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CBCS SCHEME

15MT34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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. Define a Control System. List merits and demerits of Open loop and Closed loop system. Explain both the systems with neat block diagrams. **(08 Marks)**

b. For the Mechanical system shown in Fig. Q1(b), find the transfunction $X_1(s)/F(s)$.

Fig. Q1(b)

(08 Marks)

OR

2 a. State block diagram reduction technique rules with neat diagram. **(08 Marks)**

b. For the rotational mechanical system shown in Fig. Q2(b), draw electrical network based torque – current analogy. Give all the relevant performance equations. **(08 Marks)**

Fig. Q2(b)

Module-2

3 a. State and explain the Mason's gain formula. **(08 Marks)**

b. Find $\dfrac{C(s)}{R(s)}$ by using Mason's gain formula. **(08 Marks)**

OR

4 a. Derive expression for peak time 'tp' and peak over shoot Mp of an under damped second order control systems subjected to step input. **(08 Marks)**

b. For a system $G(s)H(s) = \dfrac{K}{s^2(s+2)(s+3)}$. Find the value of 'K' to limit steady state error to 10% when input to system is $1 + 10t + \dfrac{40}{2} t^2$. **(08 Marks)**

Module-3

5 a. Explain Routh – Hurwitz's criterion and its limitations. **(08 Marks)**

   b. Find the range of value of 'K' so that system with the following characteristic equation will be stable $F(s) = s^4 + 5s^3 + 5s^2 + 4s + k = 0$. **(08 Marks)**

OR

6 a. Write general steps to solve the problems on root locus. **(06 Marks)**

   b. Draw the approximate root locus diagram for a closed loop system whose loop transfer function is given by

   $$G(s)\,H(s) = \frac{K}{s(s+5)(s+10)}.$$ **(10 Marks)**

Module-4

7 a. List the advantages and disadvantages of frequency domain analysis. **(06 Marks)**

   b. For a unity feedback system

   $$G(s) = \frac{800(s+2)}{s^2(s+10)(s+40)}.$$ Sketch the bode plot. Comment on Stability. **(10 Marks)**

OR

8 For a certain control system

   $$G(s)\,H(s) = \frac{K}{s(s+2)(s+10)}.$$ Select the Nyquist plot and hence calculate the range of values of 'K' for stability. **(16 Marks)**

Module-5

9 a. List the properties of state transition matrix. **(06 Marks)**

   b. Find the state space representation of the circuit diagram shown in Fig. Q9(b). Take V_S as the input and i_x as the output. **(10 Marks)**
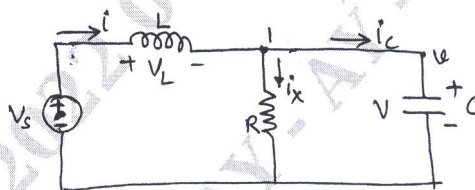

Fig. Q9(b)

OR

10 a. Define : i) State   ii) State vector   iii) State space   iv) State variable. **(08 Marks)**

   b. Derive the transfer function for state model. **(08 Marks)**

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