CBCS SCHEME

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15AE71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Control Engineering

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define control system. Compare open loop and close loop control system. **(08 Marks)**

b. Explain the various requirements of an ideal control system. **(08 Marks)**

OR

2 Find the system equation and analogous network using force voltage analog and force current analogy shown in Fig.Q.2.

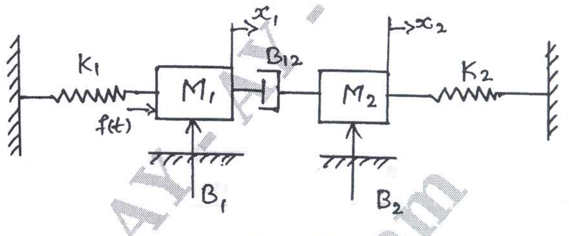

Fig. Q2 **(16 Marks)**

Module-2

3 a. Reduce the BD, shown in Fig Q3(a). Find over all TF $\frac{C}{R}$. **(06 Marks)**

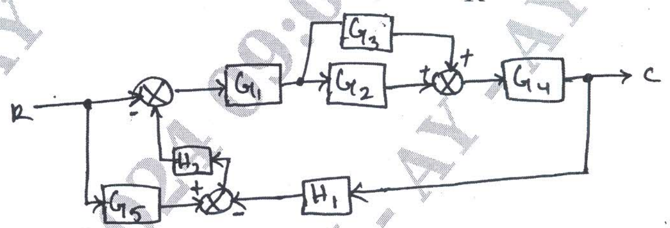

Fig. Q3(a)

b. Obtain the overall the TF $\frac{C}{R}$ for SFG shown in Fig Q3(b).

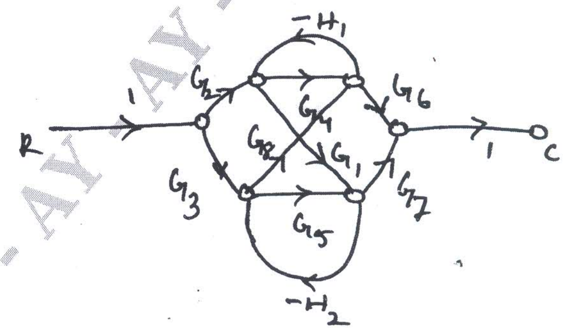

Fig. Q3(b) **(10 Marks)**

OR

4 a. Determine the type and order of the following system for which open loop transfer function are given as follows :

i) $G(s)H(s) = \frac{k}{s(1+s)(1+10s)(1+20s)}$ ii) $G(s)H(s) = \frac{100(s-1)}{s^2(s+5)(s+6)}$. **(08 Marks)**

b. Unity feedback control system is characterized by an OLTF $G(s)H(s) = \frac{k}{s(s+10)}$.

Determine the system gain k, so that the system will have damping ration of 0.5, for this value of k, find the rise time, peak time, settling time and peak over shoot. Assume that the system is subjected to a step of 1V. **(08 Marks)**

Module-3

5 Draw the complete root lows plot for the system with OLTF $G(s)H(s) = \frac{k}{s(s^2+4s+7)}$, Hence determine the range of variation of k over which the system remain stable and what is the range of damping factor for dominant poles. **(16 Marks)**

OR

6 a. Sketch the bode plot for TF

$$G(s) = \frac{Ks^2}{(1+0.02s)(1+0.2s)}.$$

Determine the value of K for the gain cross over frequency to be 5 rad/sec. **(10 Marks)**

b. The following readings were observed from a control system whose Bode plot is plotted.

Corner freq	0	5	20	200	1000
Slope of curve dB/decode	−40	−20	0	−20	−40

Find the value of OLTF for the above unity feedback control system. **(06 Marks)**

Module-4

7 a. Sketch the polar plot for the system having open loop transfer function

$$G(s) = \frac{1}{s^2(1+s)}.$$ **(06 Marks)**

b. Comment on co-relation between time domain and frequency domain. **(10 Marks)**

OR

8 Obtain the Nyquist diagram for the open loop transfunction $G(s)H(s) = \frac{12}{s(s+1)(s+2)}$ and determine the nature of stability. **(16 Marks)**

Module-5

9 a. Explain the series and feedback compensation with block diagram. **(08 Marks)**

b. Explain the following: i) Lead compensator ii) Lag compensator. **(08 Marks)**

OR

10 a. Write a note on Kalman and Gilberts test. **(06 Marks)**

b. Define the following terms :

i) State ii) State variables iii) State vector iv) State space

v) State equation. **(10 Marks)**

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