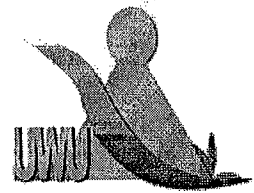




Uva Wellassa University, Sri Lanka
End Semester Examination – February/March 2012
SCT 462-2 Control Theory



Time: Two (02) hours

Total 04 Questions
Answer All Questions

01)

I. Explain Closed-Loop Control and Open-Loop Control in control engineering. What are the advantages and disadvantages of each of the above systems?

(30 marks)

II. Consider the mechanical system shown in Figure 1, where $m = 1$ kg, $b = 3$ N-sec/m, and $k = 2$ N/m. Assume that at $t = 0$ the mass m is pulled downward such that $x(0) = 0.1$ m and $\dot{x}(0) = 0.05$ m/sec.

- Obtain the mathematical equation for the motion of the mass. (Assume no external forcing function.)
- Obtain the Laplace transform of the system subjected to the initial condition.
- Using partial fraction method, obtain time domain response for the above system and plot it.

(70 marks)

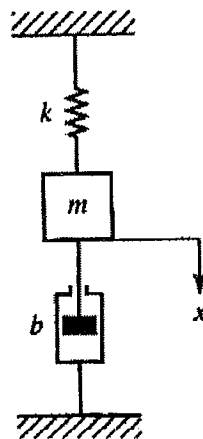


Figure. 1

02)

I. What is Root-Locus analysis? Explain it using Angle and Magnitude Criteria.

(30 marks)

II. Consider the system shown in Figure 2. (Assume that the value of K is nonnegative).

You are required to answer following questions clearly explaining each step of the answer.

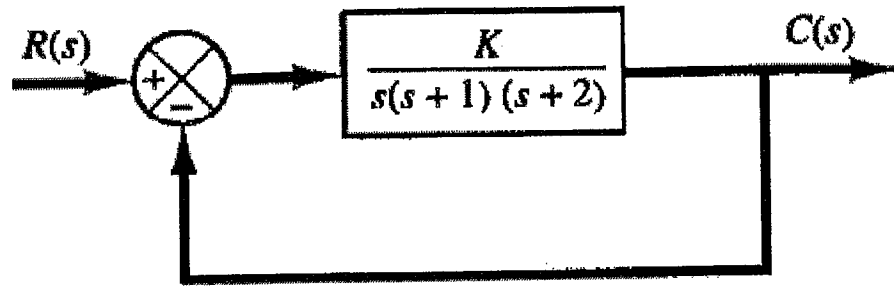


Figure. 2

- Determine root loci on the real axis
- Determine the asymptotes of the root loci.
- Determine the breakaway point.
- Determines the points where root loci crosses imaginary axis.
- Draw the root loci, based on the information you obtained for above questions.
- Determine a pair of dominant complex-conjugate closed-loop poles such that the damping ratio is 0.5.

(70 marks)

03)

- Simplify the block diagram shown in following figure and obtain the transfer function $C(s)/R(s)$.

(30 marks)

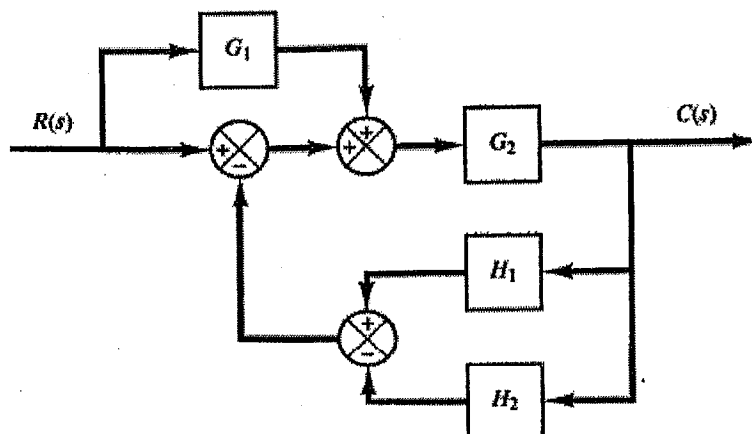


Figure. 3

II. You are required to draw the Bode-Plot for the transfer function given below

$$G(s) = \frac{10(s+3)}{s(s+2)(s^2+s+2)}$$

- Determine gain factors, integrating factors, first order factors and quadratic factors for the above system.
- Identify corner frequencies for each of the above factors.
- Plot magnitude and phase plot for each of the above factors in the given logarithmic sheet. (Clearly name each factors in graph).
- Complete the Bode- Plot for the above system.

04)

I. State Routh-Hurwitz stability criterion clearly mentioning sufficient and necessary conditions for a dynamic system.

(30 marks)

II. Closed loop control system is shown in the following Figure 4.

- Referring to the system shown in Figure 4 determine the transfer function in standard form.
- Obtain the characteristic equation of the system.
- Using Routh-Hurwitz stability criterion obtain maximum value of proportional controller gain constant (K_1) for the stability of the closed loop system.

(70 marks)

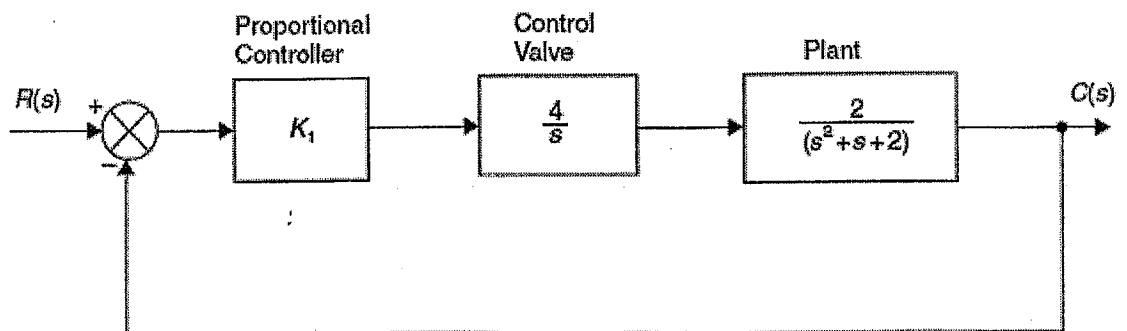


Figure 4



