Reg. No.												

Question Paper Code	11613

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

Fifth Semester

Electronics and Communication Engineering

20ECEL508 - CONTROL SYSTEM ENGINEERING

(Regulations 2020)

(Polar graph need to be issued)

Duration: 3 Hours

Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level,CO
1.	Distinguish between open loop and closed loop system.	2,K1,CO1
2.	Write the analogous electrical elements in force-current analogy for mechanical translational system.	2,K1,CO1
3.	Describe Masons gain formula.	2,K2,CO2
4.	A unity feedback system has a open loop transfer function of $G(s) = \frac{10}{(s+2)(s+1)}$. Determine the steady state error for unit step input.	2,K2,CO3
5.	List the time domain specifications of a second order system.	2,K1,CO3
6.	Define phase margin.	2,K1,CO4
7.	State Nyquist stability criterion for a closed loop system when the open loop system is stable.	2,K1,CO4
8.	State Routh's criterion for stability.	2,K1,CO5
9.	Write formula for centroid of the asymptotes found in root locus technique.	2,K2,CO5
10.	Write the need of compensators and list types of compensators.	2,K1,CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Write down the differential equation governing mechanical system shown in below Figure:1. Draw the torque voltage and torque current electrical analogous circuit. *13,K2,CO1*

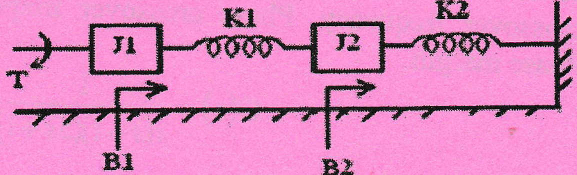

Figure:1

OR

b) Derive the transfer function of a DC servo motor. *13,K2,CO1*

12. a) Derive the transfer function for the block diagram shown in below Figure 2 using block diagram reduction technique. *13,K2,CO2*

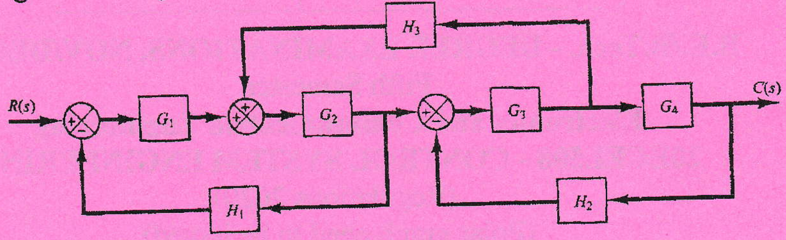

Figure 2

OR

b) Derive the overall transfer function of the system whose signal flow graph is shown in below Figure 3. *13,K2,CO2*

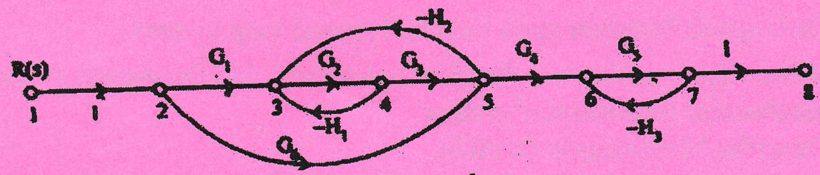

Figure 3

13. a) For a second order system with open loop transfer function $G(s)=\frac{25}{s(s+5)}$, determine the rise time, peak time, maximum overshoot and settling time when the system is subject to unit step input. *13,K2,CO3*

OR

b) Derive the time domain specifications of a second order system. *13,K1,CO3*

14. a) Plot the bode diagram for the following transfer function and obtain the gain and phase crossover frequencies. *13,K3,CO4*

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

OR

b) Sketch the polar plot for the following transfer function and find Gain crossover frequency, Phase crossover frequency, Gain margin and Phase margin. *13,K3,CO4*

$$G(s)=\frac{1}{s(s+1)(5s+1)}$$

15. a) Write down the procedure for designing lag-lead compensator using bode plot. *13,K2,CO6*

OR

b) Construct a suitable lag compensator so that phase margin is 40° 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 *13,K3,CO6*

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

PART - C (1 × 15 = 15 Marks)

16. a) Sketch the root locus of the system whose open loop transfer function is $G(s)=\frac{K}{[s(s+2)(s+4)]}$. Find the value of K so that damping ratio of the closed loop system is 0.5. *15,K3,CO5*

OR

b) (i) The open loop transfer function of a unity feedback system is given by $G(s)=\frac{K}{[(s+2)(s+4)(s^2+6s+25)]}$. By applying the Routh criterion, discuss the stability of the closed loop system as a function of K. *8,K3,CO5*

(ii) Determine the value of K of the open loop transfer function given by $G(s)=\frac{K}{[(s+1)(s+5)(s^2+6s+25)]}$, which will cause sustained oscillations in the closed loop system. Find out the corresponding oscillating frequencies. *7,K3,CO5*