## II B.Tech - II Semester – Regular / Supplementary Examinations MAY - 2023

## **CONTROL SYSTEMS ENGINEERING** (ELECTRONICS & COMMUNICATION ENGINEERING)

## Duration: 3 hours

## Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.

2. All parts of Question must be answered in one place.

BL – Blooms Level

CO – Course Outcome

			BL	СО	Max. Marks		
		UNIT-I					
1	a)	What is meant by open loop and closed loop systems? Differentiate both the systems.	L2	CO1	7 M		
	b)	Calculate the overall transfer function C/R for the block diagram shown in figure below by using block diagram reduction rules. $R + G_{1} + G_{2} + G_{2} + C$	L3	CO1	7 M		
OR							
2	a)	Explain the rules of block diagram reduction.	L2	CO1	7 M		
	b)	Obtain the transfer function of below signal	L4	CO1	7 M		
		flow graph using Mason's Gain formula.					

Image: stability criterion. $G(s) = \frac{K_1(2s+1)}{s(5s+1)(s+1)^2}$ : If the unit step input is applied to the system. Solve the value of K1 if the steady error is to be less than 0.1.Image: box of the system of the system of the system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{R(s)} = \frac{1}{1+sT}$ for unit step input.Image: system $\frac{L2}{r}$ CO2Image: system $\frac{C(s)}{r}$ system $\frac{C(s)}{r}$ system $\frac{L2}{r}$ CO3Image: system $\frac{L2}{r}$ CO3Image: system $\frac{L2}{r}$ System $\frac{L2}{r}$ CO3Image: system $\frac{L2}{r}$ CO3Image: system $\frac{L2}{r}$ CO3Image: system $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ CO3Image: system $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ System $\frac{L2}{r}$ System $$			$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
Image: constraint of the second system is a second system is a second system is a second system. Solve the value of K1 if the steady error is to be less than 0.1.Image: constraint of the system. Solve the value of K1 if the steady error is to be less than 0.1.b) Analyze the response of a first order system $\frac{C(S)}{R(S)} = \frac{1}{1+ST}$ for unit step input.L4CO27ORUNIT-III4a) What is meant by transient response and steady state response?L2CO27UNIT-III5a) Discuss the stability condition using R-H stability criterion.L2CO34b) The characteristic polynomial of a system is: stability criterion.L4CO310b) The characteristic polynomial of a system is: Examine the location of roots on s-plane and hence the stability of the system.L4CO310			UNIT-II			
b)Analyze the response of a first order system $\frac{C(S)}{R(S)} = \frac{1}{1+ST}$ for unit step input.L4CO27OR4a)What is meant by transient response and steady state response?L2CO27b)Explain about PD and PID Controllers.L2CO37UNIT-III5a)Discuss the stability condition using R-H stability criterion.L2CO34b)The characteristic polynomial of a system is: s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 23s^2 + 15s = 0. Examine the location of roots on s-plane and hence the stability of the system.L4CO310	3	a)	transfer function $G(s) = \frac{K_1(2s+1)}{s(5s+1)(s+1)^2}$ : If the unit step input is applied to the system. Solve the value of K <sub>1</sub> if the steady error is to be	L3	CO2	7 M
4a)What is meant by transient response and L2CO27steady state response?b)Explain about PD and PID Controllers.L2CO37UNIT-III5a)Discuss the stability condition using R-HL2CO34stability criterion.b)The characteristic polynomial of a system is:L4CO310b)The characteristic polynomial of a system is:L4CO310b)Examine the location of roots on s-plane and hence the stability of the system.b)b)b)		b)	Analyze the response of a first order system $\frac{C(S)}{R(S)} = \frac{1}{1+ST}$ for unit step input.	L4	CO2	7 M
steady state response?Image: Constraint of the systemb)Explain about PD and PID Controllers.L2CO37UNIT-III5a)Discuss the stability condition using R-HL2CO34stability criterion.Image: Constraint of the system is:L4CO310b)The characteristic polynomial of a system is:L4CO310 $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 23s^2 + 15s = 0.$ Examine the location of roots on s-plane and hence the stability of the system.Image: Constraint of the system			-			
UNIT-III5a)Discuss the stability condition using R-HL2CO34stability criterion.b)The characteristic polynomial of a system is:L4CO310b)The characteristic polynomial of a system is:L4CO310 $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 23s^2 + 15s = 0.$ Examine the location of roots on s-plane and hence the stability of the system.I	4	a)		L2	CO2	7 M
5a)Discuss the stability condition using R-HL2CO34stability criterion.b)The characteristic polynomial of a system is:L4CO310 $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 23s^2 + 15s = 0.$ Examine the location of roots on s-plane and hence the stability of the system.66		b)	Explain about PD and PID Controllers.	L2	CO3	7 M
stability criterion.Sb) The characteristic polynomial of a system is:L4 $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 23s^2 + 15s = 0.$ L4Examine the location of roots on s-plane and hence the stability of the system.I0			UNIT-III		11	
$s^{7} + 9s^{6} + 24s^{5} + 24s^{4} + 24s^{3} + 23s^{2} + 15s = 0.$ Examine the location of roots on s-plane and hence the stability of the system.	5	a)		L2	CO3	4 M
		b)	$s^{7} + 9s^{6} + 24s^{5} + 24s^{4} + 24s^{3} + 23s^{2} + 15s = 0.$ Examine the location of roots on s-plane and	L4	CO3	10 M
UK		1	OR	1	<u>.                                    </u>	

6	Dre	aw the complete root locus for $(s)H(s) =$	ΙΛ	CO4	14 M			
0			L4	04	14 11			
	s(s-	$\frac{K}{(k+2)(s+4)}$ . From the root locus plot, analyze						
		range of values of K for which the system						
	wil	l have damped oscillatory response.						
		UNIT-IV						
7	Ske	etch the bode plot for the following transfer	L4	CO5	14 M			
	fun	ction and analyze phase margin and gain						
	ma	rgin:						
	G	$(s) = \frac{K(s+1)}{s(s-1)(s^2+11s+24)}$						
		OR						
8	a)	Derive an expression for resonant peak and	ΙΛ	CO4	7 M			
0	<i>a)</i>	resonant frequency for a standard second	LT	COT	/ 111			
		order system.						
	b)	Construct the polar plot for the open loop	L4	CO4	7 M			
	0)	transfer function of a unity feedback system			/ 1/1			
	given by							
		$G(s) = \frac{1}{s(s+1)^2}$						
		$U(3) = \frac{1}{s(s+1)^2}$						
	、 、	UNIT-V	<b>.</b>		- > 4			
9		Determine the state transition matrix for	L4	CO5	7 M			
		$\begin{vmatrix} -2 & 1 & 0 \\ \dot{X} - & 0 & -2 & 1 \end{vmatrix} r$						
		$\dot{X} = \begin{bmatrix} -2 & 1 & 0\\ 0 & -2 & 1\\ 0 & 0 & -2 \end{bmatrix} x$						
		Deduce the condition for controllability and	L3	CO1	7 M			
		observability.						
		OR		<u>ı                                    </u>				
10	a)	State and Prove the properties of state	L3	CO1	7 M			
		transition matrix.						
		•		•				

b)	Consider a system with state model given	L4	CO5	7 M
	below:			
	$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u;$			
	Evaluate the state controllability.			