QUESTION BANK

(B.E. SEM III EC ATKT EXAM)

GUJARAT UNIVERSITY

Control Theory

Each Question of 10 Marks

Q.1 Define and explain following terms in reference to control theory:
- (a) Open loop control
- (b) Closed loop control
- (c) Transfer function
- (d) Feed forward system
- (e) Time invariant system

Q.2 Explain servomechanism with a suitable example.

Q.3 Explain armature controlled DC motor and derive its transfer function.

Q.4 (a) Differentiate open loop and closed loop control systems.
(b) Differentiate feedback and feed forward control systems.

Q.5 Discuss reduction of parameter variations by use of feedback.

Q.6 Write a short note on synchors.

Q.7 Explain force-voltage and force-current analogy

Q.8 Reduce the block diagram shown in fig 1 and obtain the closed loop transfer function.

Q.9 Reduce the block diagram shown in fig 2 and obtain the closed loop transfer function.

Q.10 Reduce the block diagram shown in fig 3 and obtain the closed loop transfer function.

Q.11 Find C(s)/R(s) for the signal flow graph shown in fig 4 with the help of Mason's gain formula.

Q.12 Find C(s)/R(s) for the signal flow graph shown in fig 5 with the help of Mason's gain formula.

Q.13 Find C(s)/R(s) for the signal flow graph shown in fig 6 with the help of Mason's gain formula.

Q.14 Obtain differential equations describing the mechanical system shown in fig 7 and draw electrical equivalent network using force-voltage analogy.

Q.15 Obtain differential equations describing the mechanical system shown in fig 8 and draw electrical equivalent network using force-voltage analogy.

Q.16 Write a note on time response of first order system for various standard inputs.

Q.17 A second order control system is subjected to unit step input. Draw response curves for underdamped, overdamped and critically damped system. For under damped system define various performance indices.

Q.18 Define: (1) Rise time (2) Peak time (3) Peak overshoot (4) delay time (5) settling time

Q.19 A second order control system is subjected to unit ramp input. Draw response curves for underdamped, overdamped and critically damped system. For under damped system define various performance indices.

Q.20 (a) Explain the types of system and steady state error constants for the same.
(b) Draw and explain first order system

Q.21 Explain rules for construction of root locus.

Q.22 Explain the multi input and multi output closed loop system.

Q.23 For the second order system with transfer function as given below, obtain Maximum percentage overshoot Mp and peak time Tp.

$$G(s) = 4 / (S^2 + 2S + 4)$$

Q.24 Explain about signal flow graph with suitable example.

Q.25 Write a note on correlation between time and frequency response of 2^{nd} order systems.

Q.26 Short note: polar plots and its significance

Q.27 State the advantage of Routh criteria. And determine the stability of the system $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$

Q.28 Write a short note on Nyquist stability criteria.

Q.29 The open loop transfer function of a closed loop system with unity feedback is

$$\frac{k(S+2)(s+1)}{(s+0.1)(s-1)}.$$

Determine the range of values of k for which the system will be stable.

Q.30 Check the stability of system given below using Nyquist criteria:

$$G(S)H(s) = \frac{10(S+3)}{S(S+1)}$$

Q.31 Discuss the concepts of states, state variable and state model of the system.

Q.32 Draw the root locus for the system

$$G(S)H(s) = \frac{K}{S(S+2)(S+5)}$$

Q.33 A unity feedback system is characterized by the open loop transfer function

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

Determine the steady state errors for unit step, unit ramp and unit acceleration input.

Q.34 Plot a bode – magnitude plot for a system given by

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

Q.35 Find the phase margin and gain margin analytically for

$$G(S)H(s) = \frac{100}{(S+2)(S+4)(S+8)}$$

Q.36 For the units feedback control system

$$G(S) = \frac{100}{(S+2)(S+4)(S+8)}$$

Sketch the bode plot. Determine the gain and phase margin

Q.37 Explain about integral action and derivative action on system performance. Can integral action be used alone?

Q.38 Draw the Nyquist Plot for G(s)=1/S(S-1) and also Write MATLAB program for it.

Q.39 Determine the value of k for a unity feedback control system having open
loop transfer function

$$G(S)H(s) = \frac{k}{S(S+2)(S+4)}$$

Such that (I) Gain margin 20 db (II) Phase margin 60 db

Q.40 Obtain root-locus plot for the unity feedback system with transfer function.

$$G(S) = \frac{k}{S(S+2)}$$

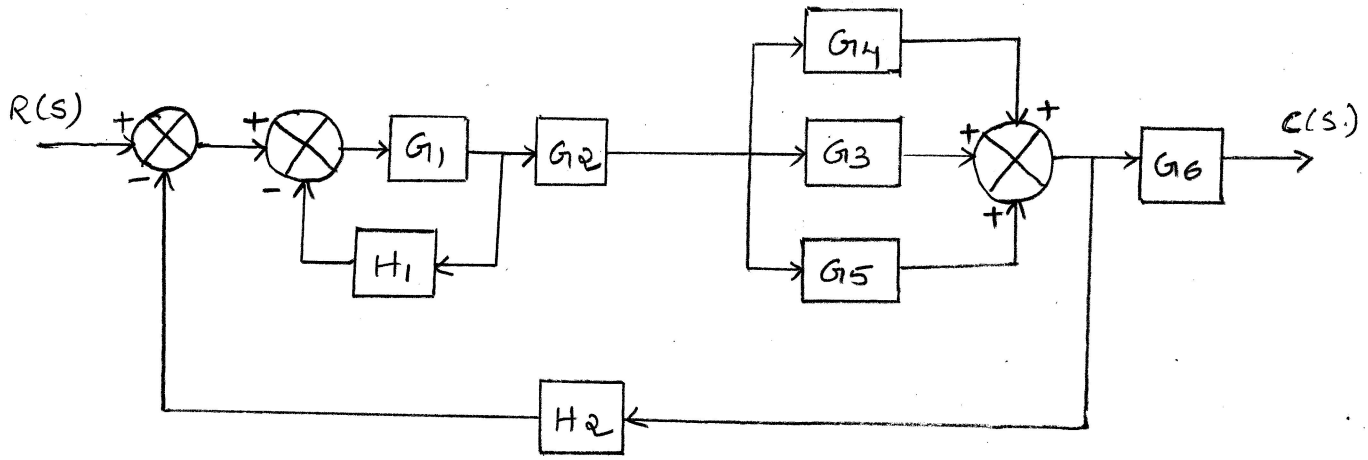

Fig. 1

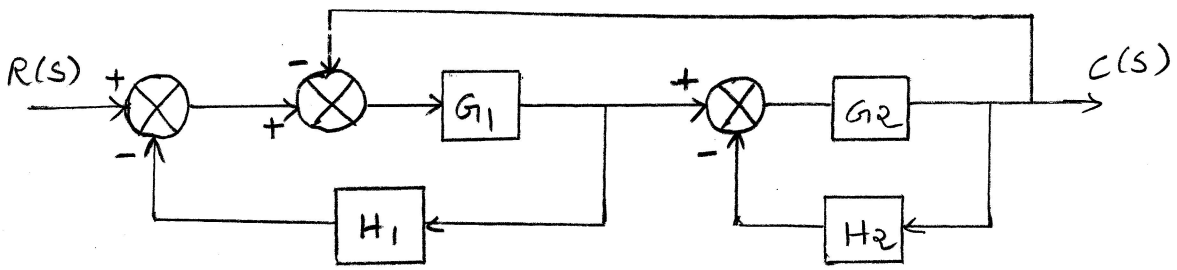

Fig. 2

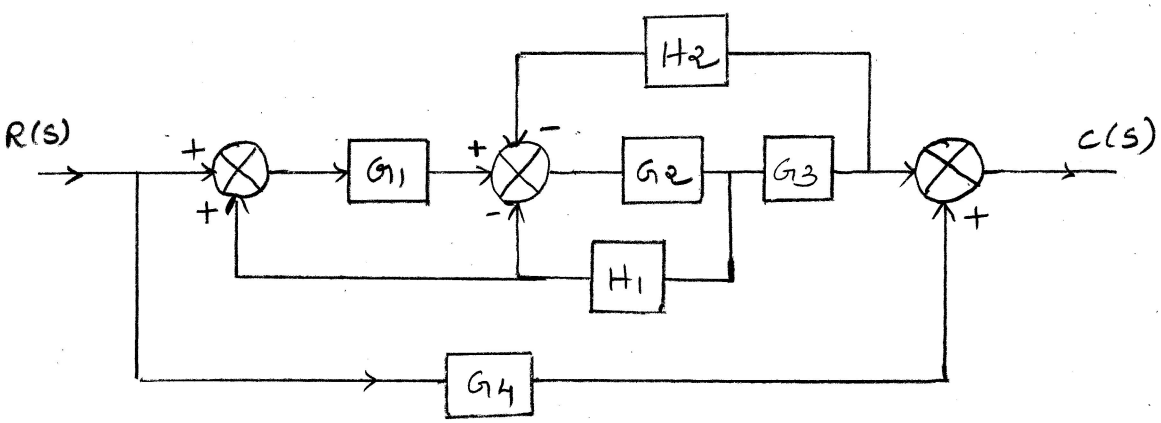

Fig. 3

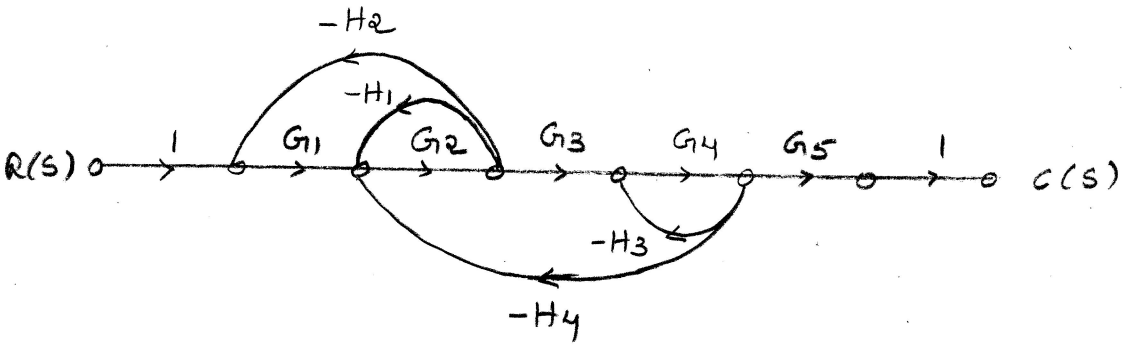

Fig. 4

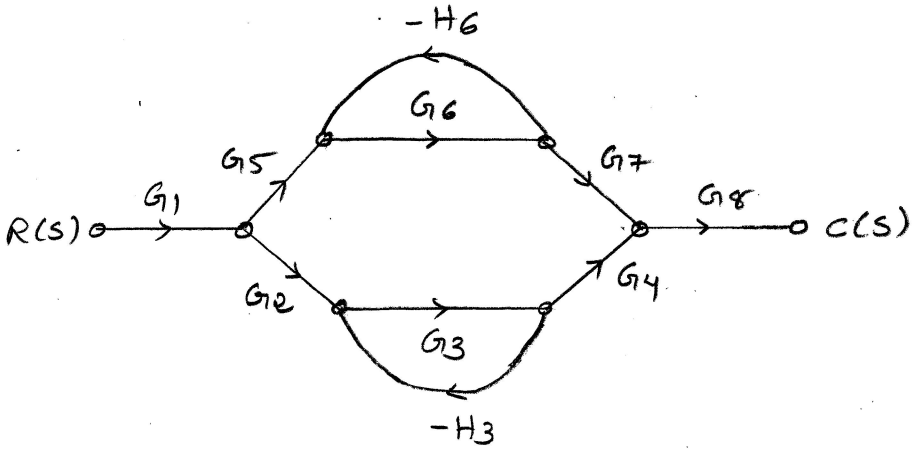

Fig. 5

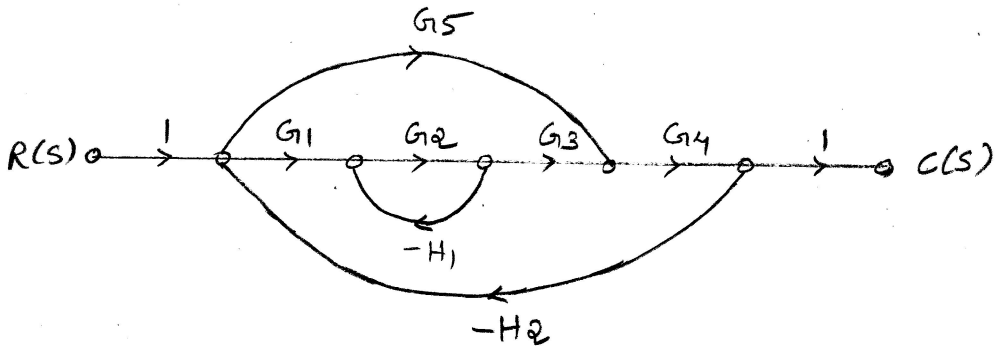

Fig. 6

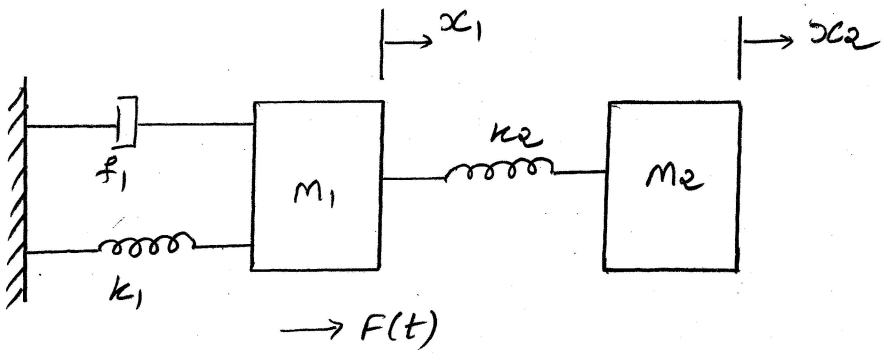

Fig 7

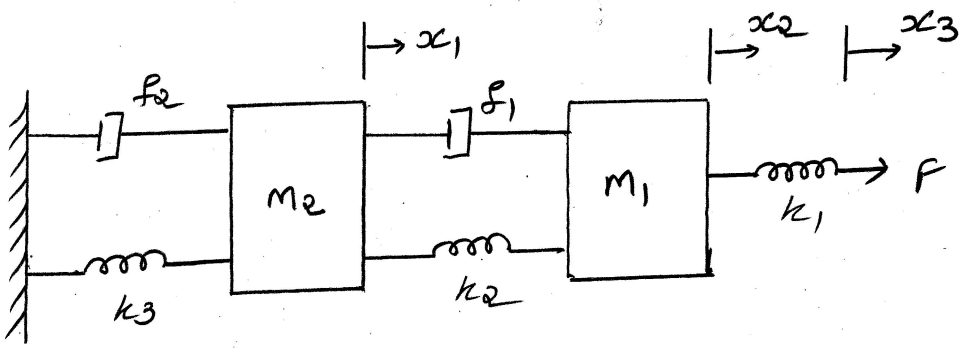

Fig 8