CBCS SCHEME

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18AE732

Seventh Semester B.E. Degree Examination, July/August 2022
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define control systems with block diagram and examples, explain open and closed loop control system. **(12 Marks)**

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

OR

2 a. Obtain the transfer function of field controlled DC motor. **(10 Marks)**

b. Write the differential equations governing the mechanical system. Also draw F-V and F-I analogous circuits. [Refer Fig.Q2(b)]

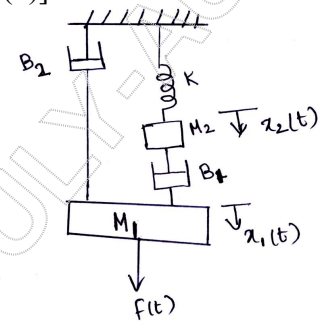

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Obtain the overall transfer function for the block diagram. [Refer Fig.Q3(a)]

S – Summing point T – Take-off point

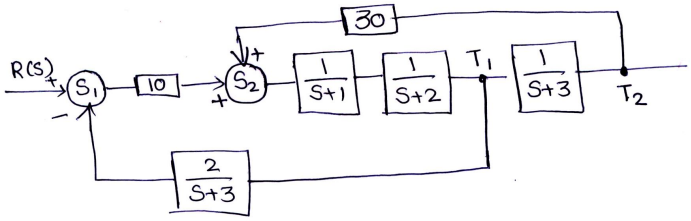

Fig.Q3(a) **(10 Marks)**

b. Find the transfer function $\frac{C(s)}{R(s)}$ by Mason's formula. [Refer Fig.Q3(b)]

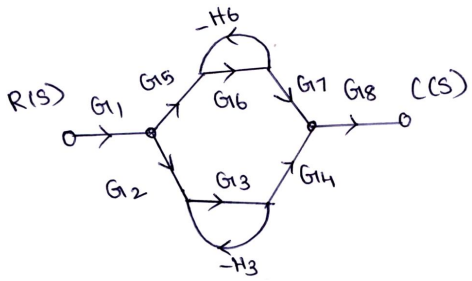

Fig.Q3(b) **(10 Marks)**

OR

4 a. Obtain an expression for response of the first order system subjected to unit step input. **(10 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. **(10 Marks)**

Module-3

5 Sketch the root locus for the system having

$$G(s)H(s)=\frac{K}{s(s+1)(s+2)(s+3)}$$ **(20 Marks)**

OR

6 For a unity feedback system $G(s)=\frac{K}{s(s+2)(s+10)}$. Determine marginal value of 'K' for which system will be marginally stable, using Bode plot. **(20 Marks)**

Module-4

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

b. Obtain polar plot for open loop transfer function $G(s)H(s)=\frac{1}{(1+T_1S)(1+T_2S)}$. **(12 Marks)**

OR

8 a. Explain the principle of argument. **(08 Marks)**

b. For a feedback control system, $G(s)H(s)=\frac{40}{(s+4)(s^2+2s+2)}$, find gain margin and stability from Nyquist plot. **(12 Marks)**

Module-5

9 a. Explain the need for system compensation. List the types of compensation used. **(10 Marks)**

b. With a block diagram, explain proportional, integral and differential controller. **(10 Marks)**

OR

10 Consider the system defined by

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -6\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u(t)$$

$$y=[10 \quad 5 \quad 1]\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

Check the controllability of the system using Gilbert's test and Kalman's test. **(20 Marks)**

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