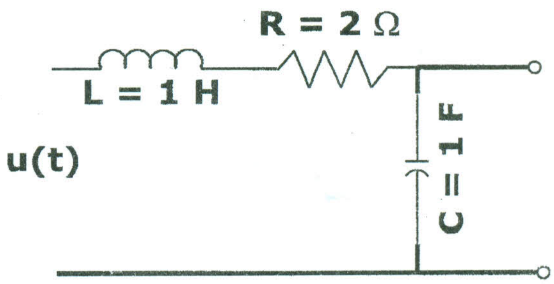
Computer and Sys. Dept.
Time Allowed: 3 Hrs.
2nd Year Students.
Total Marks:
2011 – 2012

System Modeling and Simulation
Final Exam
Date: 22 / 1 / 2012
Time allowed: 3 Hours

Question 1

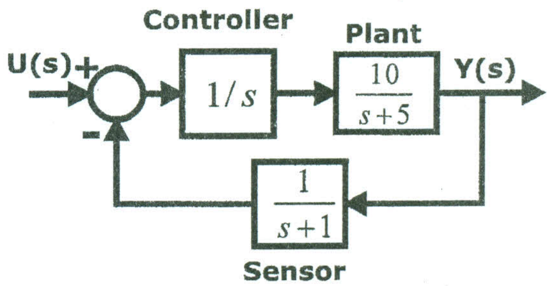
Write the dynamic equations describing the circuit shown below. Write the equations as a second-order differential equation in $y(t)$. Assuming a zero input, solve the differential equation for $y(t)$ using Laplace transform methods for the parameter values and initial conditions shown in figure. Verify your answer using the **initial** command in MATLAB



$$y(t_o) = 1 \quad \dot{y}(t_o) = 0$$

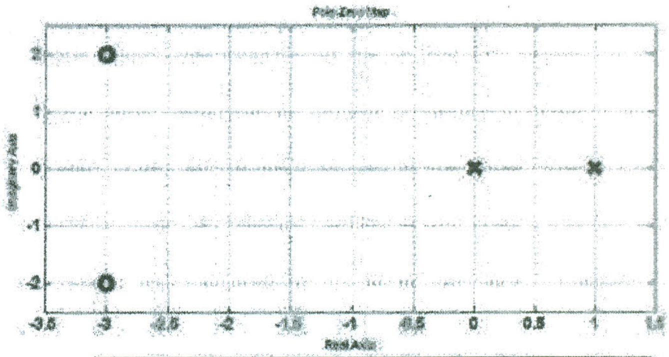
Question 2

- Obtain a state-space model for the system shown below
- Draw the state diagram



Question 3

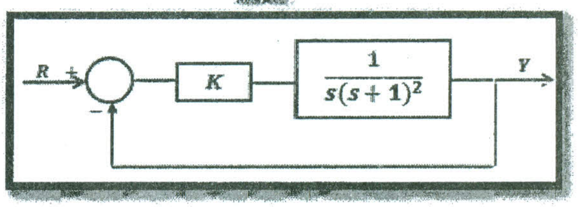
A. The figure below shows the pole-zero map for an open-loop system, sketch the root locus diagram
B. Find imaginary axis crossing
C. Write down a MATLAB code that can draw the root locus for this system



Question 4

For figure shown below:

A. Sketch the Polar Plot
B. Find Range of **K** for system stability using Nyquist criterion



Question 5

1- A system is described by:

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ 8 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}1\\ 1\end{bmatrix}u$$

$$y = \begin{bmatrix}4 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

With initial conditions of $x(0) = \begin{bmatrix}1\\ -4\end{bmatrix}$ and $u(t) = 0$

A. Find the **eigenvalues** of the system – judge the system stability
B. Find the **response** of the system $y(t)$
C. Obtain the **transfer** function $\frac{Y(s)}{U(s)}$

Best wishes **Dr. Mostafa A. El-Hosseini** **www.melhosseini.net**