

INDIAN INSTITUTE OF TECHNOLOGY MANDI
SCHOOL OF MECHANICAL AND MATERIALS ENGINEERING

ME620: Modeling and Simulation

Lab Home Assignment #2

DOS: 15.02.23

Q 1. Write a script file named *sineseries.m* that computes the value of $\sin(x)$ at a given x using n terms of the series expansion of the sine function:

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

Take: $x = [0 \pi/6 \pi/4 \pi/3 \pi/2]$; $n = 1, 5, 10$ and 20 .

Q 2. A particle is projected from the ground with a velocity of 20 m/s at angles varying from 0 to 50°. Write a MATLAB code to determine the maximum height, total time, and range.

Q 3. Write m-files (script and function) that will calculate the volume of a hollow sphere i.e., $\frac{4\pi}{3}(r_o^3 - r_i^3)$. Here, subscript 'i' stands for inner and 'o' for outer.

Q 4. Write a function to convert temperature from C to F. (use script, function, *for* loop and vectorization) and plot the results. Assume the values for input.

Q 5. Plot the function $y = \frac{e^{\sqrt{x}}}{\sqrt[3]{x^2 - xe^x}}$, $0 \leq x \leq 100$.

Q 6. The butterfly curve is given by the following parametric equations

$$x = \sin(t) \left(e^{\cos t} - 2 \cos 4t - \sin^5 \frac{t}{12} \right)$$
$$y = \cos(t) \left(e^{\cos t} - 2 \cos 4t - \sin^5 \frac{t}{12} \right)$$

Generate values of x and y for $t=0:1/16:100$. Construct plots of (a) x and y v/s t (b) y v/s x . Use subplot.

Q 7. The damping constant (c) of the dashpot is given by

$$c = \frac{6\pi\mu l}{h^3} \left[\left(a - \frac{h}{2} \right)^2 - r^2 \right] \left[\frac{a^2 - r^2}{a - \frac{h}{2}} - h \right]$$

consider $\mu=0.3445$ Pa-s, $l=10$ cm, $0.05 \text{ cm} \leq h \leq 0.10 \text{ cm}$, $2 \text{ cm} \leq a \leq 4 \text{ cm}$ and $0.5 \text{ cm} \leq r \leq 1 \text{ cm}$.

Use MATLAB to plot the variations of the damping constant c with respect to h , a , and r .
