CBCS SCHEME

USN | | | | | | | | | | |

15MA73

Seventh Semester B.E. Degree Examination, Feb./Mar.2022
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. With block diagram, explain open loop system and closed loop system. **(08 Marks)**

b. Discuss the effects of following controllers, with block diagram
(i) Proportional+Integral controller
(ii) Proportional+Integral+Differential controller. **(08 Marks)**

OR

2 a. Explain the requirements of ideal control system. **(08 Marks)**

b. List the advantages and disadvantages of open loop and closed loop control system. **(08 Marks)**

Module-2

3 a. Derive an expression for the transfer function of armature controlled DC motor. **(08 Marks)**

b. For a mechanical system shown in Fig. Q3 (b),
(i) Draw the mechanical network.
(ii) Write the differential equations of performance.
(iii) Draw the force-voltage analogous network.

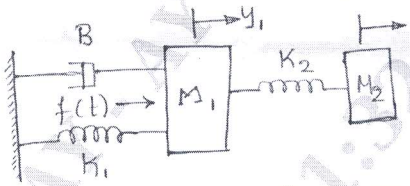

Fig. Q3(b) **(08 Marks)**

OR

4 a. Find the overall transfer function by using Mason's gain formula for the signal flow graph in the Fig. Q4 (a). **(08 Marks)**

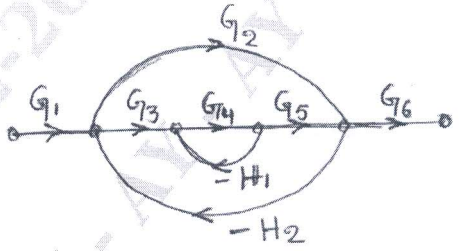

Fig. Q4 (a)

b. Obtain the overall transfer function of the block diagram, shown in Fig. Q4 (b) by reduction technique. **(08 Marks)**

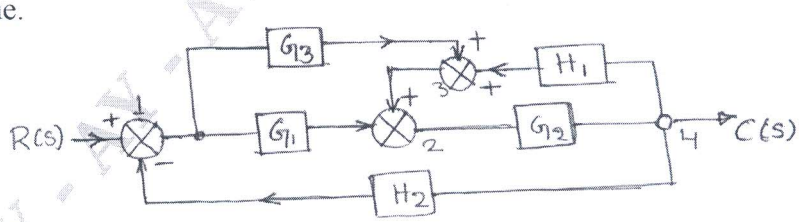

Fig. Q4 (b)

Module-3

5 a. A unity feedback control system has an open loop transfer function, $G(s)=\frac{10}{s(s+2)}$. Find the rise time, percentage peak overshoot time to peak overshoot and settling time for a step input of 12 units. **(08 Marks)**

b. A unit feedback system is characterized by an OLTE, $G(s)=\frac{10}{s^2+2s+6}$. Determine the undamped natural frequency, damping ratio peakover shoot, peak time. **(08 Marks)**

OR

6 Sketch the root locus plot for the system whose open loop transfer function is given by, **(16 Marks)**

$$G(s)H(s)=\frac{K}{s(s+2)(s^2+8s+20)}.$$

Module-4

7 Draw the Bode plot and determine GM, PM, Gain and phase crossover frequencies for a unity feedback system having OLTF of, **(16 Marks)**

$$G(s)=\frac{10}{s(1+0.1s)(1+0.05s)}.$$

OR

8 The open loop function of a control system is $G(s)H(s)=\frac{1}{s^2(s+2)}$. Sketch the Nyquist plot and ascertain the stability. **(16 Marks)**

Module-5

9 a. Explain : (i) Series – Parallel compensation. (ii) Feedback compensation. **(08 Marks)**

b. Discuss the steps to design Lag compensator. Effects and limitations. **(08 Marks)**

OR

10 a. Explain the following terms:
(i) Controllability
(ii) Observability. **(04 Marks)**

b. Consider the system with state equation,

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

Estimate the state controllability by Kalman's test and Gilbert's test. **(12 Marks)**

* * * * *