CBCS SCHEME

USN | | | | | | | | | |

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.

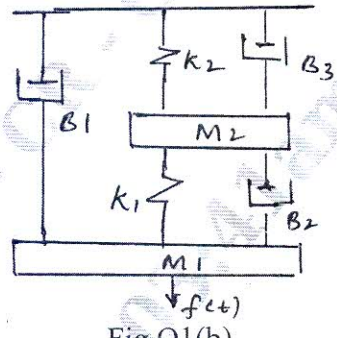

Fig.Q1(b) **(07 Marks)**

c. Explain the A.C. servo motor. **(05 Marks)**

OR

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

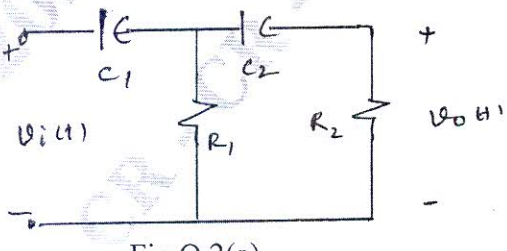

Fig.Q.2(a) **(05 Marks)**

b. Explain the synchros as on error detector. **(04 Marks)**

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

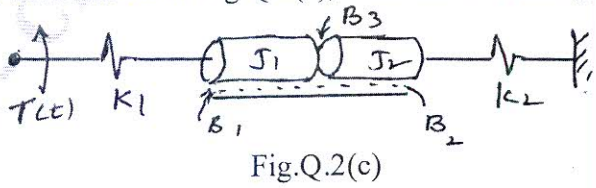

Fig.Q.2(c) **(07 Marks)**

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. **(04 Marks)**

c. For the signal flow graph shown in Fig.Q3(c), determine the T.F C(s)/R(s) using Mason's gain formula.

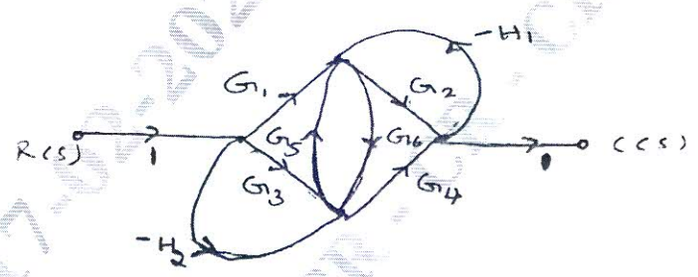

Fig.Q3(c) **(06 Marks)**

OR

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

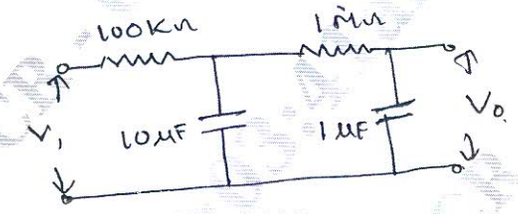

Fig.Q4(a) **(08 Marks)**

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

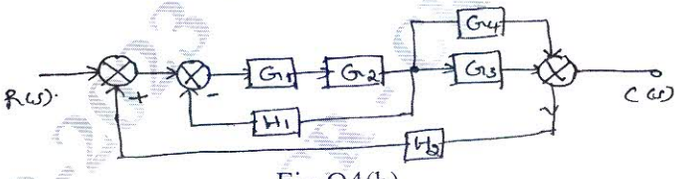

Fig.Q4(b) **(08 Marks)**

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)**

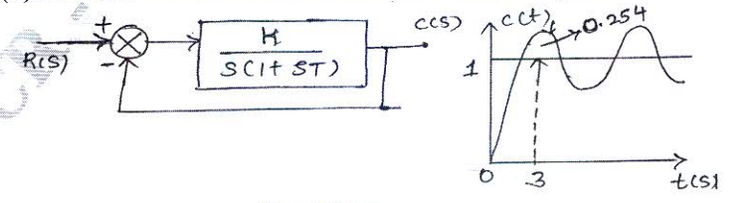

Fig.Q5(c)

OR

6 a. A system oscillate with frequency "ω" 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)**

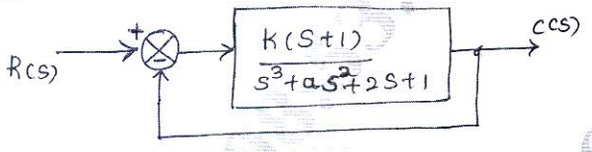

Fig.Q6(a)

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

Module-4

7 a. Sketch the root locus for unity FBCS having $G(s) = \dfrac{K(s+1)}{S(s+2)(s^2+2s+2)}$. 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 $G(s) = \dfrac{10(s+10)}{s(s+2)(s+5)}$. 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: $G(s) = \dfrac{5}{s(1-s)}$. 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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