

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V(New)• EXAMINATION – WINTER 2016

Subject Code:2151908

Date:30/11/2016

Subject Name:Control Engineering

Time:10:30 AM to 01:00 PM

Total Marks: 70

Instructions:

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

MARKS

- | | | |
|------------|---|---|
| Q.1 | Short Questions | 14 |
| | <ol style="list-style-type: none">1 Feedback is sometimes used to improve the sensitivity of a control system (True/False).2 Nonlinear elements are sometimes intentionally introduced to a control system to improve its performance (True/False).3 Define the transfer function. Why initial conditions are assumed zero?4 Define signal flow graph.5 What does the arrow on the branch of a Signal Flow Graph represent?6 Define Maximum overshoot.7 What is Parabolic-Function Input?8 Define Routh's stability criterion.9 What is Frequency Response?10 In a 4/3 Direction control valve 4 stands for_____ and 3 stands for___?11 What does FRL stands for in a Pneumatic system.12 Define: Self loop13 What is root locus?14 Define Reference input with example. | |
| Q.2 | <p>(a) Derive the Analogous relationship between Mechanical and Electrical system based on Force-Current analogy.</p> <p>(b) Obtain the Transfer function C/R from the signal flow graph as shown in figure1</p> <p>(c) Obtain the overall transfer function of the system whose block diagram is as given in figure 2 using block diagram reduction technique.</p> <p style="text-align: center;">OR</p> <p>(c) Obtain Differential Equation for the mechanical system shown in figure3. Also obtain analogous circuit using Force-Voltage analogy.</p> | <p>03</p> <p>04</p> <p>07</p> <p>07</p> |
| Q.3 | <p>(a) Discuss the effect of time constant on 1st order system response for unit step input.</p> <p>(b) Discuss the effect of damping on the position of closed loop poles of the 2nd order system with diagram.</p> <p>(c) In a mechanical vibratory system when 2N of force (step input) is applied to the system, the mass oscillates as shown in figure 4. Determine the values of M, B and K of the system from this response curve. The displacement is measured from equilibrium position.</p> <p style="text-align: center;">OR</p> <p>(a) Draw generalized unit step response for 2nd order system and define following: Rise time, Delay time, Settling time.</p> | <p>03</p> <p>04</p> <p>07</p> <p>03</p> |

- (b) A close loop system is characterized by the following transfer function, $s^4 + 5s^3 + 5s^2 + 4s + K = 0$. Determine the range of K for which the system is stable. 04
- (c) Draw root locus diagram for the system with transfer function, 07
- $$G(s)H(s) = \frac{K}{s(s+5)(s+10)}$$
- Q.4 (a) List the basic elements of a Hydraulic circuit. Explain any one in brief. 03
- (b) Explain Hydraulic Integral Control and derive its transfer function. 04
- (c) Draw the schematic diagram of Pneumatic PI controller. Explain its working and derive its transfer function. 07
- OR**
- Q.4 (a) Write the comparison between a Pneumatic system and Hydraulic system. 03
- (b) With the help of necessary diagram, explain Pneumatic nozzle-flapper amplifier. 04
- (c) Draw the schematic diagram of Hydraulic PID controller. Explain its working and derive its transfer function. 07
- Q.5 (a) State the advantages of state-space representation over conventional control system analysis method. 03
- (b) Explain the following terms: 04
- (i) State (ii) State variables (iii) State-space (iv) state transition matrix.
- (c) Obtain the state space representation of system as shown in figure 5 07
- OR**
- Q.5 (a) For an RLC circuit, Derive the state model. 03
- (b) Discuss about gain margin and phase margin for frequency response of control system. 04
- (c) Differentiate between open loop and close loop control systems. 07

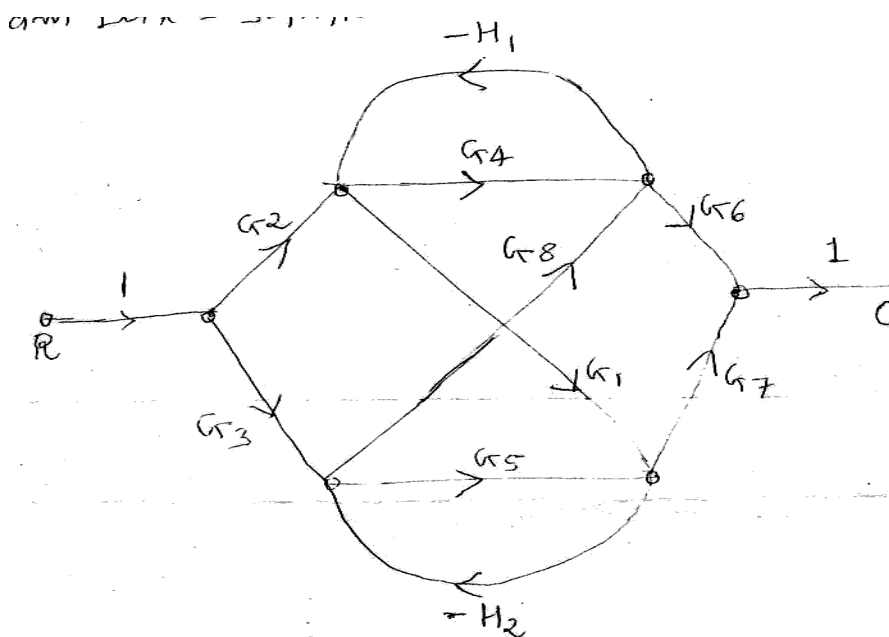


Figure1

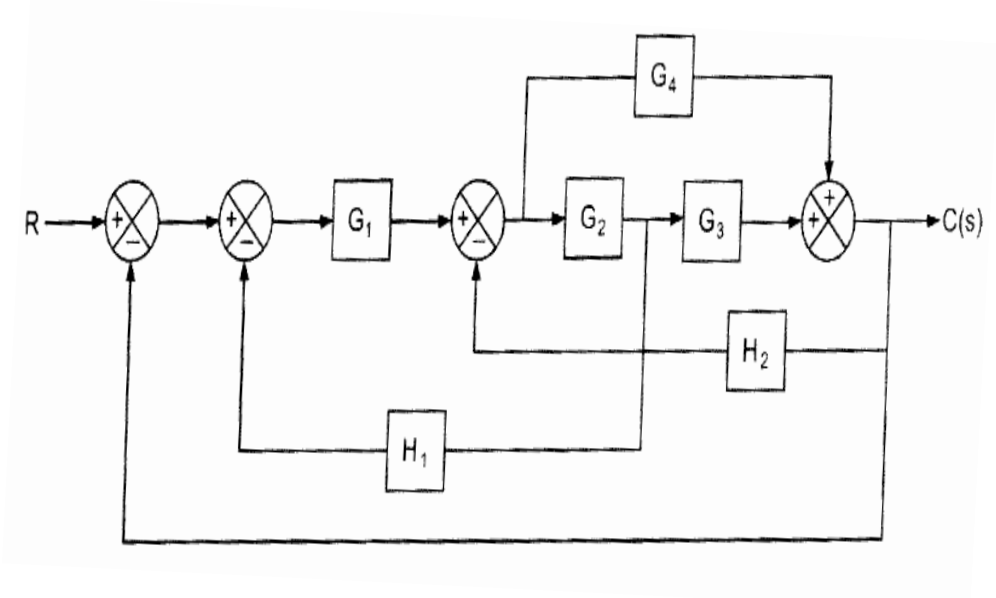


Figure 2

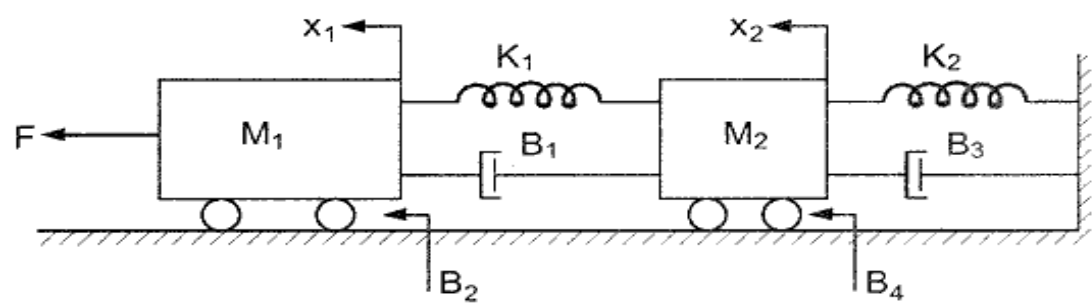


Figure 3

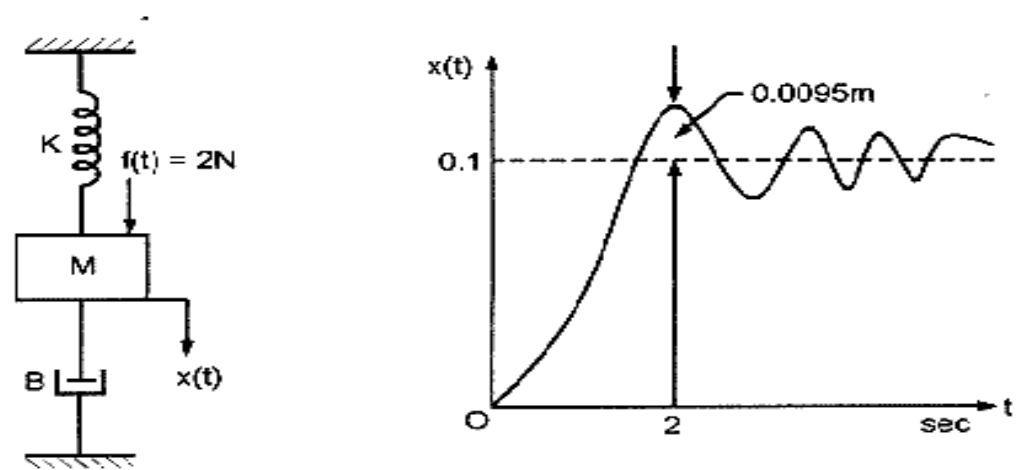


Figure 4

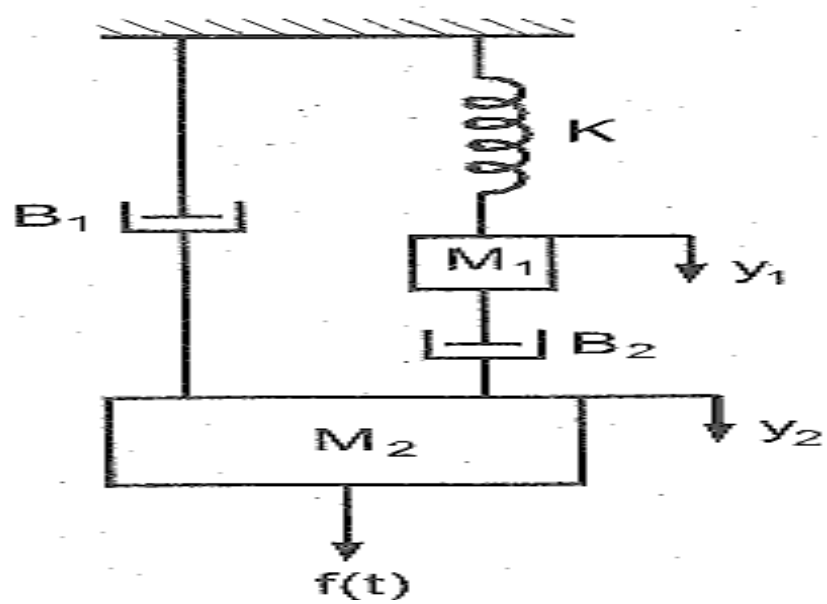


Figure 5
