**Lab:1**

**Title:** To study the dynamics of Spring Mass Damper System and analyze the response on parameter variation

**Apparatus Required:**

1. Matlab Software

**Theory:**

The system of equation that defines the dynamics of Spring Mass Damper System can be written as:

This is a second order differential equation. There are two states in this system which are defined as , where first one is the position and later one is the velocity of the mass i.e.

and .

The state space representation of the system can be written as:

The above equations are the state space representation of SMD system. This equation can be solved to obtain the solution of position and velocity of mass for input force F and given initial condition.

**Procedure:**

The system of equation defined for the motion of dynamics of SMD can be solved numerically using ODE solver toolbox of MATLAB. For this a function file is created to define the system function and a script file is created to solve and analyze the results. The program flow for function file is given below:

function x\_dot = SMD(t,x)

end

Similarly, the program code for solving the system for given initial condition and time span is given below:

**Results:**

The response of system for m = 1, b = 2, k =3 for input force 1 N step is shown below:

The response of system for m = 2, b = 2, k = 3 for input force 1 N step is shown below:

The response of system for m = 1, b = 0.5, k = 3 for input force 1 N step is shown below:

The response of system for m = 1, b = 2 and k = 10 for input force 1N step is shown below:

**Discussion:**

Write on at least 100 words on your understanding on the dynamics of SMD for different parameters.

Note: Don’t print the graphs and figure, observe the graph and draw free hand on report.