CBCS SCHEME

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

15MA73

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. What is a Control System? Explain what are the requirements of a Control System. **(08 Marks)**

b. Explain the response of proportional – plus – integral (PID) control action to unit ramp input. **(08 Marks)**

OR

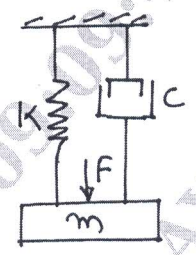
2 a. What are Open and Closed Loop Control System? Give one example of each (Open and Closed) Control System. **(08 Marks)**

b. Define the terms :
i) Actuating signal ii) Feedback signal
ii) Take off point iv) Reference input. **(08 Marks)**

Module-2

3 a. What is a Transfer Function? What are the properties of transfer function? Obtain transfer function of the system shown in fig. Q3(a).

Fig.Q3(a)



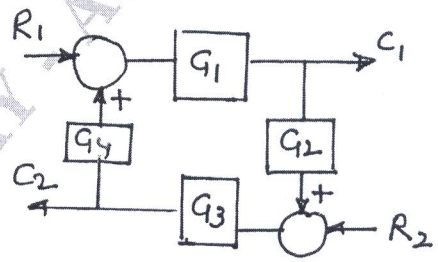
(08 Marks)

b. Obtain the transfer function :

$$\left.\frac{C_1}{R_1}\right|_{R_2=0} \quad \left.\frac{C_1}{R_2}\right|_{R_1=0} \quad \left.\frac{C_2}{R_1}\right|_{R_2=0} \quad \left.\frac{C_2}{R_2}\right|_{R_1=0}$$

Of the system shown in fig. Q3(b).

Fig.Q3(b)



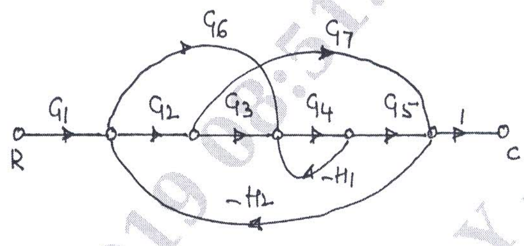
(08 Marks)

OR

4 a. Give the analogy of Force – Voltage and Force - Current. **(08 Marks)**

b. Obtain the transfer function of signal flow graph shown in fig. Q4(b), using Manson's Gain formula. **(08 Marks)**

Fig.Q4(b)



Module-3

5 a. The characteristic equation of a Closed loop system is $S^3 + 20S^2 + (75 + K)S + 30K = 0$. Find the value of K which causes sustained oscillations. What is the frequency of sustained oscillations? **(08 Marks)**

b. Represent a Electric lag network. Obtain its transfer function. Comment on transfer function of lag compensator. **(08 Marks)**

OR

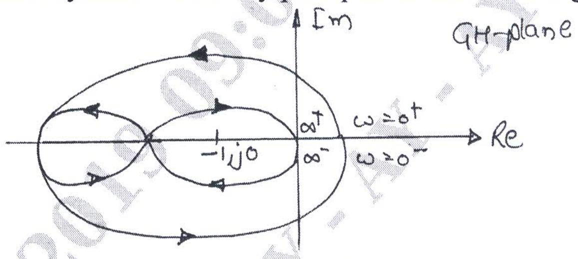
6 a. Obtain the response and steady state error of First Order System subjected to unit ramp signal. **(08 Marks)**

b. Sketch the root locus of $G(s)\,H(s) = \dfrac{K(s+4)}{s(s+2)}$. Comment on the gain margin of the system. **(08 Marks)**

Module-4

7 a. Check the stability of the system whose Nyquist plot is shown in Fig.Q7(a). **(06 Marks)**

Fig.Q7(a)



b. Determine the phase margin and gain margin of the system.

$$G(s) = \frac{10}{s(s+1)(s+5)}$$ using Bode plot. **(10 Marks)**

OR

8 a. Sketch the Polar plot of

$$G(jw) = \frac{1}{(1+jwT_1)(1+jwT_2)}.$$

Determine the imaginary axis cross over frequency and magnitude at imaginary cross over. **(06 Marks)**

b. Explain i) Gain cross cover ii) Phase cross over iii) Phase margin iv) Gain margin.
Sketch the Bode plot for a stable and unstable system. Indicate phase margin and gain margin. **(10 Marks)**

Module-5

9 a. Determine the state observability of the following system.

$$A = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -3 & 2 \\ 0 & 0 & -8 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad C = [1\ 0\ 1].$$ **(06 Marks)**

b. Obtain the state equations of the mechanical system shown in fig. Q9(b). **(10 Marks)**

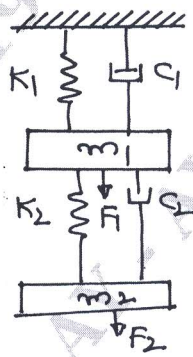


Fig.Q9(b)

OR

10 a. Is the system represented by

$\dot{x}_1 = x_2 + 4 \qquad \dot{x}_2 = -x_1 - 2x_2 + 4$ controllable? **(06 Marks)**

b. Obtain the state equations of the Electrical system shown in fig.Q10(b). **(10 Marks)**

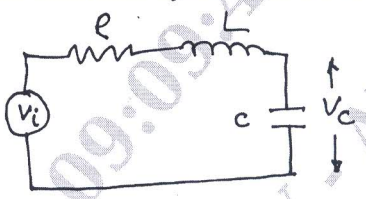


Fig.Q10(b)

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