CBCS SCHEME

USN

18MT34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Differentiate between Open loop and Closed loop systems. **(04 Marks)**

b. For the given system shown in Fig. Q1(b), below apply the differential equations in torque voltage and torque current analogy. Make nodal representation of this model. **(16 Marks)**

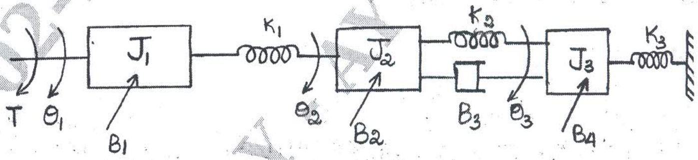

Fig. Q1(b)

OR

2 a. Explain the rules of block diagram reduction techniques, with neat sketch. **(08 Marks)**

b. For the Mechanical system shown in Fig. Q2(b) , find the transfer function . $\frac{X_1(s)}{F(s)}$ **(12 Marks)**

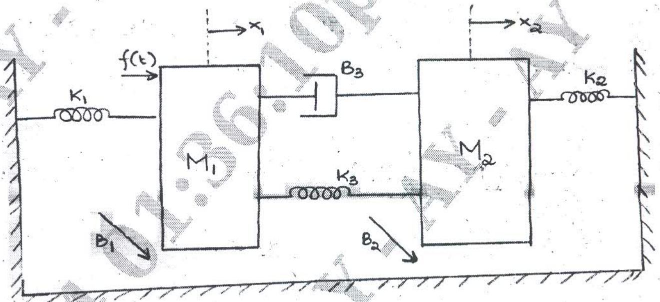

Fig. Q2(b)

Module-2

3 a. Reduce the block diagram shown in Fig. Q3(a) to its simple form and hence obtain $\frac{C(s)}{R(s)}$. **(10 Marks)**

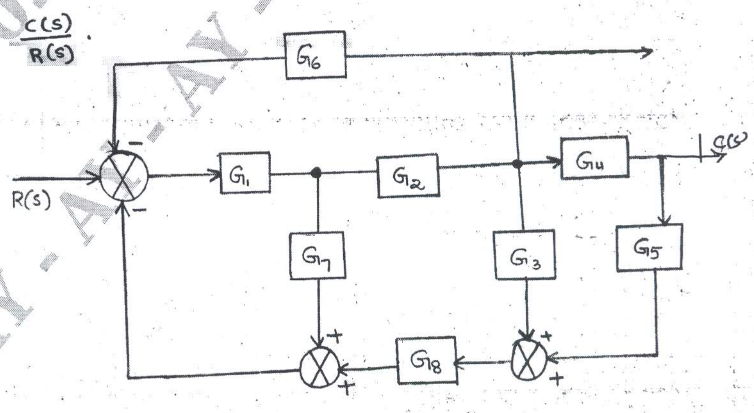

Fig. Q3(a)

b. Define the following terms related to signal flow graph with neat sketch : i) Sink node ii) Branch iii) Source nods iv) Forward path and its gain v) Feedback loop and its gain vi) Non touching loops. **(10 Marks)**

OR

4 a. Determine Transfer function using Mason gain formula (Refer Fig. Q4(a)). **(08 Marks)**

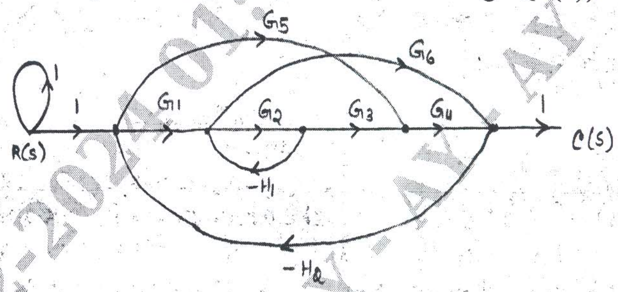

Fig. Q4(a)

b. Derive output response of an second order under damped control system. **(12 Marks)**

Module-3

5 a. Investigate the stability of a Closed – loop system whose characteristics equation is given by $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$. **(12 Marks)**

b. Investigate the stability of a Closed loop system whose characteristics equation is given by : $s^5 + 3s^4 + 7s^3 + 20s^2 + 6s + 15 = 0$. **(08 Marks)**

OR

6 Draw the root locus plot for all values of K ranging from 0 to ∞ for a negative feedback control system having an Open loop transfer function.

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

Module-4

7 a. Define the following : i) Gain cross over frequency ii) Phase cross over frequency iii) Resonant peak iv) Resonant frequency. **(04 Marks)**

b. Write the advantages of frequency domain approach. **(02 Marks)**

c. For the negative feedback control system shown in Fig. Q7(c), find i) Resonant peak ii) Resonant frequency iii) Bandwidth. For K = 5 , 21.39 , 100. **(14 Marks)**

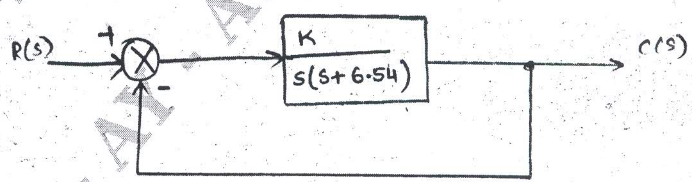

Fig. Q7(c)

OR

8 Sketch the Nyquist plot and Investigate the stability.

$$G(s)\,H(s) = \frac{10}{(s+1)(s+2)}.$$ **(20 Marks)**

Module-5

9 a. Represent the differential equation given below in a State model.

$$\frac{d^3y}{dt^3}+\frac{3d^2y}{dt^2}+\frac{6dy}{dt}+7y(t)=2\,u(t).$$ **(10 Marks)**

b. Represent the electrical circuit, shown in Fig. Q9(b) by a State model. **(10 Marks)**

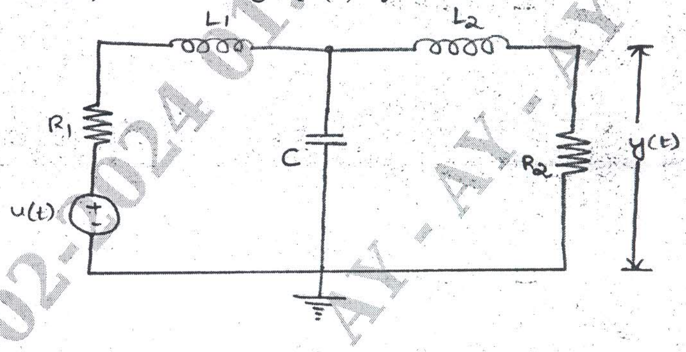

Fig. Q9(b)

OR

10 Obtain the time response for the following system :

$$\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u(t).$$

Where u(t) is unit step function. **(20 Marks)**

* * * * *