Uva Wellassa University, Sri Lanka
End Semester Examination – March 2011
SCT 462-2 Control Theory

Time: Two (02) hours

Total 04 questions
Answer **all** questions

01)

I. Explain transient response and steady state response in analyzing time domain response for any dynamic system.

(30 marks)

II. Consider the mechanical system shown in Figure 1. For the this system numerical values of m, b and k are given as m= 1 Kg , C=2N-sec/m, and k=100N/m . The mass is displaced 0.05 m and released without initial velocity.

a. Derive the transfer function for the system.
b. Find undammed natural frequency and the damping ratio of the above system.
c. Find the frequency observed in the vibration.
d. In addition find the amplitude four cycles later.

(70 marks)

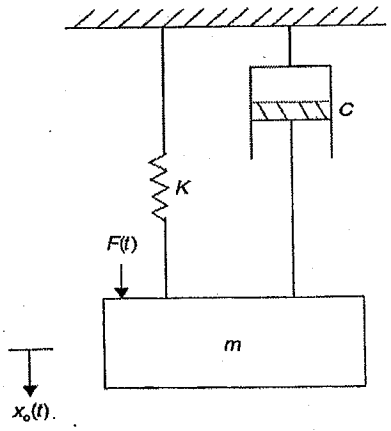

Figure. 1

02)

I. Explain how Root-Locus analysis can be used to determine the stability of a system.

(30 marks)

II. Consider the system shown in Figure 2. (Assume that the value of K_1 is nonnegative).

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

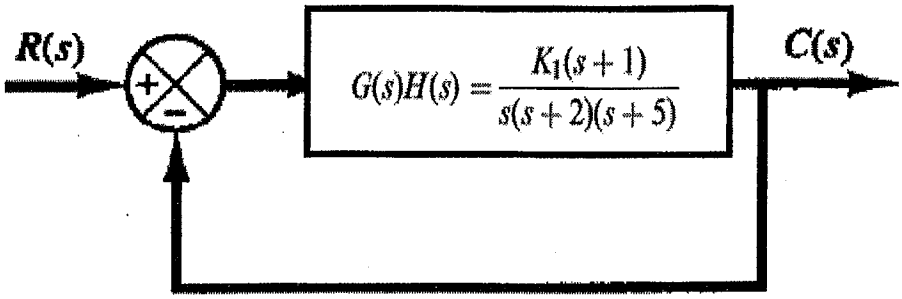

Figure. 2

a) Determine root loci on the real axis
b) Determine the asymptotes of the root loci.
c) Determine the breakaway point.
d) Determines the points where root loci crosses imaginary axis.
e) Draw the root loci, based on the information you obtained for above questions.

(70 marks)

03)

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

(30 marks)

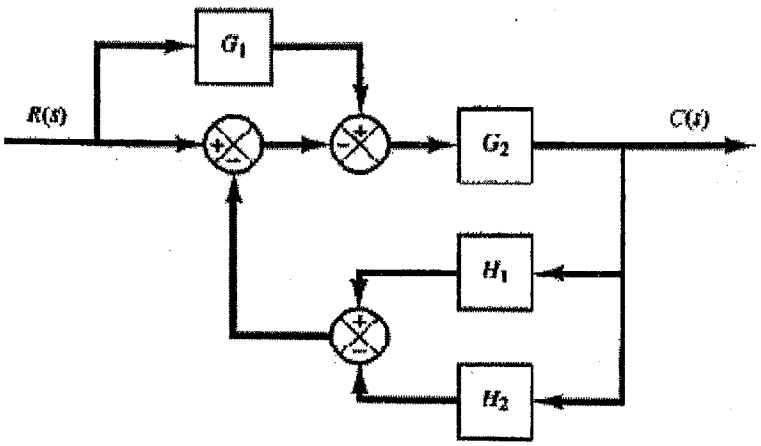

Figure. 3

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

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

a) Determine gain factors, integrating factors, first order factors and quadratic factors for the above system.

b) Identify corner frequencies for each of the above factors.

c) Plot magnitude and phase plot for each of the above factors in the given logarithmic sheet. (Cleary name each factors in graph).

d) 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.

a) Referring to the system shown in Figure 4 determine the transfer function in standard form.

b) Obtain the characteristic equation of the system.

c) Using Routh-Hurwitz stability criterion obtain maximum value of proportional controller gain constant (K1) for the stability of the closed loop system.

(70 marks)

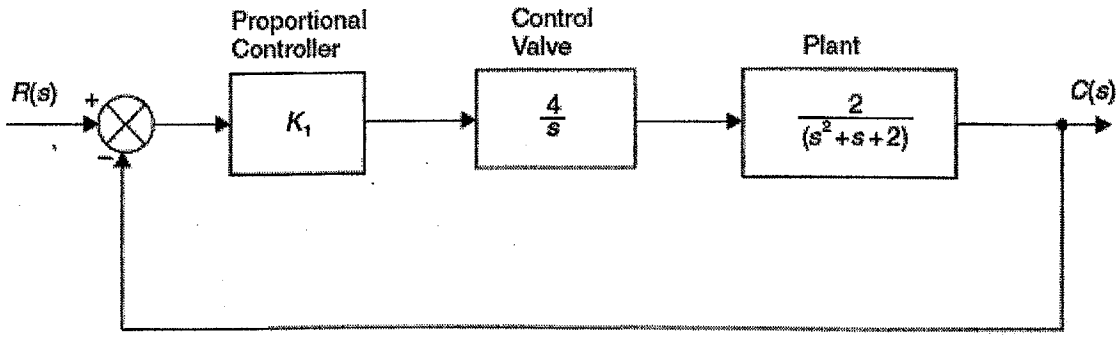

Figure 4

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