

# CBCS SCHEME

15EE61

## Sixth Semester B.E. Degree Examination, Jan./Feb. 2023 Control Systems

Time: 3 hrs.

Max. Marks:80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. What is control system? Compare open loop with closed loop control systems. (04 Marks)
- b. For the mechanical system shown in Fig.Q1(b). Draw the mechanical network and obtain the f-v analogous electrical systems.

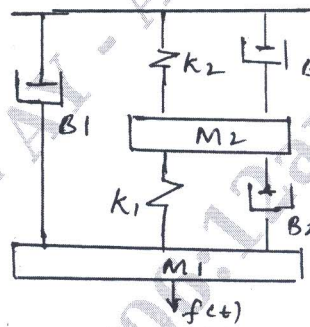


Fig.Q1(b)

- c. Explain the A.C. servo motor.

(07 Marks)

(05 Marks)

OR

- 2 a. Obtain the transfer function of electrical system shown in Fig.Q.2(a).

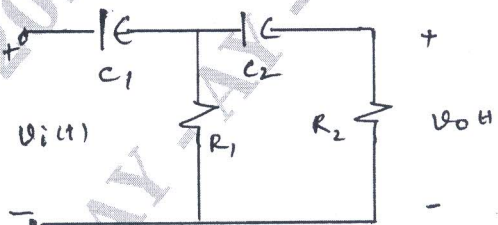


Fig.Q.2(a)

(05 Marks)

- b. Explain the synchros as an error detector.

(04 Marks)

- c. For the mechanical network shown in Fig.Q.2(c), draw the F-i analogous electrical system.

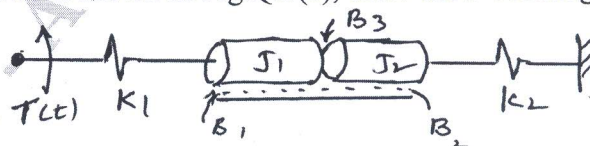


Fig.Q.2(c)

(07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

**Module-2**

- 3 a. Determine  $C(s)/R(s)$  using block diagram reduction rules for Fig.Q3(a).

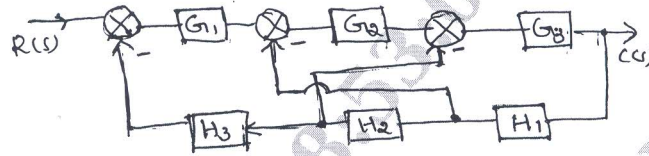


Fig.Q3(a)

(06 Marks)

- b. Explain Mason's gain formula indicating each term.  
 c. For the signal flow graph shown in Fig.Q3(c), determine the T.F  $C(s)/R(s)$  using Mason's gain formula.

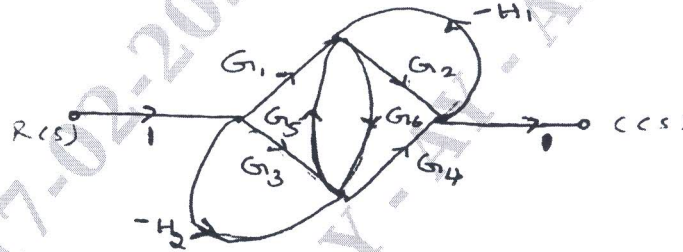


Fig.Q3(c)

(06 Marks)

OR

- 4 a. For the network shown in Fig.Q4(a), draw the SFG and obtain the T.F using Mason's rule.

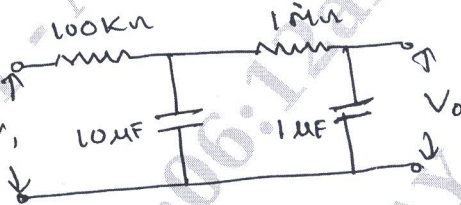


Fig.Q4(a)

(08 Marks)

- b. Draw the signal flow graph for the block diagram show in Fig.Q4(b) and determine  $C(s)/R(s)$ .

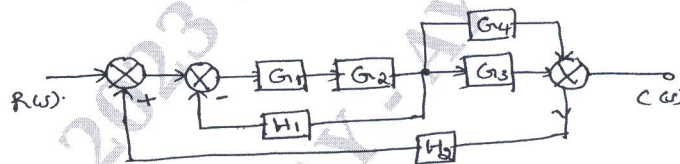


Fig.Q4(b)

(08 Marks)

**Module-3**

- 5 a. What are necessary and sufficient conditions for a system to be stable according to RH criteria. (04 Marks)  
 b. Determine the stability of the system represent by following characteristic equation,  $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$ . (04 Marks)  
 c. The system shown in Fig. Q5(c) when subjected to a unit step input gives an output response shown in Fig.Q5(c). Determine the value of K and T from response curve. (08 Marks)

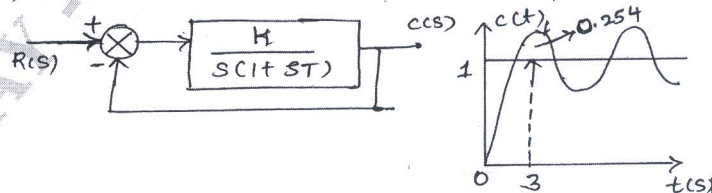


Fig.Q5(c)

OR

- 6 a. A system oscillate with frequency " $\omega$ " if it has a pole at  $s = \pm j\omega$  and no pole in right half of  $s$  plane. Determine the value of  $K$  and ' $a$ ' so that the system shown in Fig.Q6(a). Oscillate at a frequency of 2 rad/sec. (08 Marks)

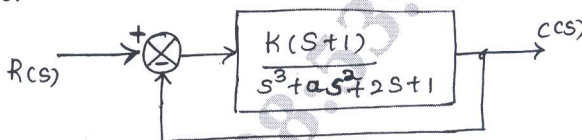


Fig.Q6(a)

- b. For the system  $G(s)H(s) = \frac{K}{s^2(s+2)(s+3)}$  find the value of  $K$  to limit steady state error to 10 unit when input to the system is  $1 + 10t + \frac{40t^2}{2}$ . (08 Marks)

**Module-4**

- 7 a. Sketch the root locus for unity FBCS having  $G(s) = \frac{K(s+1)}{S(s+2)(s^2+2s+2)}$ . Mark the salient points. (12 Marks)
- b. Derive an expression for resonant peak  $M_r$  and resonant frequency  $W_r$  for a standard second order system. (04 Marks)

OR

- 8 a. A unity FBCS with  $G(s) = \frac{10(s+10)}{s(s+2)(s+5)}$ . Find gain and phase Margin using Bode plot. (12 Marks)
- b. Write note on:  
i) Break away point  
ii) Asymptotes. (04 Marks)

**Module-5**

- 9 a. Explain the step by step design procedure of lead compensation network. (08 Marks)
- b. Sketch the Nyquist plot by unity feedback system whose open loop transfer function:  $G(s) = \frac{5}{s(1-s)}$ . Determine stability of a system using Nyquist stability criteria. (08 Marks)

OR

- 10 a. Explain Nyquist stability criteria. (04 Marks)
- b. What is controller? Explain the effect of PI and PD controller on second order system. (06 Marks)
- c. Explain the principle of Argument in Nyquist stability criteria. (06 Marks)

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