}. **(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)**

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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'. **(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 — cosx = 0 by Regula — Falsi method correct to three decimal places in (0, 1). **(06 Marks)**

OR

6 a. If 8x — lOy + 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 a_y if a = 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 tanx = 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 g8). **(08 Marks)**

c. Evaluate $\int_0^6 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's % th rule. **(06 Marks)**

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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 3^{rd} ruleto find I e^{-x} dx (0.6) by taking 6 sub-intervals. **(06 Marks)**

Module-5

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

b. Evaluate $_c$i $xydx + xy^2dy$ 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 F = 2xyl+ yz^2 xz k and S is the rectangular parallelepiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate F. n̂ us•• **(08 Marks)**

Derive Euler's equation in the standard form viz $\frac{of}{a_y} - \frac{[\ af}{dx\ ay'} = 0$. **(06 Marks)**

c. Find the external of the functional I = J(n/2)$(y^2 - y'^2 - 2y \sin x)dx$ under the end conditions y(0) = y(n/2) = 0. **(06 Marks)**