CBCS SCHEME

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15AE71

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the concept of feedback and basic structure of feedback control system. **(08 Marks)**

b. What are the requirements of an ideal control system? Explain briefly. **(08 Marks)**

OR

2 a. Explain the derivation of analogous networks using :
i) Force – voltage
ii) Force – current analogy. **(08 Marks)**

b. Write equilibrium equations for the mechanical system shown hence obtain F – I analogous system for the given in Fig.Q2(b).

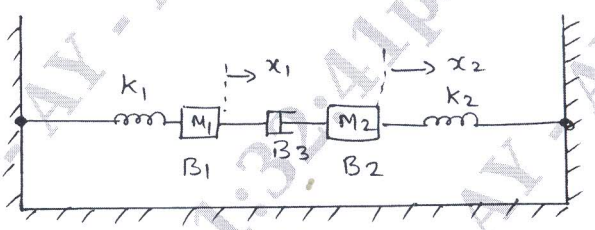

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. Reduce the block diagram shown in Fig.Q3(a). Find overall transfer function : $\frac{C(s)}{R(s)}$.

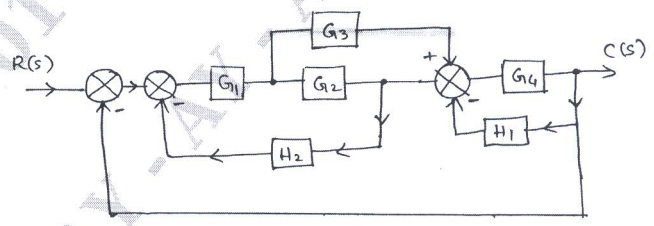

Fig.Q3(a) **(08 Marks)**

b. Draw SFG from given equations to find $\frac{C(s)}{R(s)}$.

$x_2 = 4x_1 + 3x_3 + 2x_4$
$x_3 = 7x_2$
$x_4 = 5x_2 + 6x_3 + 9x_4$
$x_5 = 3x_2 + 3x_4$. **(08 Marks)**

OR

4 a. Obtain an expression for time response of the first order system subjected to unit step input. (08 Marks)

b. The OLTF of a unity negative feedback control system is $G(s)=\frac{25}{s(s+5)}$. Obtain its maximum overshoot, peak time, rise time and settling time. (08 Marks)

Module-3

5 Draw the complete root locus plot for the system with OLTF.

$$G(s)\cdot H(s)=\frac{k}{s(s+4)(s^2+4s+20)} \text{ for } K=0 \text{ to } \infty.$$ (16 Marks)

OR

6 Sketch the bode plot for transfer function :

$$G(s)\cdot H(s)=\frac{e^{-0.2s}}{s(s+1)}.$$ (16 Marks)

Module-4

7 a. Differentiate between time domain and frequency domain. (08 Marks)

b. Obtain polar plot for open loop transfer function :

$$G(s)\cdot H(s)=\frac{1}{(1+T_1S)(1+T_2S)}.$$ (08 Marks)

OR

8 a. Explain the principle of argument. (06 Marks)

b. For a feedback control system, $G(s)H(s)=\frac{40}{(s+4)(s^2+2s+2)}$. Find Gain margin and stability form Nyquist plot. (10 Marks)

Module-5

9 a. Explain PID controller with the block diagram. (06 Marks)

b. What is compensation? Explain Lag and lead compensators. (10 Marks)

OR

10 a. Define the following terms :

i) State
ii) State variable
iii) State vector
iv) State space (08 Marks)

b. Evaluate the observability of the system with

$$A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & -3\end{bmatrix} \quad B=\begin{bmatrix}0\\0\\1\end{bmatrix} \text{ and } C=[3 \;\; 4 \;\; 1]$$

Using Gilbert's test. (08 Marks)

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