Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C. Sem - IV Examination June- 2011

Subject code: X41102 **Subject Name: Control Theory**

Date:04/06/2011 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

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

Q.1 **(a)** List the advantages & disadvantages of close loop control system. **07**

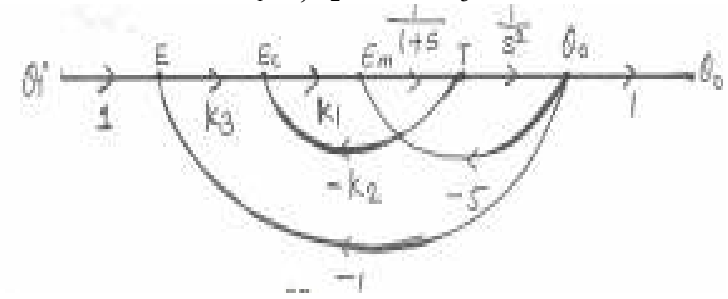
(b) Compare block diagram reduction & signal flow graph method. **07**

Q.2 **(a)** I. State the advantages of negative feedback system. **07**

II. Define following:

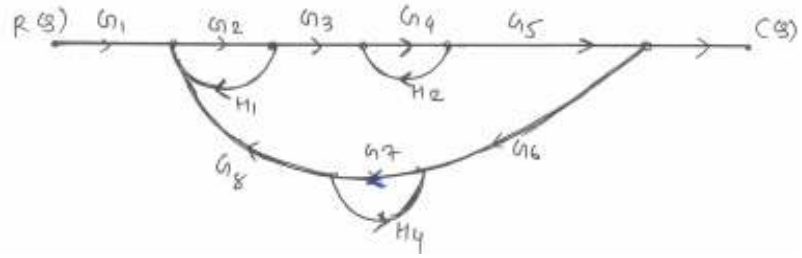
1. Absolute stable system
2. Unstable system
3. Conditionally stable system.

(b) A servo system is represented by the signal flow graph shown in the figure given below, the variable T is torque & E as error. Determine, the overall transfer function if $K_1=1, K_2=2$ and $K_3=5$. **07**



OR

(b) Find the transfer function for the figure given below using signal flow graph. **07**



Q.3 **(a)** 1. Differentiate between order & type of a system with an illustrative example. **04**

2. What is meant by dominant pole in S-plane? **03**

(b) For an under damped, critically damped and over damped control system, state the values or range of values of damping ratio with necessary diagrams. **07**

Q.3 **(a)** What is PID controller? Explain the principle of working. **07**

(b) An Unity feedback system has a loop transfer function $G(S)= \frac{10(S+1)}{S(S+2)(S+5)}$ **07**

Determine:

i. Step, Ramp and Parabolic error co-efficient

ii. Steady state error when r(t)=3+10t.

Q.4 **(a)** Determine the stability to $S^5+1.5S^4+2S^3+4S^2+5S^1+10$ **07**

(b) For the unity feedback system with $G(s) = \frac{K}{(s+1)^3(s+4)}$. **07**

1. Find the range of K for stability.
2. Find the frequency of oscillations when the system is marginally stable.

Q.4 **(a)** Draw the root locus plot for a system having open-loop transfer function $G(s)H(s)= \frac{K}{s(s+1)(s+3)}$. **07**

(b) I. State the advantages of Routh's criteria. **03**

II. Draw & explain polar plots for type-0 & type 1 system. **04**

Q.5 **(a)** Draw the Bode plot for a system having $G(s)H(s)= \frac{100}{s(s+1)(s+2)}$. **07**

I. Find Gain & Phase Margin

II. Gain cross over & Phase cross over frequency.

(b) I. State the advantages of frequency domain approach. **04**

II. Define: State, state variable & sate vector. **03**

OR

Q.5 **(a)** Construct the Bode plots for the transfer function. **07**

$G(s)= \frac{64(s+2)}{s(s+0.5)(s^2+3.2s+64)}$

(b) Determine the transfer function from the data given below. **07**

$A=\begin{bmatrix}-3 & 1\\ 0 & -1\end{bmatrix}$ $B=\begin{bmatrix}1\\ 1\end{bmatrix}$

$C=\begin{bmatrix}1 & 1\end{bmatrix}$ $D=0$

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