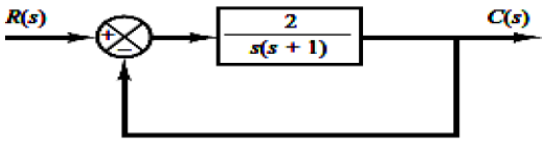
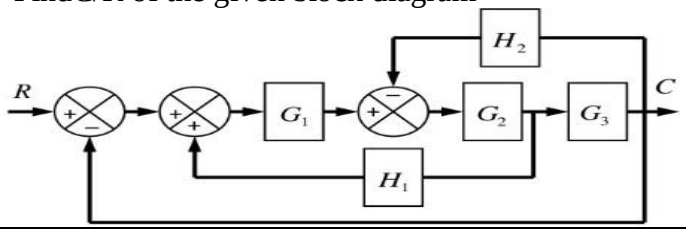
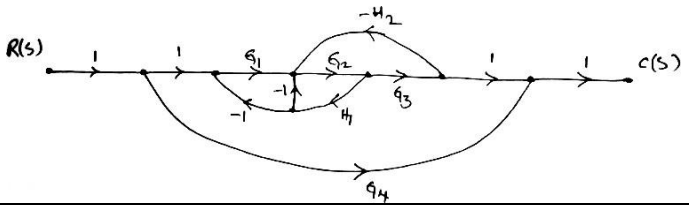
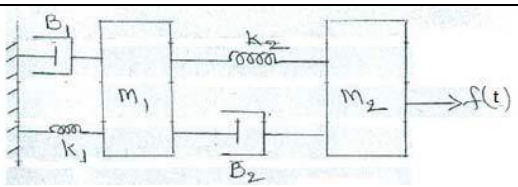
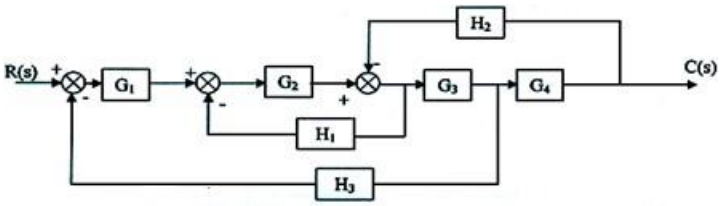
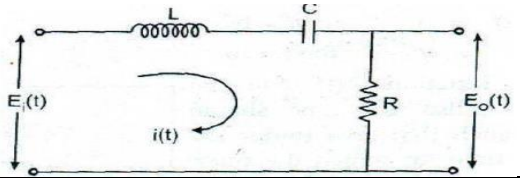
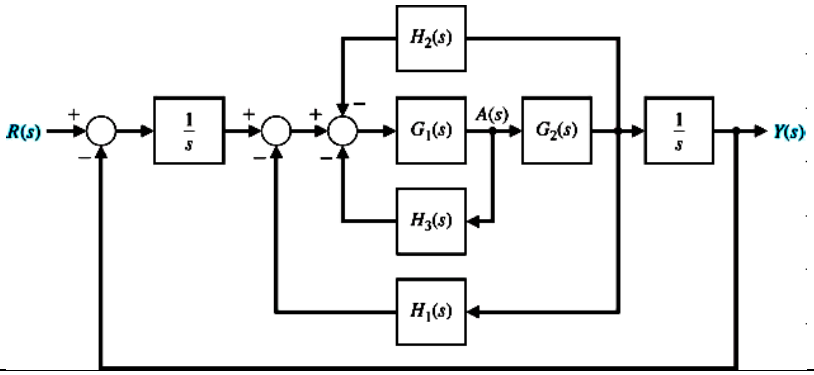
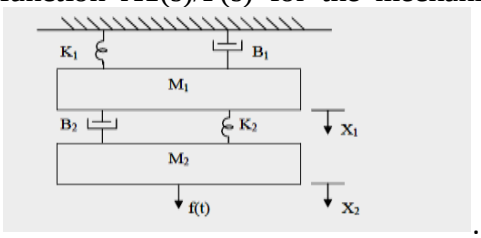
Question Bank

UNIT–I

UNIT NAME

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		Differentiate between open loop and closed loop control system	2	1	1
2		Write the Manson's gain formula. What are the basic properties of SFG?	1	1	2
3		.Find the TF of following system (figure 1).  Figure 1	3	1	2
4		Write the force balance euation of ideal mass and ideal dashpot elements	2	1	2
5		Define Transfer function of the system	1	1	1
6		What is block diagram? What are the basic components of block diagram	2	1	1
7		Write the rule for eliminating negative feedback loop	3	1	2
8		Write the analogous electrical elements in force-voltage analogy for the elements of mechanical translational systeem	2	1	2
9		Write the analogous electrical elements in Torque-Current analogy for the elements of mechanical rotational systeem	2	1	2
10		What is signal flow graph			
Part – B (Long Answer Questions)					
11	a)	FindC/R of the given block diagram  	4	1	2
	b)	Explain any two examples of closed loop control systems.			
12	a)	Find the overall gain C(s)/R(s) for the signal flow graph shown in figure 2.  	4	1	2
	b)	Explain translatory and rotary elements of mechanical systems			
13	a)	Write the differential equations to represent the following system in figure below and draw its electrical equivalent	4	1	2

		 circuit			
	b)	Find the transfer function of series RLC circuit	4	1	3
14	a)	Obtain the transfer function for the system represented by block diagram shown below figure using the block diagram reduction technique . 	4	1	3
	b)	Find the transfer function of the network given figure. 	4	1	3
15	a)	Obtain the transfer function Y(s)/R(s) from block diagram shown below figure by using the signal flow graph method. 	4	1	3
	b)	Discuss electrical analogous of mechanical rotational systems	2	1	2
16	a)	Obtain the transfer function X1(s)/F(s) for the mechanical system shown figure 2  .	4	1	3
	b)	Explain the rules for block diagram reduction technique	2	1	2

UNIT–II

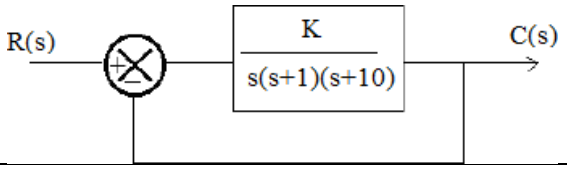
UNIT NAME

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		What are the standard test signals used in control systems?	1	2	1
2		Define an Impulse signal	1	2	1
3		What is the order of the system	1	2	1
4		How the system is classified depending on the value of damping	2	2	2
5		Sketch the response of a second order under damped system	2	2	2
6		The damping ratio for the characteristic equation $s^2 + 2s + 1 = 0$ is	4	2	2
7		Define rise time,peak time,delay time,settling time and peak over shoot.	1	2	2
8		What do mean by transient and steady state responses	1	2	1
9		Define positional error constant, velocity error constant and acceleration error constant	1	2	1
10		What is meant by steady state error	1	2	1
Part – B (Long Answer Questions)					
11	a)	The open-loop transfer function of a unity feedback control system is given by G(s)=9/s(s+3). Find the natural frequency of response, damping ratio, damped frequency and time constant	4	2	2
	b)	Find out the output of the undamped second order system when the input applied to the system is unit step input	4	2	2
12	a)	For unity feedback control system the open loop transfer function $G(s)=10(s+2)/s^2(s+4)$. Find the ess when the input is $r(t)=3-2t+3t^2$ and find Kp ,Kv , and Ka.	4	2	2
	b)	Explain the following: a) Steady state error b) positional error constant c) Velocity error constant d) acceleration error constant e) Step response.	2	2	1
13	a)	A unity feed-back control system has its open-loop transfer function given by $G(S)=(4S+1)/4S^2$ Determine an expression for the time response when thesystem is subjected to a) Unit impulse function b) Unit step input function.	4	2	2
	b)	Determine the number of roots of a given polynomial with real parts between zero and –1, $7s^2 + 4s^4 + 10s^3 + 2s^2 + 3s + 6 = 0$	4	2	2
14	a)	Determine the error coefficients and static error for $G(s)=\frac{1}{s(s+1)(s+10)}$, H(s) = s + 2	4	2	2
	b)	Obtain the unit – step response of a unity feedback control system whose open –loop transfer function is $G(s)=\frac{1}{s(s+1)}$. Obtain also the rise time, peak time, maximum overshoot and settling time.	4	2	2
15	a)	Sketch the Root locus for. Also find range of 'K' for system to be stable. G(s)H(s)=K/S(S+4)(S+11)	4	2	2
	b)	Explain Conditional stability & Relative stability.What is a Routh-Hurwitz criterion and explain its stability predicting conditions.	4	2	2

16	a)	a)Determine the RH stability of given characteristic equation, $s^4+8s^3+18s^2+16s+5=0$. b) Sketch the root locus of the system, whose open loop transfer function is, $G(s)=\frac{K(s+15)}{s(s+1)(s+5)}$	4	2	2
	b)	The open loop transfer functions of three systems are given as a) $\frac{4}{(s+1)(s+2)}$ b) $\frac{2}{s(s+4)(s+6)}$ c) $\frac{5}{s^2(s+3)(s+10)}$ Determine respectively the positional, velocity and acceleration error constants for these systems. Also for the system given in determine the steady state errors with step input u(t)=1; ramp input r(t) = t and acceleration input $r(t)=\frac{1}{2}t^2$	4	2	2

UNIT–III

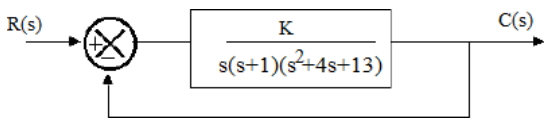
UNIT NAME

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		What are frequency domain specifications?	1	3	1
2		Define Gain margin and Phase margin.	1	3	1
3		Define i) Minimum phase transfer function ii) Non minimum phase transfer function.	1	3	1
4		Write short notes on the correlation between the time and frequency response	2	3	2
5		Define Phase cross over and gain cross over frequency.	2	3	2
6		Enlist the steps for the construction of Bode plots.	4	3	2
7		Define angle of departure and angle of arrival in root locus.	1	3	2
8		Mention the condition for system stability using Bode plot	1	3	1
9		What is Bodeplot	1	3	1
10		What are advantages of frequency response analysis	1	3	1
Part – B (Long Answer Questions)					
11	a)	What is polar plot? Define gain and phase margins	1	3	1
	b)	With the help of Nyquist plot assess the stability of a system G(s) = 2/S(S+3) . What happens to stability if the numerator of the function is changed from 3to 30?	2	3	2
12	a)	Discuss the effect of adding poles & zeros to G(s)H(s) on the shape of Nyquist plots 7.	2	3	2
	b)	A system is given by G(s) =S+1/S(S+2)(S+4).Sketch the Nyquist plot & hence determine the stability of the system.	3	3	3
13	a)	Consider the system shown in Figure 3. Draw the Bode-diagram of the open-loop transfer function G(s) with K = 1. Determine the phase margin and gain margin. Find the value of K to reduce the phase margin by 10^0. 	3	3	3
	b)	Sketch the root locus of the unity feedback system having G(s)=K/S^2+2S+2 for positive values of K. Sketch the new root locus	3	3	3

		when a simple pole at S=-5 is added to the system loop transfer function. Hence indicate the effect of adding this pole on the root locus of the system.			
14	a)	Investigate closed loop stability of a system having G(s)H(s)=K(S+4)/S(S-2) using Nyquist criterion. Determine the limiting value of 'K' for stability.	3	3	2
	b)	A unity feedback system has an open loop function G(s)=K/S(S^2+3S+10) make a rough sketch of root locus plot by determining the following (a) Centroid, number and angle of asymptotes (b) angle of departure of root loci from the poles (c) Breakaway points if any.	3	3	2
15	a)	Draw the complete Nyquist plot for the following open loop transfer function G(s)H(s)=2(S+0.25)/S^2(S+1)(S+0.5) If the system is unstable, how many poles of the closed loop system are in the 3right half of s-plane?		3	3
	b)	Sketch the root locus of the system, whose open loop transfer function is, G(s)=K/S(S+2)	3	3	3
16	a)	The forward path transfer function of a unity feedback control system is G(s)=6/S^2(S+3) Sketch the Nyquist Plot.	3	3	3
	b)	Enlist the steps for the construction of Bode plots	2	3	1

UNIT–IV

UNIT NAME

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		What is a Phase Lag compensator and why is it used?	1	4	1
2		Explain the significance of compensation	2	4	1
3		What are the effects of integral control action?	2	4	1
4		Outline the Bode plot for a Proportional Integral controller.	3	4	2
5		Why do you need a feedback controller? Justify your answer with an example.	2	4	2
6		Explain Lag compensation	2	4	2
7		What is the difference between polar plot and Nyquist plot?	2	4	1
8		Define Polar plot	1	4	1
9		Define Nyquist plot	1	4	1
10		Explain Nyquist stability criterion.	2	4	2
Part – B (Long Answer Questions)					
11	a)	The open-loop transfer function of a system isgiven by $G_p(s)=\frac{K}{s(1+0.1s)(1+0.2s)}$ Design a lag-lead compensator to meet the Kv=100$sec^{-1}$and Phase margin	4	4	3
	b)	Explain the need of lead compensator and obtain the transfer function of lead- lagcompensator.	2	4	1
12	a)	The open loop transfer function of certain unity feedback control system is given by G(S) = S (S + 4) (S + 80) K . It is desired to have the phase margin to be at least 330 and velocity error constant KV = 30 Sec−1 . Design a phase lag series compensator?	3	4	3
	b)	Sketch the root loci for the system shown in Figure 2. 	3	4	2
13	a)	For unity feedback system given by	3	4	3

		$G(s)=\frac{K}{s(s+0.5)(s^2+0.6s+10)}$ a) Find the stability using RH criterion b) for stable system find the range of K value.			
	b)	Explain the effects of adding poles and zeros to G(s)H(s) on the root loci by considering one the example.	2	4	2
14	a)	Design a lead compensator for the system with an open-loop transfer function $G(s)=K/S^2(1+0.1S)$ for the specifications of acceleration error constant, $K_a=10$ and phase margin $\Phi_{pm}= 30^0$	4	4	3
	b)	Draw the electrical circuit diagram that represents the Lead-Lag compensator and explain in detail.	2	4	2
15	a)	Explain the effect of Proportional control action on the performance of a second order system	2	4	1
	b)	Sketch the root locus of the system, whose open loop transfer function is, G(s)=K(S+15)/S(S+1)(S+5)	3	4	2
16	a)	Explain in detail about lead compensation in design.	2	4	3
	b)	Explain the following control action with neat schematic diagram and derive its necessary equations.i) Proportional ii) Integral iii) Derivative iv) Proportional plus integral	2	4	3

UNIT–V

UNIT NAME

S.No		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		What is state diagram?.	1	5	1
2		Define State	1	5	1
3		Discuss the significance of State Space Analysis?	2	5	1
4		Mention any four advantages of state variable representation	2	5	1
5		What are the properties of state transition matrix?	2	5	1
6		Define State variables	1	5	1
7		Define State space representation	1	5	1
8		What are the advantages of state variable techniques?	2	5	1
9		How do you determine the system eigen values and what is its role in the system response?	2	5	2
10		State controllability and observability	1	5	1
Part – B (Long Answer Questions)					
11	a)	Find the state transition matrix for the following matrix, $A=\begin{bmatrix}1 & 0\\ -1 & 1\end{bmatrix}$.	3	5	3
	b)	The state equation of a linear-time invariantsystem is given as, $\dot{X}=\begin{bmatrix}0 & 5\\ -1 & -2\end{bmatrix}X+\begin{bmatrix}1\\ 1\end{bmatrix}r$ and $y=\begin{bmatrix}1 & 1\end{bmatrix}X$, and , Find the transfer function and draw the state diagram.	3	5	3
12	a)	Obtain the state space representation for thefollowing differential equation. $\ddot{y}+5\dot{y}+7y=114$ Where 'y' is the output and 'u' is the input.	3	5	3
	b)	Considering the vector matrix differential equation describe the dynamics of the system as X = [0 1; -6 -5]. Determine state transition matrix?	3	5	3
13	a)	A feed back system has a closed loop transfer function.Y(S)/V(S)=10(S+4)/S(S+1)(S+3). Construct canonical state models for this system	3	5	3

	b)	Obtain the state model of the system whose transfer function is given as.Y(S)/V(S)=10(S+4)/S(S+1)(S+3).	3	5	3
14	a)	Consider the matrixA=[1 2 3;2 7 4;5 7 9] . Compute e^{At}?	3	5	3
	b)	Obtain the state space representation of an n_{th} order differential equation	2	5	3
15	a)	Distinguish between Transfer function model and State Space model	2	5	2
	b)	Explain various methods of evaluation of state transition matrix.	2	5	2
16	a)	Obtain the transfer function for linear time invariant system and also draw the state model.	2	5	2
	b)	Determine the state and output equations in vector matrix form for the system whose transfer function is given by G (s) = $s+2/(s2+4s+3)$.	3	5	3