Reg. No.												

Question Paper Code	12068

21 JUL 2023

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Fourth Semester

Electronics and Instrumentation Engineering

(Common to Instrumentation and Control Engineering)

20ICPC401 - CONTROL SYSTEMS

(Regulations 2020)

(Use of Semi log, Polar and Ordinary graph sheets can be provided)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

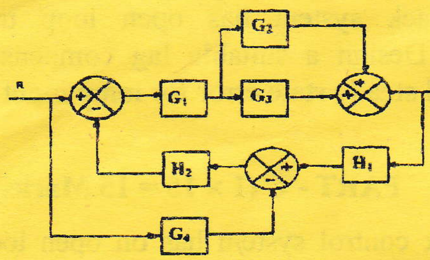
Answer ALL Questions

		Marks, K-Level, CO
1.	Write the Mason's Gain Formula.	*2,K1,CO1*
2.	What is block diagram? What are the basic components of block diagram?	*2,K2,CO1*
3.	Distinguish between type and order of a system.	*2,K2,CO2*
4.	Mention the time domain specifications.	*2,K1,CO2*
5.	Define Phase Margin.	*2,K1,CO3*
6.	Write the expression for resonant peak and resonant frequency.	*2,K2,CO3*
7.	What is the necessary and sufficient conditions for stability?	*2,K2,CO4*
8.	How will you find the gain K at a point on root locus?	*2,K1,CO4*
9.	What is series compensation?	*2,K1,CO5*
10.	Draw the S-plane representation of lead compensator.	*2,K2,CO5*

PART - B (5 × 13 = 65 Marks)

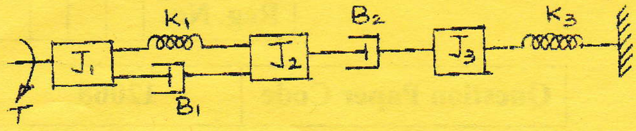
Answer ALL Questions

11. a) Obtain the closed loop transfer function C(S) / R(S) using block diagram reduction techniques. *13,K3,CO1*



OR

b) Write the differential equations governing the mechanical rotational system shown in figure. Draw the torque-voltage and torque-current electrical analogous circuits and verify by writing mesh and node equations. *13,K3,CO1*



12. a) Derive the expression and draw the response of second order system for critically damped case with unit step input. *13,K3,CO2*

OR

b) Consider the unity feedback system with a closed loop transfer function C(s)/R(s) = Ks+b/s^2+as+b. Determine open loop transfer function G(s). Show that steady state error with unit ramp input is given by (a-k)/b. *13,K3,CO2*

13. a) Sketch the bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec. $G(s) = Ks^2/(1+0.2s)(1+0.02s)$ *13,K3,CO3*

OR

b) Sketch the polar plot for the following transfer function and find Gain cross over frequency , Phase cross over frequency, Gain margin and Phase margin. G(S)= 1/S(1+S)(1+2S). *13,K3,CO3*

14. a) The characteristic polynomial of a system is $s^7+9s^6+24s^5+24s^4+24s^3+24s^2+23s+15=0$. Determine the location of roots on s-plane and hence the stability of the system. *13,K3,CO4*

OR

b) Construct the Nyquist plot for a system whose open loop transfer function is given by $G(s)\ H(s)= K(1+s)^2/s^3$. Find the range of K for stability. *13,K3,CO4*

15. a) Consider a unity feedback system with open loop transfer function G(s)= K/s(s+1). Design a lead compensator to meet the following specifications. (i) Phase margin of the system is 45°. (ii) Steady state error for ramp input ≥1/15. (iii) Gain crossover frequency < 7.5 rad/sec. *13,K3,CO5*

OR

b) An unity feedback system has open loop transfer function of G(S)=k/s(1+2s). Design a suitable lag compensator that the phase margin is 40° and steady state error for ramp input is less than or equal to 0.2. *13,K3,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) A unity feedback control system has on open loop transfer function $G(s)= K/s(s^2+4s+13)$.Sketch the root locus. *15,K3,CO4*

OR

b) Derive the expressions for Time domain specifications with unit step input. *15,K3,CO2*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create **12068**