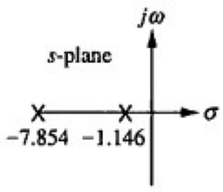
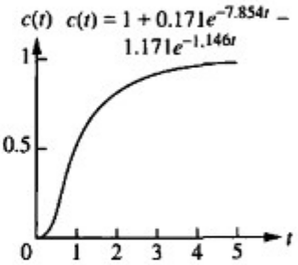
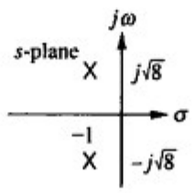
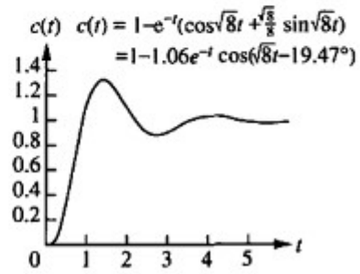
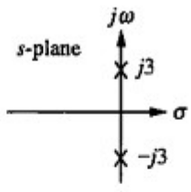
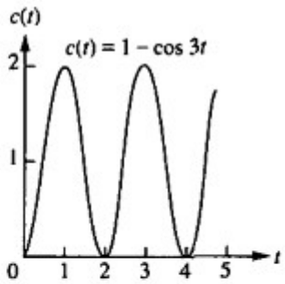
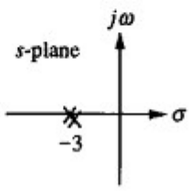
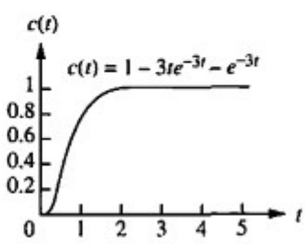
Phase 1

1. System Response of I & II order systems

   Find time domain specifications of first order and second order system response to step, ramp and sinusoidal inputs, *manual calculation, and plotting system response using Matlab program.*

PROBLEM: A system has a transfer function, $G(s) = \dfrac{50}{s+50}$. Find the time constant, T_c, settling time, T_s, and rise time, T_r.

ANSWER: $T_c = 0.02\,\text{s}$, $T_s = 0.08\,\text{s}$, and $T_r = 0.044\,\text{s}$.

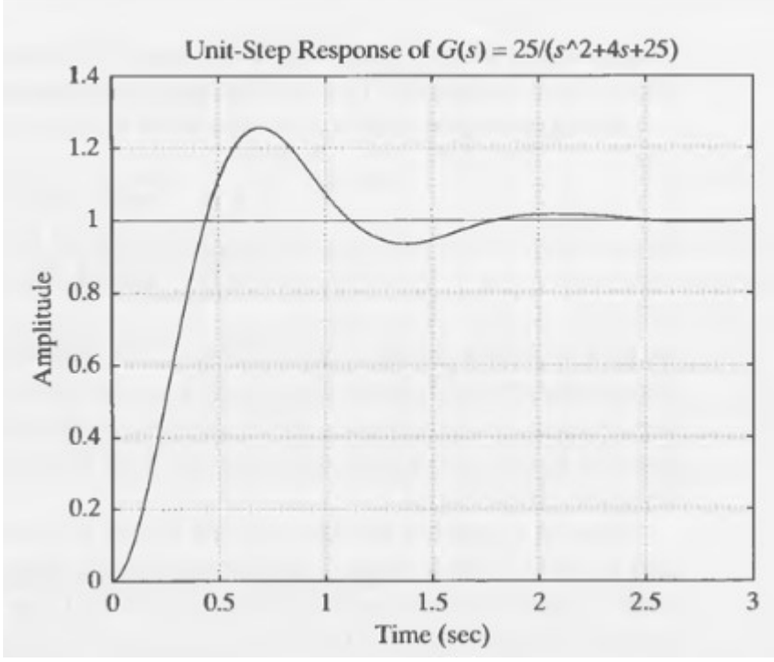
System	Pole-zero plot	Response
(a) $R(s)=\frac{1}{s}$ → $G(s)=\frac{b}{s^2+as+b}$ → $C(s)$ General		
(b) $R(s)=\frac{1}{s}$ → $G(s)=\frac{9}{s^2+9s+9}$ → $C(s)$ Overdamped		
(c) $R(s)=\frac{1}{s}$ → $G(s)=\frac{9}{s^2+2s+9}$ → $C(s)$ Underdamped		
(d) $R(s)=\frac{1}{s}$ → $G(s)=\frac{9}{s^2+9}$ → $C(s)$ Undamped		
(e) $R(s)=\frac{1}{s}$ → $G(s)=\frac{9}{s^2+6s+9}$ → $C(s)$ Critically damped		

MATLAB representation of linear systems. The transfer function of a system is represented by two arrays of numbers. Consider the system

$$\frac{C(s)}{R(s)} = \frac{25}{s^2 + 4s + 25} \tag{4–38}$$

MATLAB Program 4–1

```
% ----------Unit-step response----------

% ***** Enter the numerator and denominator of the transfer
% function *****

num = [0    0    25];
den = [1    4    25];

% ***** Enter the following step-response command *****

step(num,den)

% ***** Enter grid and title of the plot *****

grid
title ('Unit-Step Response of G(s) = 25/(s^2 + 4s + 25)')
```



Obtain the unit-impulse response of the following system:

$$\frac{C(s)}{R(s)} = G(s) = \frac{1}{s^2 + 0.2s + 1}$$

MATLAB Program 4–5

```
num = [0   0   1];
den = [1   0.2   1];
impulse(num,den);
grid
title('Unit-Impulse Response of G(s) = 1/(s^2 + 0.2s + 1)')
```