

Eighth Semester B.E. Degree Examination, June/July 2017

Control Engineering

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. Define control system. Compare open loop and closed loop control system with an example for each type. (08 Marks)
- b. What are the ideal requirements of control system? (06 Marks)
- c. Draw the block diagram of proportional plus integral plus derivative controller and state its characteristics. (06 Marks)

- 2 a. Write the differential equations governing the behaviour of the mechanical system shown in Fig.Q2(a). Also obtain the analogous electrical circuit based on force voltage analogy and loop equations.

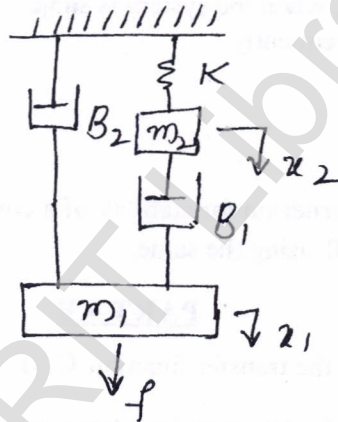


Fig.Q2(a)

- b. Obtain the transfer function of field controlled DC motor. (10 Marks)
- 3 a. Reduce the block diagram shown in Fig.Q3(a) and obtain the transfer function $\frac{C(s)}{R(s)}$. (10 Marks)

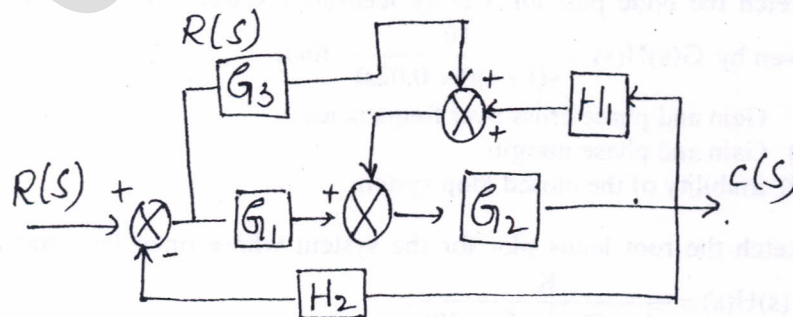


Fig.Q3(a)

(10 Marks)

- b. Find the transfer function by using Mason's gain formula for the signal flow graph shown in Fig.Q3(b).

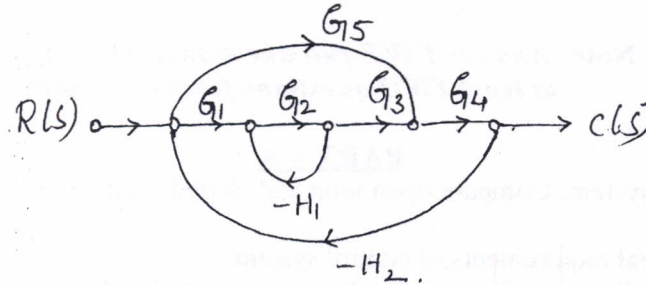


Fig.Q3(b)

(10 Marks)

- 4 a. A units feedback system characterized by an open loop transfer function

$$G(s) = \frac{10}{s^2 + 2s + 6}$$

Determine the following, when the system is subjected to a unit step input:

- Undamped natural frequency
 - Damping ratio
 - Peak overshoot
 - Peak time
 - Settling time
- (10 Marks)
- b. Explain Routh Hurwitz criterion for stability of a control system and examine the stability of $s^4 + 2s^3 + 3s^2 + 8s + 2 = 0$ using the same.

(10 Marks)

PART - B

- 5 a. Sketch the polar plot for the transfer function $G(s) = \frac{10}{s(s+1)(s+2)}$.

(10 Marks)

- b. Plot the Nyquist diagram for the open loop transfer function

$$G(s)H(s) = \frac{12}{s(s+1)(s+2)}$$

and determine the nature of stability.

(10 Marks)

- 6 Sketch the bode plot for a unity feed-back system, whose open loop transfer function is

$$\text{given by } G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}, \text{ find:}$$

- Gain and phase cross over frequencies.
 - Gain and phase margin.
 - Stability of the closed loop system.
- (20 Marks)
- 7 Sketch the root locus plot for the system whose open loop transfer function is given by

$$G(s)H(s) = \frac{K}{s(s+2)(s^2+8s+20)}$$

(20 Marks)

- 8 a. Explain the following:

- Lead compensator
- Lag compensator

(10 Marks)

- b. Explain the series and feedback compensated system, with block diagrams.

(10 Marks)
