Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-IV Examination-Nov-2011

Subject code: X41102 **Date: 23/11/2011**

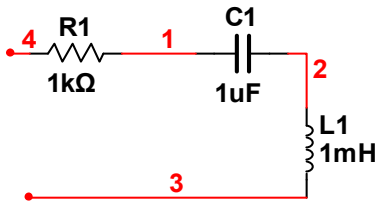
Subject Name: Control Theory **Time: 2.30 pm -5.00 pm**

Total marks: 70

Instructions:

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

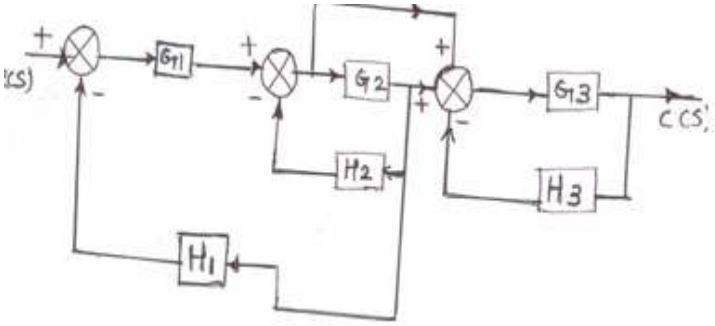
Q.1 **(a)** Determine the transfer function of the network shown in fig.1when input voltage Vin and o/p voltage as Vo. and convert it into equivalent mechanical network. **06**



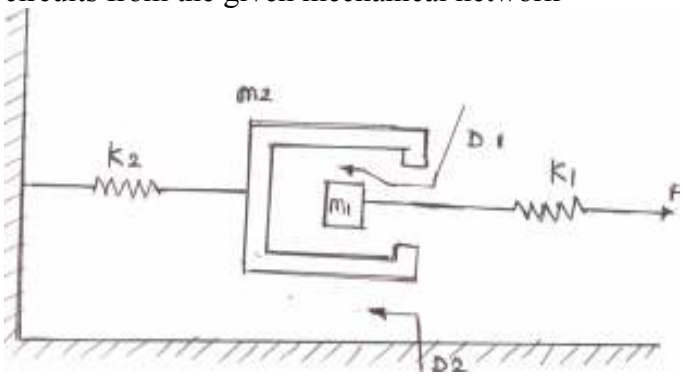
(b) Give any four differences between linear control system and non linear control system. **04**

(c) Give the effect of derivative control on damping factor, rise time and peak time. **04**

Q.2 **(a)** Determine the transfer function C/R from the block diagram shown in fig-2 using block diagram reduction method.consider input as R(s) and o/p as c(s) **07**

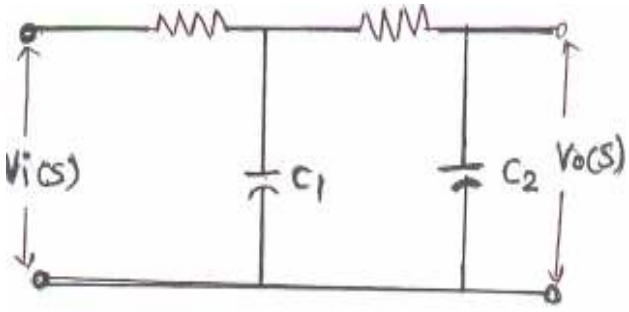


(b) Find the system equation and F-I and F-V analogous circuits from the given mechanical network **07**



OR

(b) Find the transfer function for the fig-3 as shown Consider 1st resistor as R1 and second resistor as R2 **07**



Q.3 **(a)** Give the time response of the second order control system for step as input signal. **07**

(b) Using routh's criterion comment on system stability and also find out how many poles in the right half of the s-plane, system characteristic equation are as follows. **07**

1) $S^6+3S^5+6S^4+12S^3+12S^2+12S+8=0$
2) $S^5+6S^4+6S^3+12S^2+5S+6=0$

OR

Q.3 **(a)** Draw the rout locus plot for system having open loop transfer function **07**

$$G(S)H(S) = \frac{K}{S(S+1)(S+3)}$$

For the value of k=6

(b) Define the term:- **07**

1) Gain margin
2) Phase margin
3) Gain crossover frequency
4) Phase crossover frequency

Q.4 **(a)** The open loop transfer function of a unity feedback control system is given by **07**

$$G(S)= \frac{K}{S(1+0.2S)}$$

Design a suitable compensator such that the system will have k=10 and phase margin=50 degree

(b) Obtain state equation for the transfer function given below. **07**

$$\frac{Y(S)}{U(S)} = \frac{S+3}{S^2+3S+4}$$

OR

Q.4 **(a)** A unity feedback system is characterized by an open loop transfer function G(S)=K/S(s+10) . Determine the value of k such that damping ratio is 0.5.then obtain rise time, peak time, maximum overshoot and settling time in the unit step response. **07**

(b) Draw the polar plot for any type-1 system, assume appropriate transfer function of type-1 **07**

Q.5 **(a)** Sketch the asymptotic bode plot for the transfer function given below **07**

$$G(S)H(S)=\frac{2(S+0.25)}{S^2(S+1)(S+0.5)}$$

From the bode plot determine :

a)the phase cross-over frequency

b)the gain cross- over frequency

(b) Draw nyquist plot- **07**

$$G(S)H(S)=\frac{1}{S^2(S+a)} \quad a>0.$$

OR

Q.5 **(a)** Write short note on D.C servo motor **07**

(b) Write short note on M-circle and N-circle **07**

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