APPARATUS:

Software: MATLAB

THEORY:

The time response has utmost importance for the design and analysis of control systems because these are inherently time domain systems where time is independent variable. During the analysis of response, the variation of output with respect to time can be studied and it is known as time response. To obtain satisfactory performance of the system with respect to time must be within the specified limits. From time response analysis and corresponding results, the stability of system, accuracy of system and complete evaluation can be studied easily.

Due to the application of an excitation to a system, the response of the system is known as time response and it is a function of time. The two parts of response of any system:

(i) Transient response

(ii) Steady-state response.

Transient response: The part of the time response which goes to zero after large interval of time is known as transient response.

Steady state response: The part of response that means even after the transients have died out is said to be steady state response.

The total response of a system is sum of transient response and steady state response:

$C(t)=C_{tr}(t)+C_{ss}(t)$

TIME RESPONSE OF SECOND ORDER CONTROL SYSTEM:

A second order control system is one wherein the highest power of 's' in the denominator of its transfer function equals 2.

Transfer function is given by:

$$TF=\frac{\omega n^2}{s^2+2\delta\omega ns+\omega n^2}$$

ω_n—is called natural frequency of oscillations.

$\omega_d=\omega_n\sqrt{1-\delta^2}$ is called damping frequency oscillations.

δ −affects damping and called damping ratio.

$\delta\omega n$ – is called damping factor or actual damping or damping coeeficient.

MATLAB PROGRAM:

```
wn=input('enter value of undamped natural frequency')

z=input('enter value of damping ratio')

n=[wn*wn]

p=sqrt(1-z^2)

wd=wn*p

h=[p/z]

k=atan(h)

m=pi-k;

tr=[m/wd]

tp=[pi/wd]

q=z*wn

ts=[h/q]

r=z*pi

f=[r/p]

mp=exp(-f)

num=[0 0 n]

den=[1 2*z*wn n]

s=tf(num,den)

hold on

step(s)

impulse(s)

hold off
```

PROCEDURE:

1.Time response of the system is being found when we give the values of natural undamped frequency and damping ratio.

2.When we give these values first rise time ,peak time,peak overshoot,transfer function are being calculated.

3.Then “ step(s)” And “impulse(s)” generates time response of the system.

5.The hold function determines whether new graphics object are added to the graph or replaces objects in the graph.

6.hold on retains the current plot and certain axes properties so that subsequent graphing command add to the existing graph.

7.hold off resets axes properties to their defaults before drawing new plots.hold off is the default.

THEORETICAL CALCULATIONS:

GRAPH:

RESULT: