

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - IVth Semester–Examination – May- 2012

Subject code: X41102

Subject Name: Control Theory

Date: 09/05/2012

Time: 02:30 pm – 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) Determine the over all transfer function for Fig. (1) using block diagram reduction technique. Also verify the result using signal flow graph. **07**
- (b) Define the terms transmittance, forward path & self loop. Explain the Manson's gain formula & write down rules associated for drawing up a signal flow graph for given block diagram. **07**
- Q.2** (a) Draw the mechanical circuit diagram for the system shown in Fig. (2). Write the equilibrium equations & draw the Force to Voltage analogous circuit. **07**
- (b) With neat & clean diagram the draw the time response of 2nd order control system subjected to unit step signal. Also Derive the expression for maximum over shoot. **07**
- (b) For the system 1 has TF $G_1(s) = 5/(s+4)$ & system 2 has TF $G_2(s) = 25/(s^2+10s+25)$, find the cascade & parallel transfer function for system 1 & 2. Also Write a Matlab program to find the cascade & parallel transfer function. **07**
- Q.3** (a) Define the term stability. Explain the Routh Hurwitz criterion. For system stability determine the relations between K & T for unity feedback control system whose open loop Transfer function $G(s) = K/(s(s^2+10s+T))$ **07**
- (b) For unity feedback control system open loop transfer function $G(s) = 20/((s+1)(s+5))$. Determine t_p , M_p , the time at which 1st undershoot occurs, time period of oscillations & number of cycles completed before reaching the steady state. **07**

OR

- Q.3** (a) Explain the derivative feedback control system & derive the expression for the steady state error for the same. **07**
- (b) The open loop transfer function of a control system is given $G(s) H(s) = (2(s^2+3s+20))/(s(s+2)(s^2+4s+10))$. Determine the steady state error for the input given as
a) 5 b) 4t c) $4t^2/2$ **07**
- Q.4** (a) Sketch the root locus for the open loop transfer function of a unity feedback control system $G(s) = K/(s(s+1)(s+3))$ & comment on stability. **07**
- (b) Draw the bode plot for the $G(s) = 30/(s(1+0.5s)(1+0.08s))$ determine the Gain Margin & Phase Margin & Comment on stability. **07**

OR

- Q.4** (a) Draw the nyquist plot to examine the closed loop stability of a system whose open **07**

loop transfer function is given by

$$G(s) H(s) = 50/((s+1)(s+2)) .$$

- (b) Define transient period, steady state period, sensitivity, gain cross over frequency, phase cross over frequency, gain margin, phase margin. **07**

- Q.5** (a) Determine the static error coefficients from initial slope & Discuss the correlation between transient response & frequency response. **07**

- (b) Explain thermal system & error detectors.

OR

- Q.5** (a) Enlist the methods to determine the stability of a control system. And Describe the procedure to determine the initial slope of bode plot for type 1 & type 2 system. **07**

- (b) Write a short note on controllability. **07**

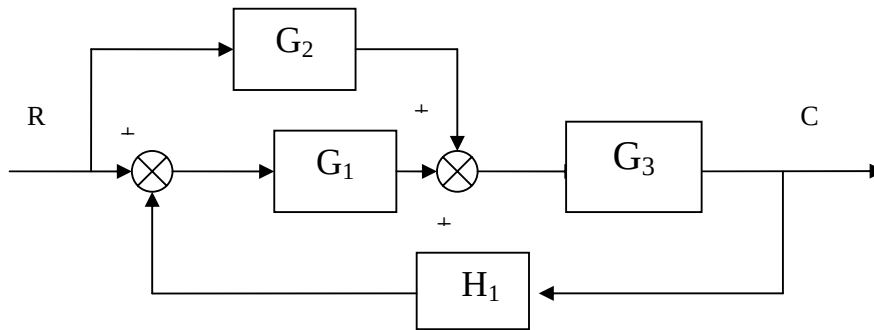


Fig. (1)

Fig.(2) Blocks indicated by K_1 & K_2 are spring constants.

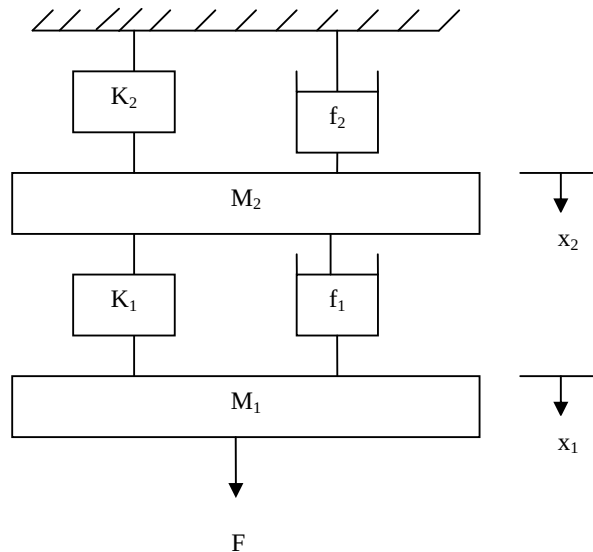


Fig. (2)
