P P SAVANI UNIVERSITY

Seven Semester of B. Tech. Examination
December 2021
SEME4011 Control Engineering

15.12.2021, Wednesday   Time: 09:00 a.m. To 11:30 a.m.   Maximum Marks: 60

Instructions:
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1 Answer the Following: (Any Six) [06]

(i) A good control system has all the following features except
    a) good stability.
    b) slow response.
    c) good accuracy.
    d) sufficient power handling capacity

(ii) Which of the following statements is correct for any closed loop system?
    a) All the co-efficient can have zero value
    b) All the co-efficient are always non-zero
    c) Only one of the static error co-efficient has a finite non-zero value
    d) None of the above

(iii) At summing point, more than one signal can be added or _____
    a) Subtracted
    b) Multiplied
    c) Both a and b
    d) None of the above

(iv) Match the following notations with their meanings:
    A. $G(s)$ --------- 1) Laplace of error signal
    B. $H(s)$ --------- 2) Laplace of output signal
    C. $C(s)$ --------- 3) Forward transfer function
    D. $E(s)$ --------- 4) Feedback transfer function
    a) A- 3, B- 4, C- 2, D- 1
    b) A- 2, B- 3, C- 4, D- 1
    c) A- 1, B- 2, C- 3, D- 4
    d) A- 2, B- 3, C- 1, D- 4

(v) Use mason's gain formula to calculate the transfer function of given figure:
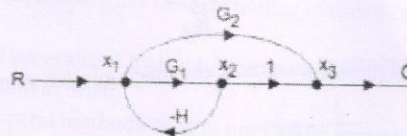
    a) G1/1+G2H
    b) G2/1+G1H
    c) G1+G2/1+G1H
    d) None of the mentioned

(vi) At summing point, more than one signal can be added or _____
    a) Subtracted
    b) Multiplied
    c) Both a and b
    d) None of the above

(vii) An automatic toaster is a _____ loop control system.
    a) Open

b) Closed
c) partially closed
d) any of the above

Q - 2 (a) Reduce the block diagram as shown in Fig. and obtain overall transfer function. [06]
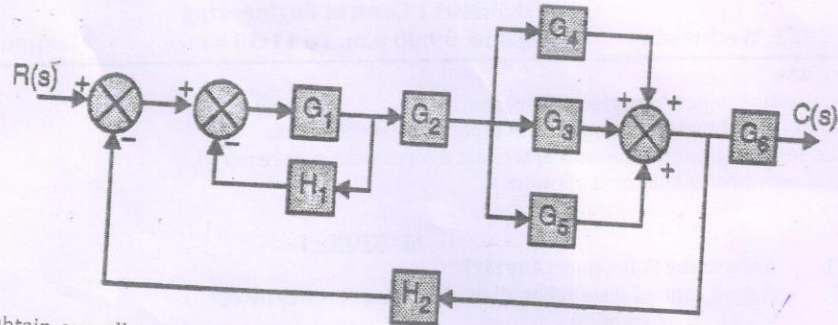
Q - 2 (b) Obtain overall transfer function of the system whose block diagram is shown in Figure, explaining the major steps of reduction involved. [06]
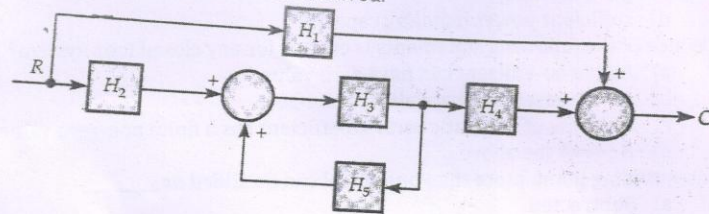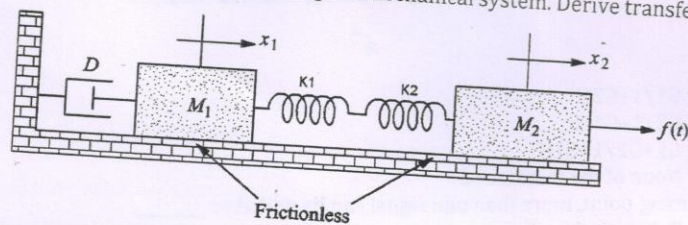

OR

Q - 2 (a) Compare block diagram representation versus Signal flow graph representation. [06]
Q - 2 (b) Determine the transfer function $C(s)/R(s)$ for the system shown in figure using Mason's gain formula. [06]
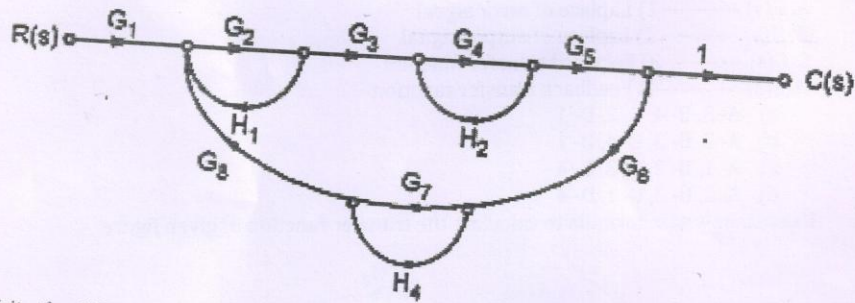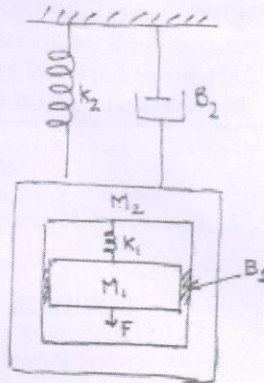

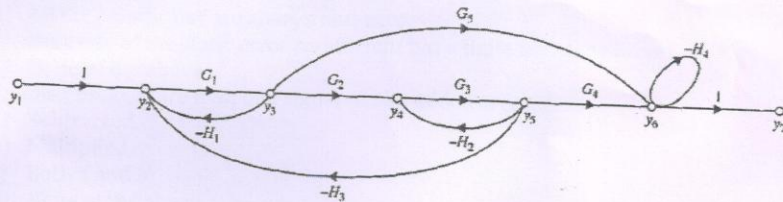Q - 3 (a) Write the differential equations governing the mechanical system. Derive transfer function. [06]

Frictionless

Q - 3 (b) For mechanical system shown in the following figure:
- Write the differential equations governing the system.
- Obtain Laplace transform of these equations. [06]

Q - 3 (a) What is system analogy? Describe analogy between Translational mechanical and **[06]** Rotational mechanical systems.

Q - 3 (b) Find the transfer function Y7(s)/Y1(s) for the system shown in figure below using Mason's **[06]** gain formula.

SECTION – II

Q - 1 (a) What is meant by step input, ramp input and impulse input? How do you represent them **[06]** graphically?

Q - 1 (b) Use routh criterion determine the stability of the system represented by characteristics **[06]** equation:

$$s^6+s^5+2s^4+s^3+2s^2+5s+6=0$$

OR

Q - 1 (a) With the help of a sketch, explain the functioning of pressure control valve used in a **[06]** pneumatic system. Also explain why lubricator required in a pneumatic system?

Q - 1 (b) Give the circuit diagram and discuss the functioning of speed control of actuators in **[06]** pneumatic systems.

Q - 2 (a) Draw a neat sketch of generalized hydraulic control system. Explain the elements of **[06]** hydraulic control system in brief.

Q - 2 (b) What are the speed control methods used in pneumatic systems? Discuss in brief. **[06]**

OR

Q - 2 (a) Explain Hydraulic bleed-off circuit. **[06]**

Q - 2 (b) Explain a types of Direction Control Valves (DCV) with the illustration. **[06]**

Q - 3 A unity feedback control system has an open loop transfer function, **[06]**

$$G(s) = \frac{10}{S(S + 2)}$$

Find the rise time, percentage overshoot, peak time and setting time for a step input for 10 units.

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