

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC SEM-III Examination-Dec-2011

Subject code: X30903

Date: 17/12/2011

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) Using Manson's gain formula obtain overall transfer function of signal flow graph shown in Fig.1. **07**
- (b) What is control system? Explain in brief open loop and closed loop control system with suitable example. Also give the compare both the systems. **07**

- Q.2** (a) Using block diagram reduction technique, find the closed loop transfer function (C/R) for the system shown in Fig.2. **07**
- (b) Define the term Servomechanism and explain the one of the applications with neat diagram. **07**

OR

- (b) Determine the range of K for system to be stable. The characteristic equation of the system is, **07**

$$S^3 + 3KS^2 + (K + 2)S + 4 = 0$$

- Q.3** (a) Compare Block diagram and Signal flow graph method. **04**
- (b) A unity feedback control system has an open-loop transfer function **10**

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

Sketch the root-locus plot of the system by determining the following.

- (i) Number and angle of Asymptotes.
- (ii) Centroid.
- (iii) Break away points if any.
- (iv) Angle of departure of root loci from the imaginary poles.
- (v) The value of K and the frequency at which the root loci cross the imaginary axis.

OR

- Q.3** (a) Derive relation between steady state error and type of system for step and ramp input. **10**
- (b) What is root-locus? State and define types of root- locus. **04**

- Q.4 (a)** Sketch the polar plot of the following transfer function. **10**

$$G(s) = \frac{1}{(1 + P_1 s)(1 + P_2 s)}$$

- (b)** Give the advantages of bode plots. **04**

OR

- Q.4 (a)** Derive equation for steady state error (e_{ss}). **04**

- Q.4 (b)** Draw Nyquist plot for system having transfer function **10**

$$GH(s) = \frac{1}{(s + 1)}$$

- Q.5 (a)** Explain thermal system. **04**

- (b)** Sketch Bode plots of a control system having transfer function as given below. Determine gain margin and phase margin. **10**

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

OR

- Q.5 (a)** Explain constant-M circles by deriving related expressions. **06**

- (b)** Obtain differential equations describing the mechanical system shown in Fig.3 and Draw the electric network using force- voltage analogy. **08**

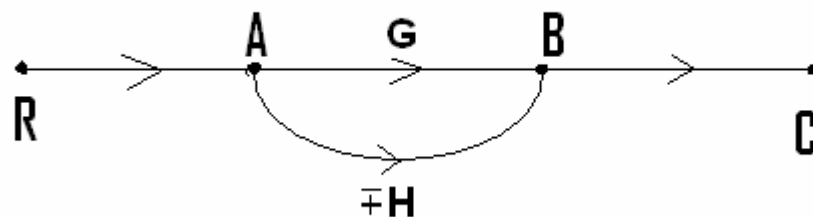


Fig. 1. [Q. 1 (a)]

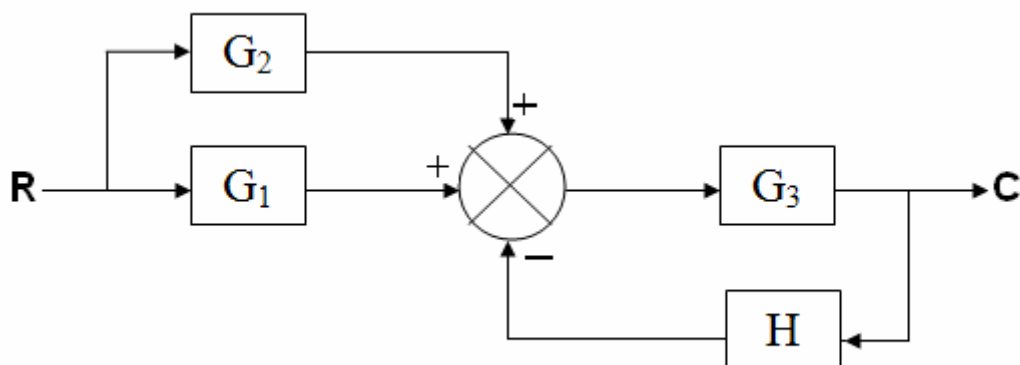


Fig. 2. [Q.2 (a)]

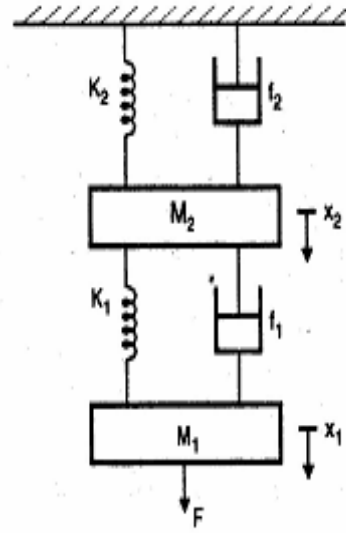


Fig. 3. [Q.5 (b), OR]
