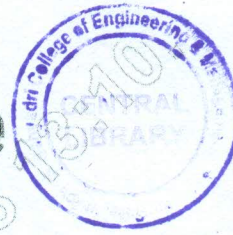


CBCS Scheme



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15MAT31

Third Semester B.E. Degree Examination, June/July 2018 Engineering Mathematics – III

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$

(08 Marks)

- b. Obtain the half-range cosine series for the function $f(x) = (x-1)^2$, $0 \leq x \leq 1$. Hence deduce

that $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots$

(08 Marks)

OR

- 2 a. Find the Fourier series of the periodic function defined by $f(x) = 2x - x^2$, $0 < x < 3$. (06 Marks)
b. Show that the half range sine series for the function $f(x) = lx - x^2$ in $0 < x < l$ is

$$\frac{8l^2}{\pi^3} \sum_{n=1}^{\infty} \frac{1}{(2n+1)^3} \sin\left(\frac{2n+1}{l}\pi x\right)$$

(05 Marks)

- c. Express y as a Fourier series upto 1st harmonic given :

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

(05 Marks)

Module-2

- 3 a. Find the Fourier transform of

$$f(x) = \begin{cases} 1-|x|, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$$

and hence deduce that $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$

(06 Marks)

- b. Find the Fourier Sine and Cosine transforms of $f(x) = e^{-\alpha x}$, $\alpha > 0$.

(05 Marks)

- c. Solve by using z -transforms $y_{n+1} + \frac{1}{4}y_n = \left(\frac{1}{4}\right)^n$ ($n \geq 0$), $y_0 = 0$.

(05 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.



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OR

- 4 a. Find the Fourier transform of $f(x) = e^{-|x|}$. (06 Marks)
b. Find the Z – transform of $\sin(3n + 5)$. (05 Marks)
c. Find the inverse Z – transform of: $\frac{z}{(z-1)(z-2)}$. (05 Marks)

Module-3

- 5 a. Find the correlation coefficient and the equation of the line of regression for the following values of x and y. (06 Marks)

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

- b. Find the equation of the best fitting straight line for the data : (05 Marks)

x	0	1	2	3	4	5
y	9	8	24	28	26	20

- c. Use Newton – Raphson method to find a real root of the equation $x \log_{10} x = 1.2$ (carry out 3 iterations). (05 Marks)

OR

- 6 a. Obtain the lines of regression and hence find the coefficient of correlation for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

- b. Fit a second degree parabola to the following data : (05 Marks)

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

- c. Use the Regula–Falsi method to find a real root of the equation $x^3 - 2x - 5 = 0$, correct to 3 decimal places. (05 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. (06 Marks)

- b. Construct the interpolation polynomial for the data given below using Newton's divided difference formula :

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

- c. Use Simpson's $\frac{1}{3}$ rd rule with 7 ordinates to evaluate $\int_2^8 \frac{dx}{\log_{10} x}$. (05 Marks)



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OR

- 8 a. Given $f(40) = 184$, $f(50) = 204$, $f(60) = 226$, $f(70) = 250$, $f(80) = 276$, $f(90) = 304$, find $f(38)$ using Newton's forward interpolation formula. (06 Marks)
- b. Use Lagrange's interpolation formula to fit a polynomial for the data :

x	0	1	3	4
y	-12	0	6	12

Hence estimate y at $x = 2$. (05 Marks)

- c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule taking seven ordinates and hence find $\log_e 2$.

(05 Marks)

Module-5

- 9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ using Green's theorem in a plane. (06 Marks)

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

- c. Find the extremal of the functional : $\int_{x_1}^{x_2} [y' + x^2(y')^2] dx$. (05 Marks)

OR

- 10 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 $y = x^2$. (06 Marks)

- b. If $\vec{F} = 2xy\mathbf{i} + yz^2\mathbf{j} + xz\mathbf{k}$ and S is the rectangular parallelepiped bounded by $x = 0$, $y = 0$,

$z = 0$, $x = 2$, $y = 1$, $z = 3$ evaluate $\iint_S \vec{F} \cdot \hat{n} ds$. (05 Marks)

- c. Find the geodesics on a surface given that the arc length on the surface is

$S = \int_{x_1}^{x_2} \sqrt{x[1 + (y')^2]} dx$. (05 Marks)
