

**FACULTY OF ENGINEERING**  
**B.E. 3/4 (Mech) II-Semester (Main) Examination, May 2013**

**Subject : Control System Theory**

**Time : 3 Hours**

**Max. Marks: 75**

**Note: Answer all questions of Part - A and answer any five questions from Part-B.**

**PART – A (25 Marks)**

1. State the objectives of control system design.
2. Find the behaviour at Infinity for a system given by  $G(s) = \frac{1}{s(s-1)}$
3. State Mason's Gain formula.
4. Compare between block diagram and signal flow graph methods.
5. A thermometer requires 1 min to indicate 98% of the response to a step input. Assuming the thermometer to be first order system, find the time constant.
6. What is the effect of adding a zero to the closed loop transfer function?
7. Compare AC and DC servomotors.
8. Compare between Block diagram and signal flow graph methods.
9. What is the effect of a PI controller on the system performance?
10. If  $A = \begin{bmatrix} -2 & 1 \\ -2 & 0 \end{bmatrix}$ , Find  $\phi(t)$ .

**PART – B (5x10=50 Marks)**

11. Find the transfer function  $X_3(S) / F(s)$  for the given translational mechanical system in figure 1. (10)

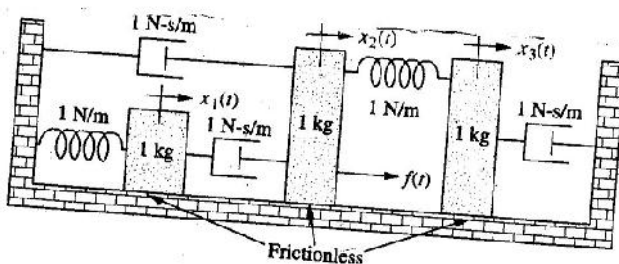


Figure 1

- 12.(a) Using Mason's rule for the given system in figure 2 find the transfer function

$$T(s) = \frac{C(S)}{R(s)} \tag{5}$$

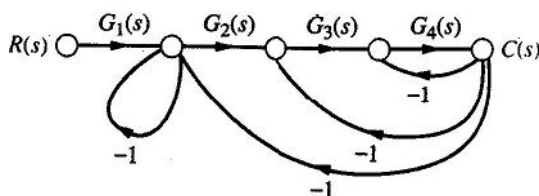


Figure 2

- (b) For the system given in figure 1 determine the value of 'k' such that the damping ratio is 0.5 and then obtain rise time, peak time, maximum overshoot, settling time for a given unit response. (5)

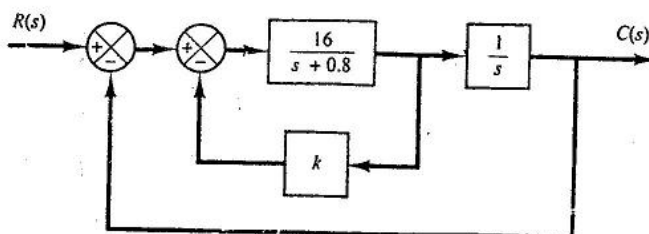


Figure 3

..2..

13. Plot the root loci for a closed loop control system with unity feedback is given by

Locate  $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$  the closed poles on the root loci such that the dominant closed loop poles have a damping Ratio equal to 0.5 and find the corresponding value of K. (10)

14. With the help of Bode plots, determine stability of a system represented by unity

open loop transfer function  $G(s) = \frac{10K(s+0.5)}{s^2(s+2)(s+10)}$  (10)

15. Apply Nyquist criterion and determine the range of stability of a system represented by unity feedback equation (10)

$$G(s) = \frac{K(s-4)}{s(s+8)}$$

16. Check the controllability and observability of a system represented by unity feedback system (10)

$$G(s) = \frac{s^2 + 7s + 10}{s^3 + 8s^2 + 19s + 122}$$

17. Write short notes on the following: (10)

- (a) PID Controller
- (b) Correlation between Transient response and frequency response of a 2nd order system
- (c) Servomotors

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