Reg. No.															

Question Paper Code	13478

B.E. / B.Tech. - DEGREE EXAMINATIONS, APR / MAY 2025

Fifth Semester

Electronics and Communication Engineering

20ECEL508 - CONTROL SYSTEMS ENGINEERING

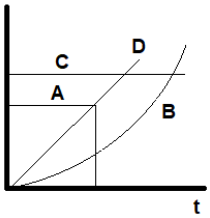
Regulations - 2020

(Use of Graph, Semilog sheet, Polar graph is permitted)

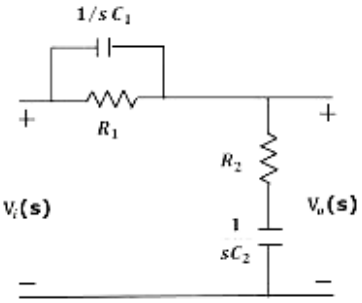
Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following is incorrect pair under force – voltage analogy?? (a) Spring Constant – Capacitance (b) Mass – Inductance (c) Velocity – Current (d) Displacement – Charge	1	K1	CO1
2.	Which of the following distinguishes a closed loop system from open loop system? (a) Output Pattern (b) Input Pattern (c) Servo Mechanism (d) Feedback	1	K1	CO1
3.	Two blocks have transfer function G1 and G2. If the blocks are connected in parallel, their resultant will be (a) G1G2 (b)G1 + G2 (c) G1 / 1-G1G2 (d) G1 / 1+G1G2	1	K1	CO2
4.	While modelling the state variable system using physical variables, the number of state variable is equal to (a) Order of the system (b) Number of zeros (c) Non – Linear variables in the system (d) Type of the system	1	K1	CO2
5.	Read the following statements and answer the question (A) Step function is the derivative of ramp function (B) Impulse function is the derivative of step function (a) (A) is True, (B) is True (b) (A) is True, (B) is False (c) (A) is False, (B) is True (d) (A) is False, (B) is False	1	K1	CO3
6.	In the given Figure, the signal D represents  (a) Impulse function (b) Parabolic function (c) Step function (d) Ramp function	1	K1	CO3
7.	The Bode plot is drawn for the (a) Open Loop transfer function (b) Closed Loop transfer function (c) Feedback transfer function (d) Laplace transfer function	1	K1	CO4
8.	The frequency domain specification is (a) Rise time (b) Delay time (c) Phase Margin (d) Peak time	1	K1	CO4
9.	In root locus plot, the angle of asymptode is given by (a) 360/Number of poles (b) 360/Number of Zeros (c) 360/[Number of poles + Number of zeros] (d) 360/[Number of poles – Number of zeros]	1	K1	CO5

10. The following electrical network belongs to *1 K1 CO6*



(a) Lag Lead compensator (b) Lead Lag compensator
(c) Lag compensator (d) Lead compensator

PART - B (12 × 2 = 24 Marks)

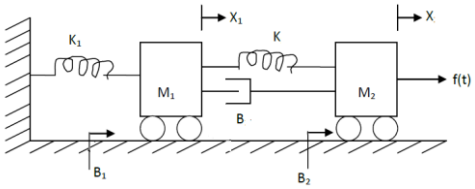
Answer ALL Questions

11. Differentiate between open loop and closed loop system. *2 K2 CO1*
12. Define transfer function of a system. *2 K1 CO1*
13. Write the Mason's Gain formula. *2 K1 CO2*
14. What do you meant by controllability? *2 K1 CO2*
15. Distinguish between the order and type of system. *2 K1 CO3*
16. What is the impact of steady state error in a control system? *2 K1 CO3*
17. Define Phase margin. *2 K1 CO4*
18. What is gain crossover Frequency? *2 K1 CO4*
19. State Routh's criterion for stability. *2 K1 CO5*
20. Define characteristic equation. *2 K1 CO5*
21. Why derivative controller is not used separately in control applications? *2 K2 CO6*
22. What is the need for a controller? *2 K1 CO6*

PART - C (6 × 11 = 66 Marks)

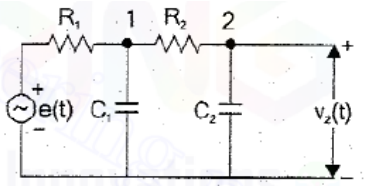
Answer ALL Questions

23. a) Write the differential equations governing the mechanical system and derive the transfer function of the system. *11 K2 CO1*

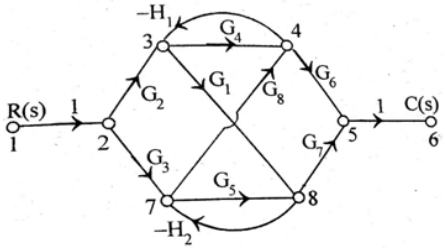


OR

b) Examine the given electrical network and derive the transfer function. *11 K2 CO1*



24. a) Using the mason's gain formula formulate the gain of the following system: *11 K2 CO2*



OR

b) Interpret the system and check whether it is completely controllable and observable *11 K2 CO2*

$$\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \\ \dot{x}3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u$$

$$y = [1 \quad 0 \quad 0] \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix}$$

25. a) Explain the response of a closed loop first order system for a unit step input. Plot the response of the system. *11 K2 CO3*

OR

b) Consider a unity feedback system with a closed loop transfer C(s)/R(s) = (Ks+b)/(s^2 + as + b). Determine the open loop transfer function G(s). Show that steady state error with unit ramp input is given by (a-k)/b. *11 K2 CO3*

26. a) Sketch the bode plot for the transfer function G(S) = 75(1+0.2S)/S (S^2+16S+100) and determine phase margin and gain margin. *11 K3 CO4*

OR

b) Model the open loop transfer function of a unity feedback system given by G(S) = 1/S (1+S) (1+2S). Sketch the polar plot and determine the gain and phase margin. *11 K3 CO4*

27. a) Construct the Routh Table and determine the stability of the system defined by the equation $9S^5$-$20S^4$+$10S^3$-S^2-9S-10 = 0. Identify the location of the roots and comment. *11 K3 CO5*

OR

b) Construct the root locus of a unity feedback system whose open loop transfer is G(S) H(S)= K(S+1.5)/S(S+1)(S+5). *11 K3 CO5*

28. a) Apply the effects of P, PI and PID controllers on the system dynamics. *11 K3 CO6*

OR

b) Determine a suitable lag compensator so that phase margin is 40^o and the steady state error for ramp input is less than or equal to 0.2 for a unity feedback system having an open loop transfer function of G(S) = K/S (1+2S). *11 K3 CO6*