Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, December 2024

Course: Introduction to MATLAB Programming **Semester: III**

Program: BSc Math by Research **Time: 03 hrs.**

Course Code: CSEG2054K **Max.Marks: 100**

Instructions: Answer all the questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	The following matrix is defined in MATLAB: $N = \begin{bmatrix} -2 & -23 & 4 \\ 56 & 343 & 5 \\ -9 & -2 & 5 \end{bmatrix}$ Write the output that will be displayed if the following commands are executed by MATLAB a) $A = [N(1,1:3)', N(2,2:3)']$ b) $B = [N(:,3)'\ \ N(3,:)]$	**4**	**CO1**
Q 2	Write a MATLAB script to find the first, second and third derivative of the following function using *syms*. $\sin(2x^3)$	**4**	**CO4**
Q 3	Write MATLAB commands to compute the following integral numerically and symbolically: $\int_0^8 (xe^{-x} + 0.2)dx$	**4**	**CO4**
Q 4	Write MATLAB commands to carry out the following multiplication of two polynomials: $(2x^2 + 3)(x^3 + 3.5x^2 + 5x - 16)$	**4**	**CO3**
Q 5	Write MATLAB commands to calculate the following integrals: a) $\int_1^6 \frac{(2x^2)}{\sqrt{1+x}} dx$ b) $\int_1^2 \frac{e^{2x}}{x}\ dx$	**4**	**CO4**

SECTION B **(4Qx10M= 40 Marks)**			
Q 6	The graph of the function $f(x) = ax^4 + bx^3 + cx^2 + dx + e$ passes through the points $(-4, -7.6), (-2, -17.2), (0.2, 9.2), (1, -1.6)$, and $(4, -36.4)$. Determine the constants a, b, c, d, and e. (Write a system of five equations with five unknowns and use MATLAB commands to solve the equations.)	**10**	**CO4**
Q 7	The following points are given: x: $-5, -3.4, -2, -0.8, 0, 1.2, 2.5, 4, 5, 7, 8.5$ y: $4.4, 4.5, 4, 3.6, 3.9, 3.8, 3.5, 2.5, 1.2, 0.5, -0.2$ Write MATLAB commands to (a) Fit the data with a first-order polynomial and to make a plot of the points and the polynomial. (b) Fit the data with an eight-order polynomial and to make a plot of the points and the polynomial.	**10**	**CO3**
Q 8	Write MATLAB commands for the following: a) Solve $\frac{dy}{dx} = \sqrt{x} + \frac{x^2\sqrt{y}}{4}$ with $y(1) = 1$. b) Determine the solution of the equation $3 + 3\sin x = 0.5x^3$. c) Determine the positive roots of the equation $x^2 - 5x\sin(3x) + 3$.	**10**	**CO4**
Q 9	Write a program in a script file that finds the smallest odd integer that is divisible by 11 and whose square root is greater than 132. Use a loop in the program. The loop should start from 1 and stop when the number is found. The program prints the message "The required number is:" and then prints the number. **OR** Write a program (using a loop) that determines the expression $$\sqrt{12}\sum_{n=0}^{m}\frac{\left(-\frac{1}{3}\right)^n}{2n+1}.$$ for $m = 5, m = 10$, and $m = 20$. (Use loop for m as well)	**10**	**CO2**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	The monthly payment M of a loan amount P for y years and with interest rate r can be calculated by the formula: $$M = \frac{P\left(\frac{r}{12}\right)}{1 - \left(1 + \frac{r}{12}\right)^{-12y}}$$ Using MATLAB commands, calculate the monthly payment and the total payment for a \$1,00,000 loan for $10, 11, 12, \ldots, 29, 30$ years with an	**20**	**CO2**

	interest rate of 4.85% and display the results in a three-column table where the first column is the number of years, the second is the monthly payment, and the third is the total payment.		
Q 11	A 24 ft–long rod is cut into 12 pieces, which are welded together to form the frame of a rectangular box. The length of the box's base is three times its width. Write MATLAB commands to (a) Create a polynomial expression for the volume V in terms of x. (b) Make a plot of V versus x. (c) Determine the value of x that maximizes the volume and determine that volume. **OR** The Taylor series for $\sin x$ is: $$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \cdots$$ Write MATLAB commands to plot in the same figure, for $-2\pi \leq x \leq 2\pi$, the graph of the function $sin(x)$ and graphs of the Taylor series expansion of $sin(x)$ with one, two, and five terms.	**20**	**CO3**