

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

Q.1 Solve Any Two of the following.

- A) Explain sensitivity? what is effects of feedback on sensitivity.
- B) Obtain transfer function of given electrical circuit.

(Level/CO)

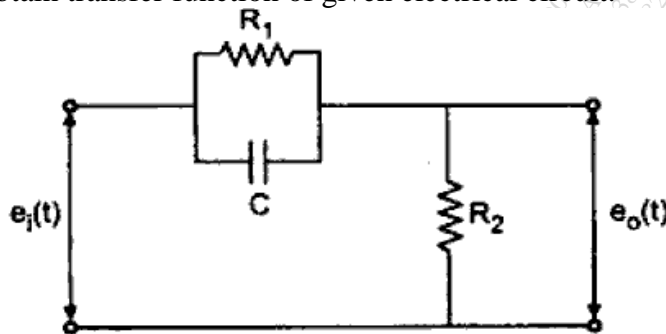
Mark

Understanding

06

Understanding

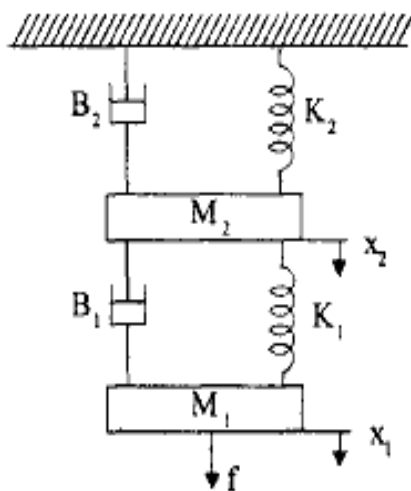
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- C) Write the equation describing the motion of the mechanical system also find the transfer function.

Applying

06



Q.2 Solve Any Two of the following.

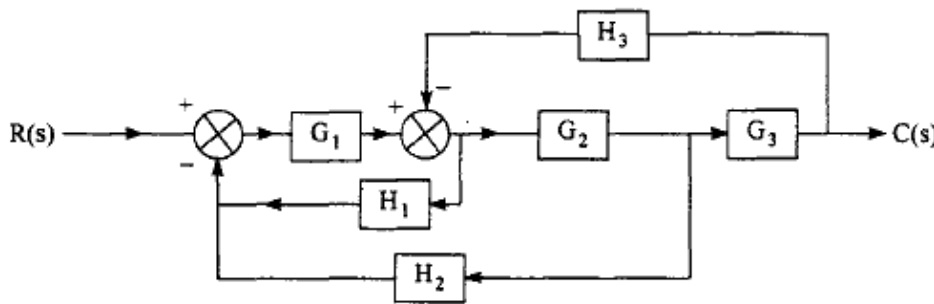
- A) Explain signal flow graph in detail with the help of Masons gain formula.
- B) Determine transfer function of given system using block diagram reduction technique.

Understanding

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Understanding

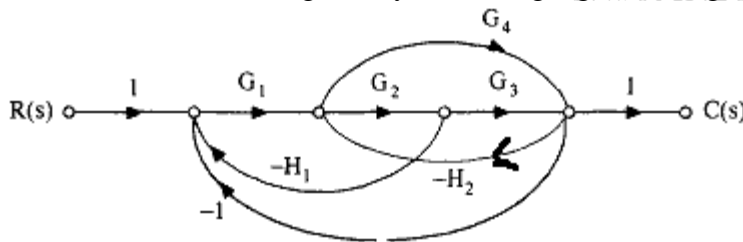
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C) Determine transfer function of given system using signal flow graph.

Understanding

06



Q.3 Solve Any Two of the following.

- A) Derive expression for delay time, rise time, peak time and settling time.
 B) Find the steady state error for unit step, unit ramp and unit acceleration inputs for the following systems.

Understanding

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$$G(S) = \frac{10}{S(0.1S+1)(0.5S+1)}$$

- C) Determine stability of the system with the following characteristic equation.

Applying

06

$$D(s) = S^6 + S^5 + 7S^4 + 6S^3 + 31S^2 + 25S + 25$$

Q.4 Solve Any Two of the following.

- A) Write a short note on PI Controller and PID Controller
 B) A Unity feedback system has an open loop transfer function

Understanding

06

$$G(S) = \frac{K(S+4)}{S^2+2S+2}$$

Sketch root locus of given system.

Understanding

06

- C) A Unity feedback system has an open loop transfer function

Understanding

06

$$G(S) = \frac{10}{S(1+0.4S)(1+0.1S)}$$

Determine GM, PM and comment on system stability using bode plot.

Q.5 Solve Any Two of the following.

- A) Derive the expression for the transfer function from the state model

Understanding

06

$$\dot{X} = AX + BU \quad Y = CX + DU$$

- B) Find the state space model for the system having transfer function

Understanding

06

$$\frac{Y(S)}{U(S)} = \frac{1}{(S^2 + S + 1)}$$

- C) Verify the controllability and observability given system represented by

Applying

06

$$\dot{x} = \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} [u]$$

$$Y = \begin{bmatrix} 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

*** End ***