Reg. No.															

Question Paper Code	13920

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fifth Semester

Electronics and Communication Engineering

20ECEL508 - CONTROL SYSTEMS ENGINEERING

Regulations - 2020

(Use of Polar Graphs, Semilog Graphs 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 element is not used in an automatic control system? (a) control element (b) Sensor (c) Oscillator (d) Error detector	1	K1	CO1
2.	The output of the feedback control system must be a function of _____ (a) Output and feedback signal (b) Input and feedback signal (c) Reference input (d) Reference output	1	K2	CO1
3.	A node having only outgoing branches. (a) Input node (b) Output node (c) Incoming node (d) Outgoing node	1	K1	CO2
4.	Loop which does not possess any common node are said to be _____ loops. (a) Forward gain (b) Touching loops (c) Non touching loops (d) Feedback gain	1	K1	CO2
5.	The ramp input is applied to a unity feedback system with type number 1 and zero frequency 20. What is the percentage of steady state error? (a) 1% (b) 2% (c) 5% (d) 9%	1	K2	CO3
6.	The initial response when output is not equal to input is _____. (a) Error response (b) Transient response (c) Dynamic response (d) Static response	1	K1	CO3
7.	The polar plot of a transfer function passes through the critical point (-1,0). Gain margin is (a) Zero (b) -1dB (c) 1dB (d) Infinity	1	K2	CO4
8.	If the gain of the open-loop system is doubled, the gain margin (a) Is not affected (b) Gets doubled (c) Becomes half (d) Becomes one-fourth	1	K2	CO4
9.	If root loci plots of a particular control system do not intersect the imaginary axis at any point, then the gain margin of the system will be: (a) 0 (b) 0.707 (c) 1 (d) Infinite	1	K2	CO5
10.	Kalman's test is for: (a) Observability (b) Controllability (c) Optimality (d) Observability and controllability	1	K2	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	What are the basic elements used for modeling mechanical translational system?	2	K1	CO1
12.	Why negative feedback is invariably preferred in a closed loop system?	2	K1	CO1
13.	What are the basic components of block diagram?	2	K1	CO2
14.	Write the Mason's Gain formula.	2	K1	CO2
15.	Outline the difference between type and order of a system.	2	K2	CO3
16.	Define rise time.	2	K1	CO3
17.	Define phase margin.	2	K1	CO4
18.	The damping ratio and the undamped natural frequency of a second order system are 0.5 and 5 respectively. Apply suitable formula and solve for the resonant frequency.	2	K2	CO4
19.	What is root locus?	2	K1	CO5
20.	Write the necessary and sufficient condition for stability in Routh's stability criteria.	2	K2	CO5

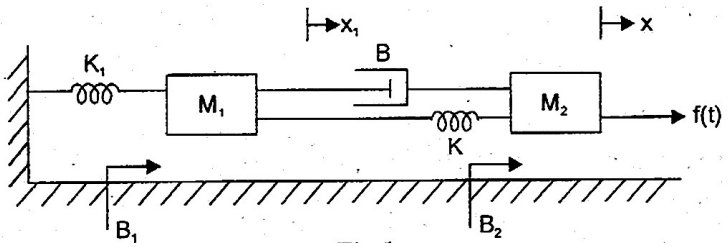
21. Define observability. 2 K1 CO6

22. Construct the circuit diagram of a lag compensator and illustrate its pole–zero plots. 2 K1 CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

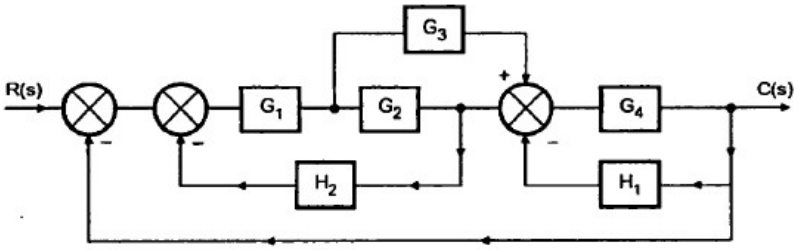
23. a) Analyze the given mechanical system and write the differential equations governing them. Also, determine the transfer function. 11 K2 CO1



OR

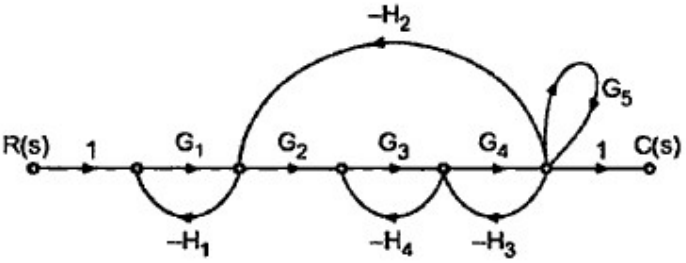
b) Examine field-controlled DC servomotor and derive its transfer function. 11 K2 CO1

24. a) Apply block diagram reduction technique and find the transfer function C(s)/R(s) for the system shown in figure. 11 K2 CO2



OR

b) Make use of Mason's gain formula and find the transfer function for the following signal flow graph. 11 K2 CO2



25. a) Analyze the time-domain specifications of a second-order system when subjected to a step input and derive the necessary expressions. 11 K2 CO3

OR

b) Analyze the time response of the second-order system given by $\frac{C(s)}{R(s)} = \frac{25}{s^2+6s+25}$ for a unit-step input, and determine its rise time, peak time, peak overshoot, and settling time. 11 K2 CO3

26. a) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{1}{s(1+s)^2}$. Utilize the polar plot and determine the gain and phase margin. 11 K3 CO4

OR

b) Make use of semilog graph to sketch the bode plot for the following transfer function and determine phase margin and gain margin. *11 K3 CO4*

$$G(s) = \frac{75(1 + 0.2s)}{s(s^2 + 16s + 100)}$$

27. a) Utilize Routh Hurwitz criterion to determine the stability of a system representing the characteristic equation, $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15 = 0$. *11 K3 CO5*

OR

b) Apply the rules of root locus construction to illustrate the step-by-step procedure for obtaining the root locus of a given system. *11 K3 CO5*

28. a) Explain the steps to design lead compensator. *11 K2 CO6*

OR

b) Explain Kalman's test for observability. *11 K2 CO6*