Reg. No.												

Question Paper Code	11649

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Fourth Semester

Instrumentation and Control Engineering

(Common to Electronics and Instrumentation Engineering)

20ICPC401 - CONTROL SYSTEMS

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Interpret the 'transfer function of a system'.	*2,K1,CO1*
2.	Write the mason's gain formula.	*2,K1,CO1*
3.	The damping ratio of a system is 0.75 and the natural frequency of oscillation is 12rad/sec. Determine the peak time.	*2,K2,CO2*
4.	Name the standard test signals used in control system.	*2,K1,CO2*
5.	Define the phase margin.	*2,K1,CO2*
6.	List any two advantages of frequency response analysis.	*2,K1,CO2*
7.	State the necessary condition for the Routh's criterion for stability.	*2,K1,CO3*
8.	What are asymptotes? How will you find the angle of asymptotes?	*2,K2,CO3*
9.	Draw the pole-zero plot lead compensator and write its equation.	*2,K2,CO4*
10.	Infer the need of compensator in control system.	*2,K2,CO4*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Derive a transfer function for an armature controlled DC motor and a field controlled DC motor with block diagrams. *13,K3,CO1*

OR

b) Write the differential equations governing the behaviour of the mechanical system shown in Figure 1. Draw the force voltage and force current electrical analogous circuits and verify by writing mesh and node equations. *13,K3,CO1*

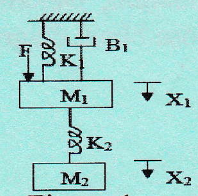

Figure.1

12. a) (i) Derive the step response of a second order undamped system. 7,K3,CO2
(ii) With the neat diagram,discuss the working of PD controller in detail. 6,K3,CO2

OR

b) The open loop transfer function of a servo system with unity feedback system is $G(s) = \frac{10}{s(0.1s+1)}$ Evaluate the static error constants of the system. Obtain the steady state error of the system, when subjected to an input given by the polynomial $r(t) = a_0 + a_1 t + \frac{a_2}{2} t^2$. 13,K3,CO2

13. a) Sketch the Bode plot for the following transfer function and obtain gain and phase cross over frequencies. 13,K3,CO3

$$G(s) = \frac{10}{[s(1 + 0.4s)(0.1s + 1)]}$$

OR

b) The open loop transfer function of a unity feedback system is given by 13,K3,CO3

$$G(s) = \frac{1}{[s^2(1 + s)(1 + 2s)]}$$

Sketch the polar plot and determine the phase margin and gain margin.

14. a) A unity feedback control system has an open loop transfer function is $G(S) = \frac{K}{s(s^2+4s+13)}$ Calculate the value of K using root locus method. 13,K4,CO3

OR

b) (i)Writ short notes on Nyquist the stability criterion. 3,K4,CO3
(ii)Construct the Routh array and determine the stability of the system represented by the characteristic equation s5+s4+2s3+2s2+3s+5=0. Comment on the location of the roots of characteristic equation. 10,K4,CO3

15. a) Describe the design procedure of lag–lead compensator using Bode plot. 13,K4,CO4

OR

b) 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 40^0 and the steady state error for ramp input is less than or equal to 0.2. 13,K4,CO4

PART - C (1 × 15 = 15 Marks)

16. a) Using block diagram reduction, Determine the closed loop transfer function of the system whose block diagram is shown in Figure.2. 15,K3,CO1

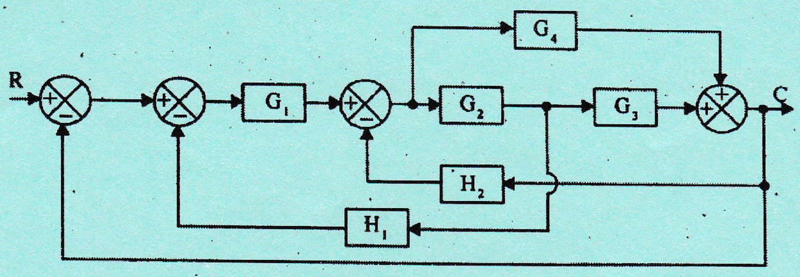

Figure.2

OR

b) Estimate the overall gain of the system whose signal flow graph is shown in Figure 3. *15,K3,CO1*

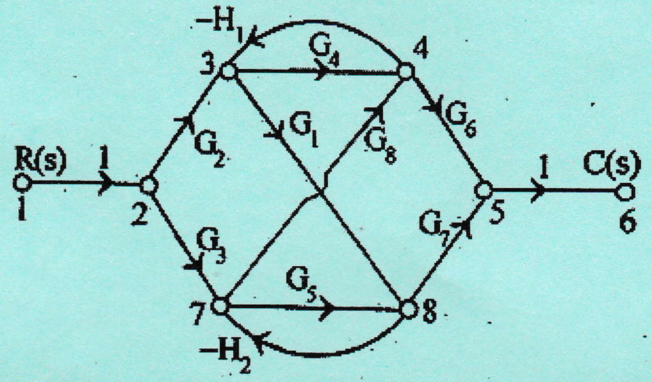

Figure.3