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GPCET
Pioneering Innovative Education

SET NO: II

G.PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY::KURNOOL

(Autonomous)

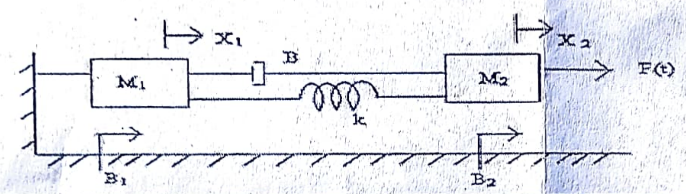
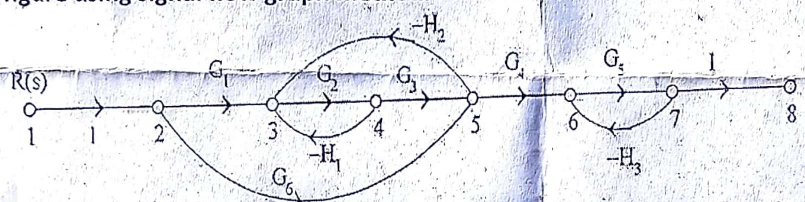
II B.Tech II SEM (R23) MID-I Examinations – Feb'2025

Department of Electronics and Communication Engineering

Sub: LCS (A40217) Date: 28-02-2025

Time: 90 min Max. Marks: 30

Answer all the Questions (3X10=30M)

		Marks	Unit	CO	Cognitive Level
1	Write the differential equation governing the mechanical system shown in figure. Draw the Force-voltage and Force-Current analogous circuit. 	10M	I	CO 1	Analyze
	(OR)				
2	Obtain the transfer function of the feedback control system shown in figure using signal flow graph method. 	10M	I	CO1	Analyze
3	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 the damping ratio of the closed loop system is 0.5	10M	II	CO2	Analyze
	(OR)				
4.a	Analyze for the nature of the roots of $F(s)=s^3+6s^2+11s+6=0$. Using R-H criterion.	5M	II	CO2	Analyze
4.b	What are breakaway and break in points? How to determine them?	5M	II	CO2	Remember
5	What is Control system? Explain various types of Control systems with examples.	10M	I	CO1	Remember
	(OR)				
6.a	State the limitations of RH criterion and Define relative stability	5M	II	CO2	Understand
6.b	Explain the procedure to construct Root Locus.	5M	II	CO2	Understand

Signature of faculty

Signature of HOD

SET NO: II

GPCET

G.PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY::KURNOOL

(Autonomous)

II B.Tech II SEM (R23) MID-II Examinations – APRIL'2025

Department of Electrical and Electronics Engineering

Sub: LCS (A40217) | Date: 28-04-2025

Time: 90 min | Max. Marks: 30

Answer all the Questions (3X10=30M)

		Marks	Unit	CO	Cognitive Level
1	The unity feedback system is characterized by an open loop transfer function G(S)=K/s(s+10). Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and peak time for a unit step input.	10M	II	CO2	Analyze
	(OR)				
2	Derive an expression for the steady state errors of Type-0, Type-1 and Type-2 systems excited by unit step, unit ramp and unit parabolic inputs.	10M	II	CO2	Apply
3	Define and explain various frequency domain specifications with relevant expressions.	10M	IV	CO4	Understand
	(OR)				
4	Given a unity feedback system with the forward-path transfer function G(s)=K/s(s+1)(s+3)(s+6) and a delay of 0.5 second, find the range of gain, K, to yield stability. Use Bode plots.	10M	IV	CO4	Analyze
5	Determine the solution of given A state model of a system is given as: $[\dot{X}] = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -3 & -3 \end{bmatrix}[X] + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ U and Y=[1 0 0] X	10M	V	CO5	Analyze
	(OR)				
6.a	Discuss about the properties of state transition matrix.	5M	V	CO5	Remember
6.b	Compute the resolvent matrix and state transition matrix of the state matrix: $A=\begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$	5M	V	CO5	Analyze

Signature of faculty

Signature of HOD

CODE: A40217 | R23 | H.T.No:

G.PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

B.Tech II Year II Semester Regular Examinations May 2025

Subject Name: **Linear control systems**

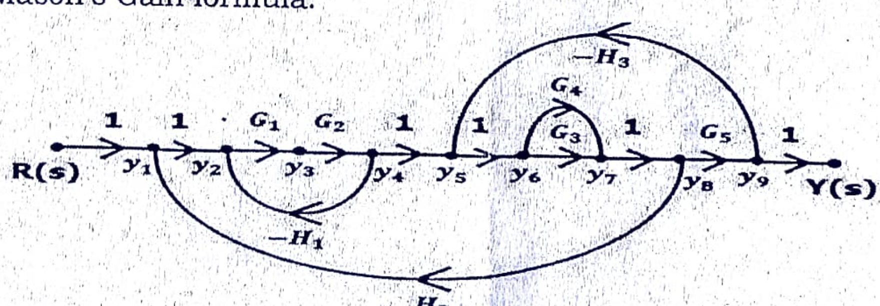
Branch: **Electronics& communication Engineering**

SET-2

Time: 3 Hours **Max. Marks: 70**

Instructions:

1. Answer all 10 questions from Part-A. Each question carries two marks
2. Answer one full question from each unit in Part-B. Each full question carries 10marks

		PART-A			
1	a	What is the effect of positive feedback on stability?	2M	CO1	BTL1
	b	Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system.	2M	CO1	BTL1
	c	Define 'TYPE' and 'ORDER' of a system. What are the TYPE and ORDER of $G(s)H(s) = \frac{2}{s(1+s)}$?	2M	CO2	BTL1
	d	What are test signals and write their significance	2M	CO2	BTL1
	e	How the roots of characteristic equation are related to stability?	2M	CO3	BTL1
	f	In Routh array what conclusion you can make when there is a row of all zeros?	2M	CO3	BTL1
	g	Draw the Bode plot for Phase Lead compensator.	2M	CO4	BTL1
	h	For a second order system, the damping ratio is 0.5 and natural frequency of oscillation is 8 rad/sec. Calculate resonant peak and resonant frequency.	2M	CO4	BTL1
	i	Define state and state variable.	2M	CO5	BTL1
	j	What are the advantages of state space analysis over transfer function analysis?	2M	CO5	BTL1
		PART-B			
		UNIT-I			
2		Draw the circuit diagram of armature-controlled D.C Motor. Derive its transfer function	10M	CO1	BTL6
		OR			
3		Obtain the transfer function of below signal flow graph using Mason's Gain formula. 	10M	CO1	BTL6
		UNIT-II			

4	a	Explain the effect of PI and PD controllers on transient response of the system.	5M	CO2	BTL2
	b	Obtain the time response of un-damped second order system for unit step input.	5M	CO2	BTL2
OR					
5		A unity feedback control system has an open-loop transfer function G(s) = 5/(s(s+1)). Find the rise time, percentage overshoot, peak time and settling time for a step input of 10 units. Also determine peak overshoot.	10M	CO2	BTL5
UNIT-III					
6		Determine the range of K for stability of a unity-feedback control system whose open loop transfer function :G(S)=K/S(S+1)(S+2)	10M	CO3	BTL3
OR					
7	a	Obtain the Routh array for the system whose characteristic polynomial equation is: $S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$. Check the stability.	5M	CO3	BTL2
	b	Define the following terms with respect to Root locus technique: (i) Centroid. (ii) Asymptote. (iii) Break away point.	5M	CO3	BTL1
UNIT-IV					
8		Make a polar plot of the frequency response for the transfer function given by: G(s)=s+5/s(s+2)(s+4)	10M	CO4	BTL3
OR					
9		Explain Nyquist criterion. Write the procedure for determining Nyquist plot.	10M	CO5	BTL2
UNIT-V					
10		A state model of a system is given as: $[\dot{X}]=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -1 & -3 & -3\end{bmatrix}[X]+\begin{bmatrix}0\\0\\1\end{bmatrix}U$ and $Y=[1\ \ 0\ \ 0]X$ Determine: (i) The Eigen values. (ii) The state transition matrix.	10M	CO5	BTL2
OR					
11		$A=\begin{bmatrix}0 & 1 & 0\\ 3 & 0 & 2\\ -12 & -7 & -6\end{bmatrix}$ Diagonalize the given matrix	10M	CO5	BTL6

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G PULLAIAH COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade |
Accredited by NBA (CIV, CSE, ECE & EEE) | Affiliated to JNTUA)
Nandikotkur Road, Venkayapalli (V), Kurnool - 518452, Andhra Pradesh

Subject Code	:	A30218	Subject Name	:	Control Systems Engineering		
Class/Section	:	B.Tech	Year	:	II	Semester	: II

QUESTIONBANK

Name of Faculty: Dr. G. Pandu Ranga Reddy

BLOOMS LEVEL					
Remember	L1	Understand	L2	Apply	L3
Analyze	L4	Evaluate	L5	Create	L6

2 Marks Questions

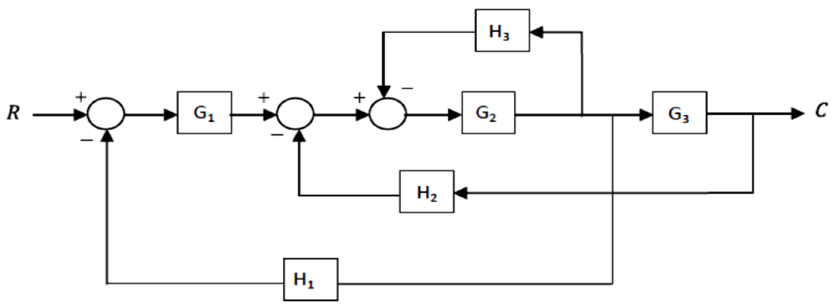
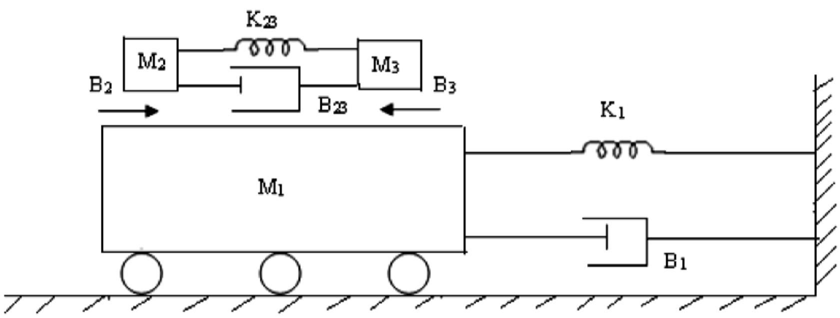
Unit No	Q.No	Question	CO Mapped	Bloom's Taxonomy Level
Unit 1	1	Distinguish between open loop and closed loop systems.	CO1	L1
	2	Define Masons Gain formula.	CO1	L1
	3	What is the basic rule used for block diagram reduction technique?	CO1	L1
	4	What is the effect of positive feedback on stability?	CO1	L1
	5	List the advantages of negative feedback in control system	CO1	L1
	6	Write the force balance equation of an ideal mass element and ideal dashpot element.	CO1	L1
	7	What are the difference between synchro transmitter and Control transformer	CO1	L1
	8	In Torque-Voltage analogy, what are the analogous electrical quantities for (i) Torque (ii) Moment of inertia (iii) Angular displacement (iv) Stiffness.	CO1	L1
	11	List out the advantages of closed loop systems	CO1	L1
	12	If a forward path touched all closed loops, what would be the value of Δ_k	CO1	L1
	13	Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system.	CO1	L1

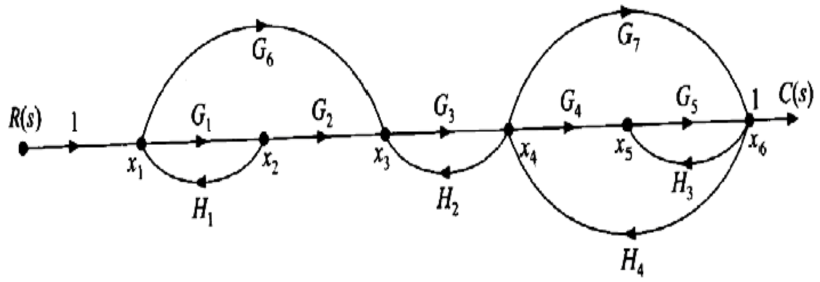
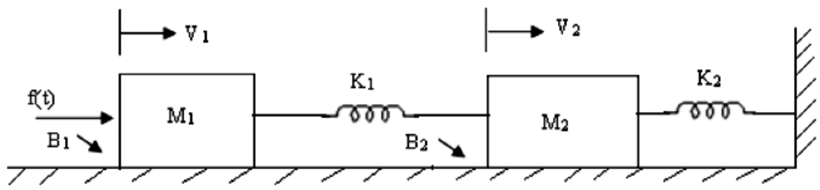
Unit 2	1	List the time domain specifications.	CO2	L1
	2	What are test signals and write their significance	CO2	L1
	3	How do you find the type of a control system	CO2	L1
	4	Find the value of position error constant for second order system using ramp input	CO2	L1
	5	Give steady state error for step and velocity input	CO2	L1
	6	The closed loop transfer function of a second order system is $C(S)/R(S) = 10/S^2+6S+10$. What is the type of damping in the system	CO2	L1
	7	What is steady state error?	CO2	L1
	8	Sketch the unit step response of a first order system and show how Time constant is defined	CO2	L1
	9	Distinguish between order and type of system	CO2	L1
	10	The open loop transfer function of a unity feedback system is $G(s) = 20/s(s+10)$. What is the nature of response of closed loop system for unit step input?	CO2	L1
	11	Define impulse signal with its waveform	CO2	L1
	12	How the system was classified depending on the value of the damping?	CO2	L1
Unit 3	1	State limitations for Routh's stability	CO3	L1
	2	How do you determine the centroid and angle of asymptotes?	CO3	L1
	3	What are asymptotes? How will you find angle of asymptotes	CO3	L1
	4	When is a system said to be Bounded Input-Bounded Output (BIBO) stable?	CO3	L1
	5	State the necessary and sufficient conditions of Routh-Hurwitz criterion stability?	CO3	L1
	6	Determine the stability of the system whose characteristic equation is given by: $S^4+6S^3+23S^2+40S+50=0$ using Routh's stability criterion.	CO3	L1
	7	How the roots of characteristic equation are related to stability?	CO3	L1
	8	What is centroid? How the centroid is calculated?	CO3	L1
	9	State the rules for obtaining the breakaway point in Root locus	CO3	L1
	10	What are the effects of adding a zero to a system	CO3	L1
	11	Why marginally stable systems are considered unstable under the BIBO definition of stability?	CO3	L1
	1	Find the resonant frequency and resonant peak for a unity feedback system with: $(ss)=100s/s(s+10)$.	CO4	L1

Unit 4	2	What is Polar plot?	CO4	L1
	3	Define Phase Margin, Gain Margin with reference to Bode plot	CO4	L1
	4	What is meant by lag compensation?	CO4	L1
	5	Write the expression for resonant peak in frequency response analysis	CO4	L1
	6	Draw the approximate polar plot for a Type Zero second order systems	CO4	L1
	7	For a second order system, the damping ratio is 0.5 and natural frequency of oscillation is 8 rad/sec. Calculate resonant peak and resonant frequency.	CO4	L1
	8	What are the advantages of Bode plot?	CO4	L1
	9	Draw the polar plot of G(S)=1/1+ST	CO4	L1
	10	A unity feedback system has G(S) = 100/S(S+10). What is the resonant frequency of system.	CO4	L1
	11	Draw the Bode plot for Phase Lead compensator.	CO4	L1
	12	Define resonant frequency. Write the transfer function of Lag/ Lead Compensator.	CO4	L1
	13	Write a short note on the correlation between the time and frequency response.	CO4	L1
Unit 5	1	State the properties of state transition matrix.	CO5	L1
	2	What are the advantages of state space modeling using physical variables?	CO5	L1
	3	Define State and State Variables	CO5	L1
	4	Write general form of state variable matrix.	CO5	L1
	5	What are phase variables?	CO5	L1
	6	What is meant by Diagonalization	CO5	L1
	7	Enumerate any four important advantages of state space approach over transfer function approach	CO5	L1
	8	Define Controllability	CO5	L1
	9	How can the poles of a system be found from the state equations?	CO5	L1
	10	Write the general form of the state-transition matrix. How many constants would have to be found?	CO5	L1

10 Marks Questions

Unit No	Q.No	Question	COs	Bloom's Taxonomy Level

Unit 1	1	Compare and contrast ‘open loop control systems’ and ‘closed loop control systems’.	CO1	L2
	2	What are the various ways of classifying control systems? Discuss in detail the effects of feedback on system performance	CO1	L2
	3	Write Mason’s gain formula and explain the meaning of all the terms in the formula.	CO1	L2
	4	Draw the circuit diagram of armature-controlled D.C Motor. Derive its transfer function	CO1	L2
	5	Find the transfer function by using signal flow graph method	CO1	L3
	6	Write the differential equations governing the mechanical rotational system shown in fig. and determine the transfer function.	CO1	L2
	7	Find the transfer function by using Block diagram reduction methods.	CO1	L2
	8	Explain synchro transmitter and receiver.	CO1	L2
	9	For the mechanical system shown in the figure draw the Force-Voltage and Force-Current analogous circuits.	CO1	L3
	10	Derive the transfer function of A.C servo motor.	CO1	L2
	11	Using block diagram reduction technique, obtain closed loop transfer function of the figure give below. 	CO1	K4
	12	Write the differential equations governing the mechanical system shown in figure. Draw the force-voltage and force-current electrical analogous circuits and verify by writing mesh and node equations. 	C01	K4
	13	Obtain the transfer function using mason gain formula for the signal flow graph shown in figure.	CO1	

				K4
	14	For the mechanical system shown in the figure draw the force-voltage and force-current analogous circuits. 	CO1	K3
	15	Derive the transfer function of the following I. Armature controlled D.C.Motor. II. Field controlled D.C.Motor.	CO1	K3
Unit 2	1	Define and derive Time domain specifications of Rise time and Peak time.	CO2	L2
	2	The unity feedback system is characterized by an open loop transfer function G(S)=K/s(s+10). Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and peak time for a unit step input.	CO2	L2
	3	Find the steady state error when the input is unit step signal.	CO2	L2
	4	The unity feedback system is characterized by an open loop transfer function G(s)=K/S(S+10). Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine rise time, peak time, peak over shoot and settling time.	CO2	L2
	5	Derive the response of under damped second order system for unit step input.	CO2	L2
	6	The open loop transfer function of a system with unity feedback ,G(s) =K/S(ST+1) where K and T are positive constants. By what factor should the amplifier gain K be reduced, so that the peak overshoot of the unit step response of the system is reduced from 75% to 25%?	CO2	L2
	7	The open loop transfer function of a control system with unity feedback is given by G(s)=100/S(S+0.1S). Determine the steady state error of the system when the input is $10 + 10t + 4t^2$.	CO2	L3
	8	Explain error constants Kp, Kv and Ka for type II system.	CO2	L2
	9	Derive an expression for the steady state errors of Type-0, Type-1 and Type-2 systems excited by unit step, unit ramp and unit parabolic inputs.	CO2	L3
	10	A unity feedback control system has an open-loop transfer function G(s) = 5/(s(s+1)). Find the rise time, percentage overshoot, peak time and	CO2	L2

		settling time for a step input of 10 units. Also determine peak overshoot.		
	11	Derive the Response of Underdamped Second Order System With Unit Step Input	CO2	K3
	12	The unity feedback system is characterized by an open loop transfer function G(S)=K/s(s+10). Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and peak time for a unit step input.	CO2	K4
	13	The unity feedback system is characterized by an open loop transfer function G(S)=K/s(s+10). Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and peak time for a unit step input.	CO2	K4
	14	Define and derive Time domain specifications of Rise time, Peak Time and Maximum Peak overshoot.	CO2	K3
Unit 3	1	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.	CO3	L2
	2	Draw the root locus plot for G(s) =K/(s(s+1)(s+3)).	CO3	L3
	3	Explain the Routh's criterion to determine the stability of a dynamical system and give its limitations.	CO3	L2
	4	Determine the range of K for stability of a unity-feedback control system whose open loop transfer function :G(S)=K/S(S+1)(S+2)	CO3	L2
	5	How many roots of the characteristic polynomial of a system have positive real parts?	CO3	L3
	6	State and explain the rules for construction of root loci, which are concerned with:	CO3	L2
	7	(i)Angle of asymptotes. (ii) Breakaway point on real axis.	CO3	L3
	8	Consider the loop transfer function $G(s)H(s)=K(s+2)/(s^2+2s+2)$. Construct the root locus and comment on stability.	CO3	L2
	9	Determine the range of K for stability of unity feedback system whose open loop transfer function is: G(s) = /s(+ 1)(+ 2) using Routh Hurwitz criterion.	CO3	L2
	10	Using the Routh-Hurwitz criterion and the unity feedback system with G(s)=K/s(s+1)(s+2)(s+5).(i) Find the range of K for stability. (ii) Find the value of K for marginal stability. (iii) Find the actual location of the closed-loop poles when the system is marginally stable.	CO3	L3
	11	Determine the location of roots on s-plane and hence the stability of the following systems. (i) s5 + s4 + 2s3 + 2s2 + 3s + 5 = 0.. (ii) $s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$.	CO3	K4
	12	Consider the loop transfer function $\boldsymbol{G(s)} = \frac{\mathbf{K(s+2)}}{\mathbf{(s^2+2s+2)}}$ Construct the root locus and comment on stability.	CO3	K4
	13	With the help of Routh's stability criterion find the stability of the following systems represented by the characteristic equations:	CO3	K4

		(i)s4+8s3+18s2+16s +5 =0. (ii)s6+2s5+8s4+12s3+20s2+16s +16 =0.		
	14	Sketch the root locus for the unity feedback system whose open loop transfer function is: $G(s) = \frac{k}{s(s+4)(s+6)}$	CO3	K4
	15	The characteristic polynomial of a system is s7+9s6+24s5+24s4+24s3+24s2+23s+15=0. Determine the location of roots on s-plane and hence the stability of the system.	CO3	K4
	16	Sketch the root locus of the system whose open loop transfer function is $\boldsymbol{G(s) = \frac{K}{s(s+2)(s+4)}}$. Find the value of K so that the damping ratio of the closed loop system is 0.5.	CO3	K4
Unit 4	1	Define and explain various frequency domain specifications with relevant expressions.	CO4	L3
	2	State and explain the Nyquist Criterion.	CO4	L3
	3	Draw the Nyquist plot for the system whose open loop transfer function is: G(S)H(S) = K/S (S+2) (S+10). Determine the range of K for which closed loop system is stable.	CO4	L3
	4	Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies. G(S) = KS/(1 + 0.2S) (1 + 0.02S). Determine the value of K for a gain cross over frequency of 20 rad/sec.	CO4	L2
	5	Make a polar plot of the frequency response for the transfer function given by: G(s)=s+5/s(s+2)(s+4)	CO4	L3
	6	Given a unity feedback system with the forward-path transfer function G(s)=K/s(s+1)(s+3)(s+6) and a delay of 0.5 second, find the range of gain, K, to yield stability. Use Bode plots.	CO4	L3
	7	Sketch the Bode plots for a system G(s)=15(s+5)/s(s^2+16s+100) and discuss its stability.	CO4	L3
	8	Use Nyquist criteria to find the stability of system G(s)=1/s^2(1+s) and H(s) = 1 + 2s.	CO4	L2
	9	What is Lead compensator and obtain the transfer function? Also draw its Pole-Zero plot.	CO4	L3
	10	The transfer function of a phase-lead controller is given as G(s)=1+asT/1+sT, a>1 and T is constant depending on the circuit parameters. Determine the maximum value of the phase load which can be obtained from this controller.	CO4	L3
	11	Draw the bode plot and determine gain margin and phase margin of a system whose open loop transfer function is given by **G(S)=100/S(S+1)(S+2)**	CO4	K5
	12	Determine the stability of the system using Nyquist stability criterion: G(s)H(s) = 10/[s(s+1)(s+4)]	CO4	K5
	13	Draw the Bode Plot of the Transfer Function G(s)=20/s(1+3s)(1+4s) and determine Gain Margin, Phase Margin, Gain Crossover Frequency and Phase Crossover Frequency.	CO4	K4

	14	Sketch the Polar Plot of the following Transfer Function and determine Phase Margin and Gain Margin $G(s) = (S+5)/S(S+2)(S+4)$	CO4	K4
	15	Derive the expressions for resonant frequency, resonant peak and bandwidth of a second order system.	CO4	K4
	16	Draw the Bode Plot of the Transfer Function G(S)=20/s(1+3s)(1+4s) and determine Gain Margin, Phase Margin, Gain Crossover Frequency and Phase Crossover Frequency.	CO4	K5
Unit 5	1	What is meant by state space model? Evaluate the mathematical expression for the state space representation for the continuous system.	CO5	L2
	2	Consider a system whose transfer function is given by: Y(S)/U(S) = 10(S+1)/S3+6S2+5S+10. Evaluate the state model for the system by Block diagram reduction.	CO5	L2
	3	Obtain the state variable representation of an armature controlled D.C Servomotor	CO5	L3
	4	The dynamic behaviour of the system is described by dc(t)/dt+10c(t)=40e(t) , where 'e(t)' is the input and 'c(t)' is the output. Determine the transfer function of the system.	CO5	L3
	5	Obtain the state model for the system described by $Y(S)/U(S)=s^2+2s+4/s^3+9s^2+26s+24$. Using phase variables.	CO5	L2
	6	Diagonalize the system matrix,A= $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$	CO5	L3
	7	Compute the resolvent matrix and state transition matrix of the state matrix: A= $\begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$	CO5	L3
	8	Consider the system $\dot{X}=AX$ with $X_0=X(0)$ where A= $\begin{bmatrix} -2 & -4 \\ 1 & -2 \end{bmatrix}$ Find Ø(t) and the solution for $X_0=[1 \quad 1]^T$.	CO5	L3
	9	Discuss about the properties of state transition matrix.	CO5	L3
	10	A state model of a system is given as: $[\dot{X}] = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -3 & -3 \end{bmatrix} [X] + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ U and Y=[1 0 0] X	CO5	L3
	11	Obtain the state model for the transfer function of a control system given by $\frac{Y(s)}{U(s)} = \frac{s^2+3s+4}{s^3+3s^2+3s+2}$	CO5	K4
	12	Consider a system with state model given by $\begin{bmatrix} \dot{x}1 \\ \dot{x}2 \\ \dot{x}3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix}$ u and y= $[1 \quad 0 \quad 0] \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix}$; Check the controllability and observability of the system.	CO5	K4
	13	Obtain the state model for the system represented by:	CO5	K4

		$\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+10y=3u(t)$		
	14	Consider a system with state model given below: $\dot{x}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -1 & -5 & -1\end{bmatrix}X+\begin{bmatrix}0\\ 5\\ -24\end{bmatrix}u$; $y=[1 \quad 0 \quad 0]x+[0]u$ Verify, the system is observable and controllable.	CO5	K4
	15	Obtain the state model of a system described by a differential equation $\dddot{y}+6\ddot{y}+11\dot{y}+6y=8\ddot{u}+17\dot{u}+8u$; Where y is output and u is input	CO5	K4
	16	Determine the controllability and observability of the system $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}1 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}r(t)$ and $Y=[1 \quad 0]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$	CO5	K1