Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – WINTER 2013

Subject Code: 160104 **Date: 06-12-2013**

Subject Name: Basic Control Theory

Time: 02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define transient response specifications with neat diagram along with equations. **07**

(b) Find system equation and derive F→I analogy network for fig.1 (b). **07**

Q.2 **(a)** An unity feedback system has a loop transfer function **07**

$$G(s) = \frac{10(s+1)}{s(s+2)(s+5)}$$

Determine (i) Stability gain (ii) step, ramp, parabolic coefficients (iii)e_{ss} when r(t)=3+10t.

(b) Reduce the following block diagram in fig.2 (b) (i) to open loop form using block diagram reduction technique. **07**

OR

(b) Using Manson's Gain formula find C(s)/R(s).Refer fig.2 (b) (ii). **07**

Q.3 **(a)** The characteristic equation of a feedback system is **07**

$$F(s)=s^6+2s^5+8s^4+12s^3+20s^2+16s+16$$

Using the Routh's Hurwitz criterion determine the stability of the system.

(b) A unity feedback system has **07**

$$G(s)= \frac{K(s+1)}{s^2(s+2)(s+5)}$$

Using Routh's Hurwitz criteria find the range of K for closed loop system to be stable.

OR

Q.3 **(a)** For the system shown in fig.3 (a) with unity feedback find the time domain specification when a unit step i/p is applied. **07**

(b) Calculate the transient response parameters for the given system with i/p r(t)=2t. **07**

$$G(s) = 6/s(s+4).$$

Q.4 **(a)** Draw the root locus for the system and obtain value of K when ς=0.6 from root locus. **07**

$$G(s)= K /s(s+3)(s+6)$$

(b) The open loop transfer function of a system G(s) =K/s(s+2+2j) (s+2-2j). Determine the complete root locus and comment on the stability of the closed loop system. **07**

OR

Q.4 **(a)** Sketch bode plot for the following system and find gain margin, phase margin, gain crossover frequency and phase crossover frequency. **07**

$$G(s)= \frac{4(s+0.5)}{s(s+0.2)(s+1)}$$

(b) Sketch bode plot for the following system and determine gain margin, phase margin and stability of system. **07**

$$G(s)= \frac{25(s+4)}{s(s+1)(s+10)}$$

Q.5 **(a)** Define transfer function. Find the transfer function of the lead compensator for the network shown in fig.5 (a). **07**

(b) Draw the polar plot of GH(s)=100/(s+2)(s+4)(s+8). **07**

OR

Q.5 **(a)** Find the eigen values for the following matrix. **07**

$$A = \begin{matrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{matrix}$$

(b) Draw the Nyquist plot for the system given below. Determine phase crossover frequency, gain crossover frequency, gain margin and phase margin. **07**

G(s)H(s)=10/1+0.2(1+0.02s)

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Q-1 (b)

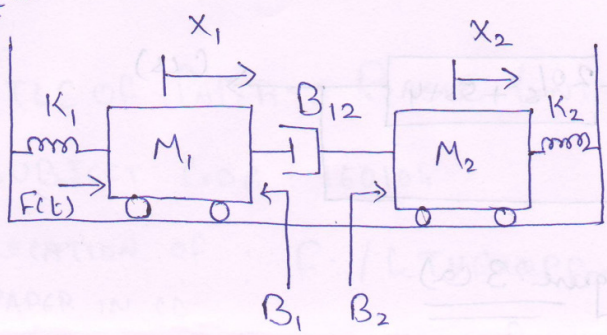


Figure-1 (b)

Q-2 (b)

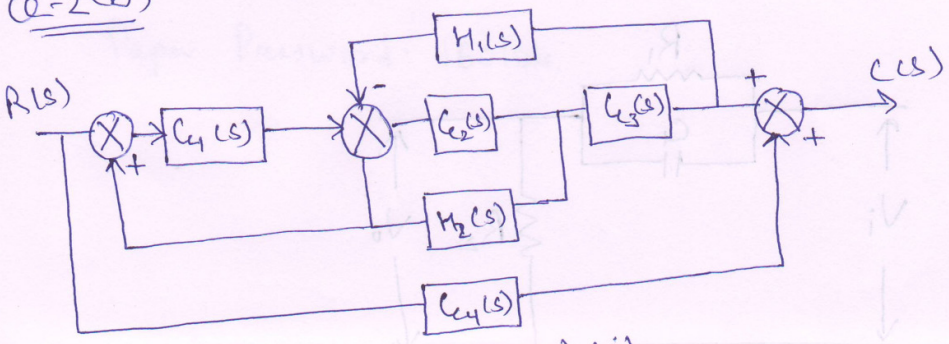
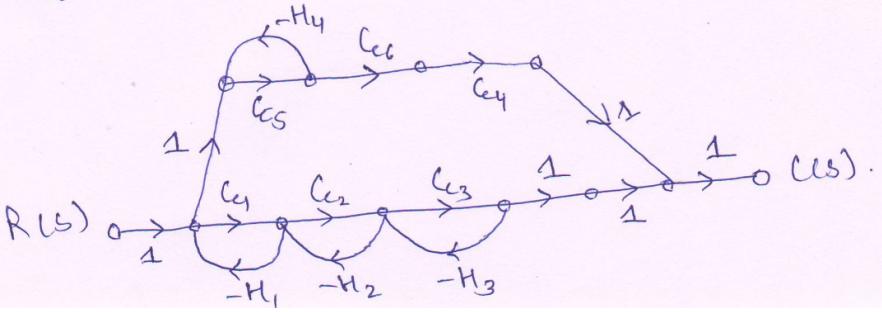


figure-2 (b) (i)

OR

Q-2 (b)



Q-3 (a)

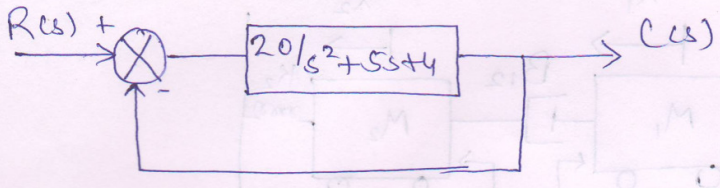


Figure-3 (a)

Q-5 (a)

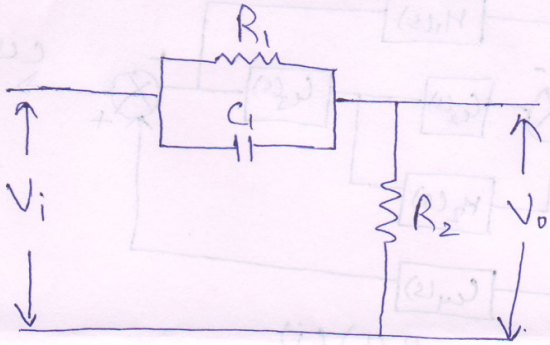


Figure: 5 (a).