Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTERB.TECH DEGREE EXAMINATION (S), FEBRUARY 2023
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code: **20ECT307**

Course Name: **Control Systems**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

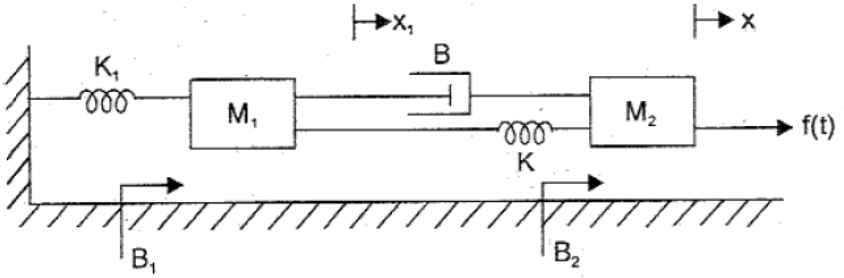
1. Write Mason's gain formula and explain the terms in it.
2. With a neat diagram explain an example of closed loop control system.
3. What is time response of a system.?
4. Define any three-time domain specifications.
5. Construct Routh array and determine the stability of the system whose characteristic equation is $s^4+8s^3+18s^2+16s+5=0$.
6. Explain about the stability of linear control systems.
7. Explain Nyquist stability criterion with neat diagrams.
8. Differentiate gain margin with phase margin.
9. Obtain the state model of the system whose transfer function is given as $\frac{Y(s)}{U(s)} = \frac{1}{s^2+10s+7}$.
10. List the drawbacks in the transfer function analysis of control systems.

PART B

(Answer one full question from each module, each question carries 14marks)

MODULE I

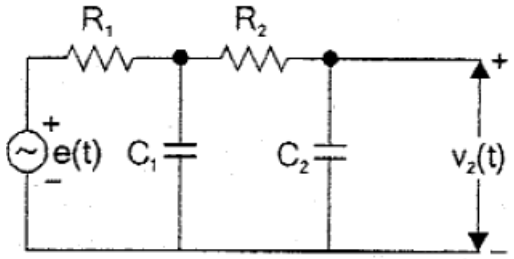
11. Determine the transfer function X (s)/ F(s) of the system shown in figure.



(14)

OR

12. Determine the transfer function of the electrical system shown in figure. (14)



MODULE II

13. a) With neat diagrams explain the standard test signals used for analyzing the system performance. (10)

b) What is steady state error of the system? (4)

OR

14. Explain step response of undamped and critically damped second order system in detail. (14)

MODULE III

15. Sketch the root locus plot for the system whose open loop transfer function is given by $GH(s) = \frac{k}{s(s^2 + 4s + 13)}$. (14)

OR

16. a) Explain the effect of introduction of P, PI and PID controllers in the systems. (9)

b) What are the effects of addition of a zero and a pole in transfer function? Explain with an example. (5)

MODULE IV

17. Sketch the bode plot for the following transfer function and obtain the gain margin and phase margin. $G(s) = \frac{10}{(1+0.4s)(1+0.1s)}$ (14)

OR

18. A unity feedback system has an open loop transfer function $G(s) = \frac{k}{s(2s+1)}$. Design a suitable lag compensator so that phase margin is 40 degrees and the steady state error for the ramp input is less than or equal to 0.2. (14)

MODULE V

19. a) Obtain the state model of the system whose transfer function is given as $\frac{Y(s)}{U(s)} = \frac{10}{s^3 + 4s^2 + 2s + 1}$ (10)

b) Sketch the block diagram and signal flow graph of state model (4)

OR

20. a) Explain controllability and observability with an example. (5)

b) Compute the state transition matrix for a system represented by the state equation $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ by Laplace transform method. (9)

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