B.E. Sixth Semester (Mechanical Engineering) (CGS)

10863 : Control System Engineering : 6 ME 03

P. Pages : 2 | AU - 2742

Time : Three Hours | Max. Marks : 80

Notes :
1. All question carry marks as indicted.
2. Answer **three** question from Section A and **three** question from Section B.
3. Assume suitable data wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Give at least two examples of feedback control systems. Explain each with the help of suitable sketch. **6**

b) Sketch and explain the basic rotational mechanical elements. Design a simple mechanical system using these elements and derive the transfer function for it. **7**

OR

2. a) Draw the signal flow graph and determine the overall transfer function for the block diagram shown in figure 2 (a). **6**

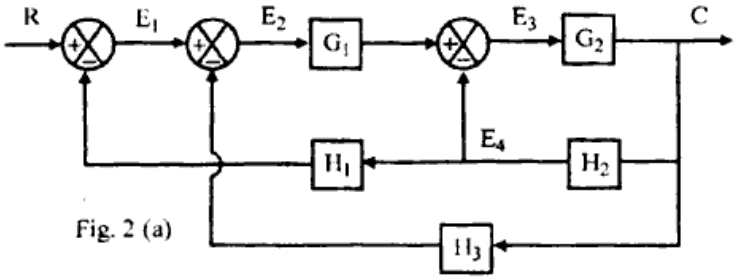

Fig. 2 (a)

b) Find the overall transfer function for the system shown in Figure – 2 (b) by using block diagram reduction method. **7**

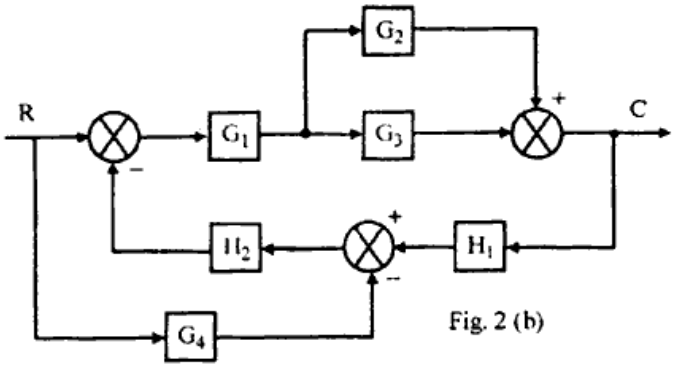

Fig. 2 (b)

3. a) Sketch and explain the working of hydraulic proportional controller obtain the transfer function for it. **10**

b) Give the classification of industrial controllers. Explain any one of it. **4**

OR

4. a) Draw the neat sketch of pneumatic proportional controller. Derive the necessary transfer function for it. **10**

b) Explain the effects of integral and derivative control actions on system performance. **4**

5. a) The open loop transfer function of a servo system with unity feedback is given by – **7**

$$G(s) = \frac{10}{(s+2)(s+5)}.$$

Determine the damping ratio, undamped natural frequency and percentage overshoot of the response to unit step input.

b) Determine the response of the system for which the closed loop transfer function is given by – 6

$$G(s) = \frac{s(s^2+9s+19)}{s^3+7s^2+14s+8},$$

if the unit step is applied at input.

OR

6. a) If the system has $G(s) = \frac{6}{s(s+4)}$ and $H(s) = 1$, calculate the transient response specifications. 7

b) The open loop transfer function of a unity feedback system is given by – 6

$$G(s) = \frac{100}{(1+0.15)(s+10)}.$$

Determine the position, velocity and acceleration error constants. Also find the respective steady – state – errors.

SECTION – B

7. a) Draw the root locus of the control system having characteristic equation – 10

$$s\left(s^2+12s+45\right)+k=0.$$

b) The transfer function of a system is – 4

$$\frac{C(s)}{R(s)} = \frac{k}{s^4+3s^3+3s^2+2s+k}$$

Find the range of K for which system will remain stable.

OR

8. Sketch the root locus plot of the system whose open loop transfer function is – 14

$$G(s)H(s) = \frac{k(s+4)}{(s^2+6s+13)}$$

for all positive values of k.

9. Sketch the Bode plot for the transfer function – 13

$$G(s) = \frac{512(s+3)}{s(s^2+16s+256)}.$$

OR

10. Sketch the Bode plot for the given transfer function – 13

$$G(s) = \frac{4(s+0.5)}{s(s+0.2)(s+1)}$$

Find gain margin and phase margin.

11. Sketch and explain the working of a field controlled DC motor used to drive the prime movers. Derive the transfer function for it. 13

OR

12. Sketch and explain the working of speed control system for diesel engine. Derive the transfer function for it. 13

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