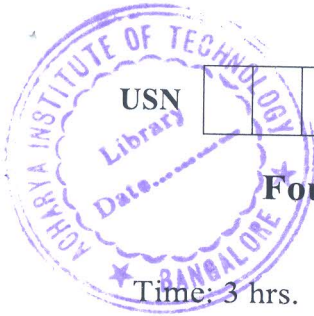


CBCS SCHEME



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

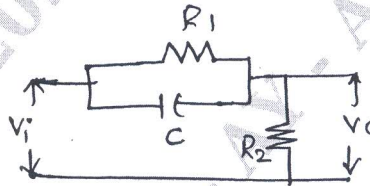


Fig.Q1(b)

(06 Marks)

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

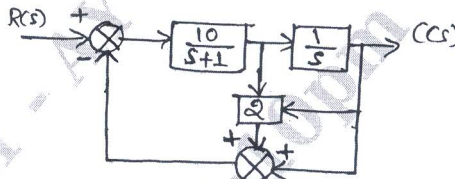


Fig.Q1(c)

(06 Marks)

OR

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

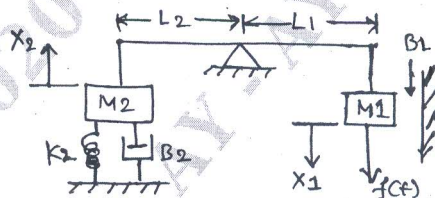


Fig.Q2(a)

(08 Marks)

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

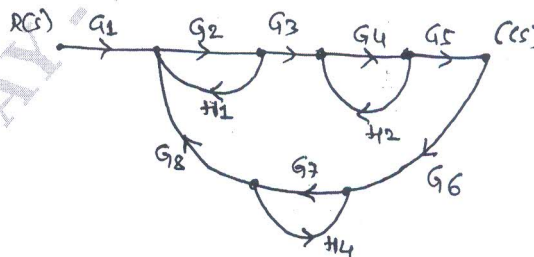


Fig.Q2(b)

(08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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 marginally 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 compensator 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).

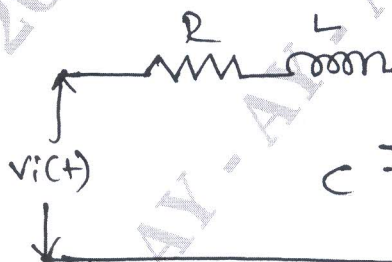


Fig.Q9(b)

(08 Marks)

OR

- 10 a. State the useful 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)
