CBCS SCHEME

USN | | | | | | | | | |

17MAT31

Third Semester B.E. Degree Examination, June/July 2024
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. Obtain the fourier series of the function $f(x) = x - x^2$ in $-\pi \le x \le \pi$ and hence deduce $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots$ **(08 Marks)**

b. Obtain the Half Range Fourier cosine series for the $f(x) = \sin x$ in $[0, \pi]$. **(06 Marks)**

c. Obtain the constant term and the coefficients of first sine and cosine terms in the fourier expansion of y given

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

(06 Marks)

OR

2 a. Obtain the fourier series of $f(x) = \frac{\pi - x}{2}$ in $[0, 2\pi]$ and hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots$ **(08 Marks)**

b. Find the fourier half range cosine series of the function $f(x) = 2x - x^2$ in $[0, 3]$ **(06 Marks)**

c. Express y as a fourier series upto first harmonic given

x :	0	30	60	90	120	150	180	210	240	270	300	330
y :	1.8	1.1	0.30	0.16	1.5	1.3	2.16	1.25	1.3	1.52	1.76	2.0

(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 $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

Module-3

5 a. Find the correlation coefficient using the following table as values: **(08 Marks)**

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

b. Obtain an equation of the form $y = ax + b$ given that, **(06 Marks)**

x	0	5	10	15	20	25
y	12	15	17	22	24	30

c. Apply Regula-Falsi method to find the root of $xe^x = \cos x$ in four approximations with four decimals in (0, 1). **(06 Marks)**

OR

6 a. Obtain the regression line of y on x for the following table of values: **(08 Marks)**

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

b. Fit a parabola $y = a + bx + cx^2$ to the following data: **(06 Marks)**

x	20	40	60	80	100	120
y	5.5	9.1	14.9	22.8	33.3	46

c. Find the root of the equation $x^4 - x - 9 = 0$ by Newton-Raphson method in three approximations with three decimal places. (Take $x_0 = 2$) **(06 Marks)**

Module-4

7 a. From the following table, estimate the number of students who obtained marks between 40 and 45.

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

(08 Marks)

b. Use Newton's dividend formula to find f(9) for the data:

x :	5	7	11	13	17
f(x) :	150	392	1452	2366	5202

(06 Marks)

c. Find the approximate value of $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by Simpson's $\frac{1}{3}^{rd}$ rule by dividing $\left[0, \frac{\pi}{2}\right]$ into 6 equal parts. **(06 Marks)**

OR

8 a. The area A of a circle of diameter d is given for the following values:

d :	80	85	90	95	100
a :	5026	5674	6362	7088	7854

Calculate the area of circle of diameter 105 by Newton's backward formula. **(08 Marks)**

b. Using Lagrange's interpolation formula to find the polynomial which passes through the points (0, –12), (1, 0), (3, 6), (4, 12). **(06 Marks)**

c. Evaluate $\int_4^{5.2} \log_e x\, dx$ taking 6 equal parts by applying Weddle's rule. **(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 boundary of the region defined by $x = 0$, $y = 0$, $x + y = 1$. **(08 Marks)**

b. Evaluate $\oint_C \vec{F}.\vec{dr}$ by Stoke's theorem with $\vec{F} = y^2\hat{i} + x^2\hat{j} - (x + z)\hat{k}$ and C is the boundary of the triangle with vertices at, (0, 0, 0), (1, 0, 0) and (1, 1, 0). **(06 Marks)**

c. Show that the geodesies on a plane are straight lines. **(06 Marks)**

OR

10 a. Find $\iint_S \vec{F}.\vec{dS}$, where $F = (2x + 3z)\hat{i} - (xz + y)\hat{j} + (y^2 + 2z)\hat{k}$ and S is the surface of the sphere having center at (3, -1, 2) and radius 3. (Use Gauss divergence theorem). **(08 Marks)**

b. Derive Euler's equation with usual notations as, $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(06 Marks)**

c. Find the extremals of the functional,

$\int_{x_0}^{x_1} \left(\frac{y'^2}{x^3}\right) dx$. **(06 Marks)**

* * * * *