CBCS SCHEME

USN | | | | | | | | | | |

17MAT31

Third Semester B.E. Degree Examination, July/August 2022
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 of $f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$.

Hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$. **(08 Marks)**

b. Find the Fourier Half – range sine series of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \end{cases}$. **(06 Marks)**

c. Express y as a Fourier Series upto first harmonics for the following table : **(06 Marks)**

X	0	1	2	3	4	5
Y	4	8	15	7	6	2

OR

2 a. Compute the first two harmonics of the Fourier Series of f(x) given the following table :

x :	0	π/3	2π/3	π	4π/3	5π/3	2π
f(x) :	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(08 Marks)

b. Find the Fourier series of $f(x) = x^2 - 2$ when $-2 < x < 2$. **(06 Marks)**

c. Obtain the Fourier Cosine series for $f(x) = \begin{cases} \cos x, & 0 < x < \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < x < \pi \end{cases}$. **(06 Marks)**

Module-2

3 a. Find the Infinite Fourier transform of

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

b. If the Fourier sine transform of f(x) is given by $F_s(\alpha) = \frac{\pi}{2} e^{-2\alpha}$, find the function f(x). **(06 Marks)**

c. Find the Z – transform of $3n - 4\sin\frac{n\pi}{4} + 5a$. **(06 Marks)**

OR

4 a. Find the Fourier Cosine transform of e^{-ax}, hence evaluate $\int_0^\infty \frac{\cos\lambda x}{x^2 + a^2} dx$. **(08 Marks)**

b. Find the inverse Z – transform of $\frac{5Z}{(2 - z)(3z - 1)}$. **(06 Marks)**

c. Solve $u_{n+2} - 5u_{n+1} + 6u_n = 1$, with $u_0 = 0$, $u_1 = 1$, by using Z – transform method. (06 Marks)

Module-3

5 a. Calculate the coefficient of correlation and obtain the lines of regression for the following data :

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

(08 Marks)

b. Fit a Parabola to the following data :

x :	1	2	3	4	5
y :	2	6	7	8	10

(06 Marks)

c. Use Newton – Raphson method to find a real root of equation $x \sin x + \cos x = 0$ near $x = \pi$, correct to four decimal places. (06 Marks)

OR

6 a. In a partially destroyed laboratory record of correlation data, the following results only are available : Variance of x is 9. Regression equations are $8x - 10y + 66 = 0$, $40x - 18y = 214$. Find i) the mean values of x and y ii) standard deviation of y iii) the coefficient of correlation between x and y. (08 Marks)

b. By the method of least squares, fit a straight line to the following data : as $y = ax + b$.

x :	1	2	3	4	5
y :	14	13	9	5	2

(06 Marks)

c. Compute the real root of the equation $x \log_{10} x - 1.2 = 0$, lying between 2.7 and 2.8 correct to four decimal places, using the method of false position. (06 Marks)

Module-4

7 a. Given $\sin 45^0 = 0.7071$, $\sin 50^0 = 0.7660$, $\sin 55^0 = 0.8192$, $\sin 60^0 = 0.8660$, find $\sin 57^0$ using an appropriate Interpolation formula.. (08 Marks)

b. A curve passes through the points (0, 18), (1, 10), (3, -18) and (6, 90). Find the polynomial f(x) using Lagrange's formula. (06 Marks)

c. Use Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule to find $\int_0^{0.6} e^{-x^2}\, dx$ by taking seven ordinates. (06 Marks)

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) and f(85) using suitable Interpolation formulae. (08 Marks)

b. Use Newton's divided difference formula to find f(40), given the data :

x	0	2	3	6
f(x)	-4	2	14	158

(06 Marks)

c. Use Weddle's rule to compute the area bounded by the curve y = f(x), x - axis and the extreme ordinates from the following table : (06 Marks)

x :	0	1	2	3	4	5	6
y :	0	2	2.5	2.3	2	1.7	1.5

Module-5

9 a. Using Gauss – divergence theorem, evaluate $\int_S \vec{F}.d\vec{s}$, where $\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and s is the surface bounding the region $x^2 + y^2 = 4$, $z = 0$ and $z = 3$. **(08 Marks)**

b. Find the work done in moving a particle in the force field $\vec{F} = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$, along the Straight from (0, 0, 0) to (2, 1, 3). **(06 Marks)**

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

OR

10 a. Verify Stoke's theorem for the vector field $\vec{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ over the upper half surface $x^2 + y^2 + z^2 = 1$, bounded by its projection on the xy – plane. **(08 Marks)**

b. Find the Geodesics on a plane. **(06 Marks)**

c. A heavy cable hangs freely under gravity between two fixed points. Show that the shape of the cable is a catenary. **(06 Marks)**

* * * * *