CBCS SCHEME

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

15EC43

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Control Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Distinguish between open loop and closed loop systems. **(04Marks)**

b. For the circuit shown in Fig.Q1(b) find the transfer function.

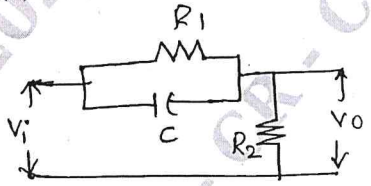

Fig.Q1(b) **(06 Marks)**

c. For the block diagram shown n Fig.Q1(c) determine the transfer function $T(s) = \frac{C(s)}{R(s)}$.

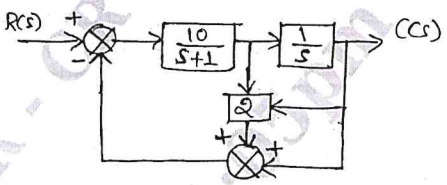

Fig.Q1(c) **(06 Marks)**

OR

2 a. For the mechanical system shown in Fig.Q2(a) draw the F-V analogous network. Find the transfer function $X_2(s)/X_1(s)$.

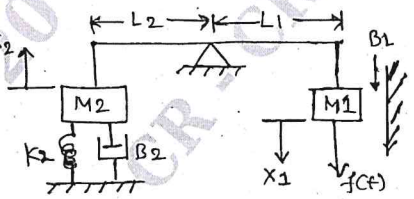

Fig.Q2(a) **(08 Marks)**

b. Using Mason's gain formula find the transfer function of the signal flow graph shown in Fig.Q2(b).

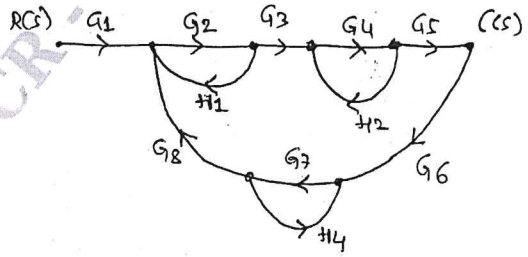

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. Define following time response specifications for under damped system :
i) Peak time
ii) Rise time
iii) Peak over shoot
iv) Settling time. **(08 Marks)**

b. The open loop transfer function of a unity feedback control system is given by

$$G(s) = \frac{K}{S(ST+1)}$$

i) By what factor should K be multiplied so that damping ratio is increased from 0.2 to 0.8
ii) By what factor should T be multiplied so that damping ratio is reduced from 0.6 to 0.3. **(08 Marks)**

OR

4 a. A unity feedback control system is described by the given transfer function :

$$G(s) = \frac{k}{s^2(s+20)(s+30)}.$$

Determine steady state error coefficients also determine the value of K to limit the steady state error to 10 units due to input $r(t) = 1 + 10t + 20t^2$. **(08 Marks)**

b. Explain PD type controller with block diagram, also define with key points for effect of PD controller on the system. **(08 Marks)**

Module-3

5 a. Define stability. Explain necessary conditions for stability. **(06 Marks)**

b. For the unity feedback system with

$$G(s) = \frac{K}{(s+1)^3(s+4)}$$

i) Find range of K for stability
ii) Find the frequency of oscillations when the system is marghally stable. **(10 Marks)**

OR

6 a. List the general rules for construction of root locus. **(04 Marks)**

b. A negative feedback control system is characterized by

$$G(s)H(s) = \frac{K(s+4)}{s(s^2+6s+13)}.$$

Sketch the root locus plot and find the value of K for a system having damping ratio 0.707. **(12 Marks)**

Module-4

7 a. Define gain cross over and phase cross over related to frequency analysis. **(04 Marks)**

b. Draw the bode plot and also find the gain and phase margin for the system equation.

$$G(s)H(s) = \frac{100(1+s/10)(1+s/100)}{(s^2+s+4)}.$$ **(12 Marks)**

OR

8 a. Explain lag compensator circuit, list the effects and limitations of lag comparator network on a system. **(08 Marks)**

b. Sketch the Nyquist plot and calculate the range of 'K' for stability, for the system function : **(08 Marks)**

Module-5

9 a. Define advantages of state variable analysis, also define state, state variables and state space. **(08 Marks)**

b. Obtain the state model for the electrical circuit shown in Fig.Q9(b).

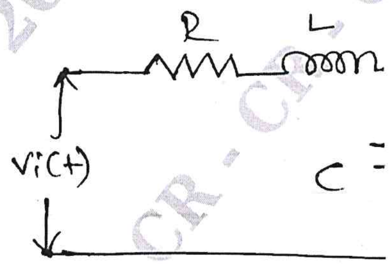

Fig.Q9(b) **(08 Marks)**

OR

10 a. State the usefull properties of the state transition matrix. **(07 Marks)**

b. Obtain the state transition matrix for the matrix given : $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$ **(09 Marks)**

* * * * *