Code No. 2388 / N

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 $\varnothing$ (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)

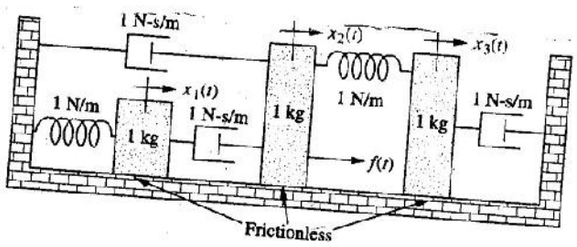

Figure 1

12.(a) Using Mason's rule for the given system in figure 2 find the transfer function $T(s) = \frac{C(S)}{R(s)}$ (5)

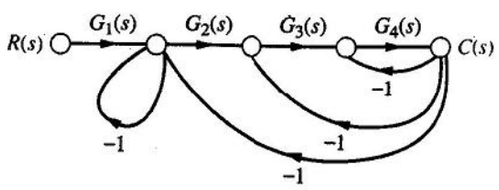

Figure 2

(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)

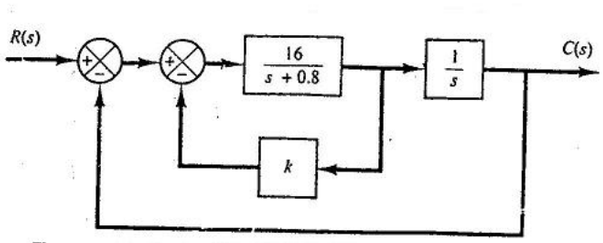

Figure 3

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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