INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

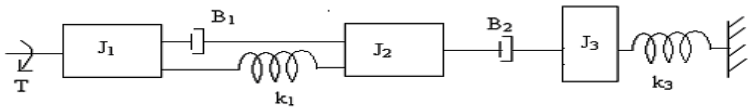
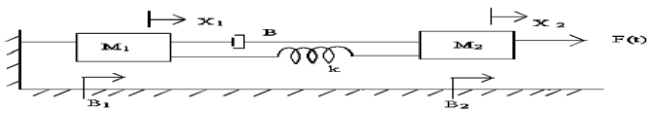
Department of Electrical and Electronics Engineering

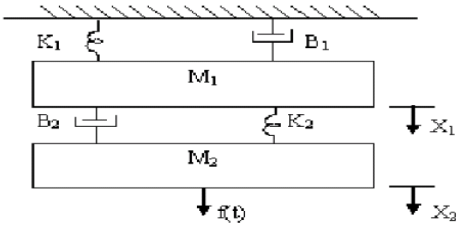
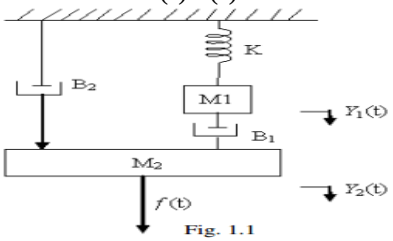
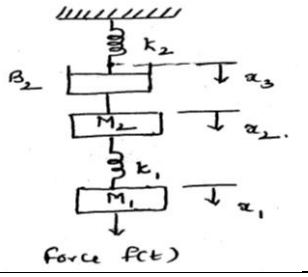
ASSIGNMENT

Course Name	**:**	**CONTROL SYSTEMS**
Course Code	**:**	**A50211**
Class	**:**	**III B. Tech I Semester**
Branch	**:**	**Electrical and Electronics Engineering**
Year	**:**	**2017- 2018**
Course Faculty	**:**	Dr. S. Vathsal

OBJECTIVES

This course it is aimed to introduce the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I **INTRODUCTION TO CONTROL SYSTEMS**		
	Part – A (Short Answer Questions)		
1	What is control system?	Understand	2
2	Define open loop control system?	Understand	2
3	Define closed loop control system?	Understand	2
4	Define transfer function?	Remember	1
5	What are the basic elements used for modeling mechanical rotational system?	Remember	1
	Part – B (Long Answer Questions)		
1	Explain open loop & closed loop control systems by giving suitable? Examples & also highlights their merits & demerits?	Understand	3
2	Explain the difference between Open loop and Closed loop systems?	Remember	3
3	Illustrate at least three applications of feedback control systems?	Remember	1,2
4	Explain the classification of control systems?	Remember	1,2
5	Explain the advantages of systems with feedback? What are the effects of feedback On the performance of a system? Briefly explain?	Remember	1,2
6	Write the differential equations governing the Mechanical rotational system shown in fig. Draw the Torque-voltage and Torque-current electrical analogous circuits. 	Apply	3
7	Write the differential equations governing the Mechanical system shown in fig. and determine the transfer function 	Apply	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
8	Obtain the transfer function X1(s)/F(s) for the mechanical system as shown in figure 	Apply	3
9	Write the differential equations governing the mechanical system shown below and determine the transfer function Y1(s)/F(s).  Fig. 1.1	Apply	3
10	Draw the electrical analogous circuit of the mechanical system shown below 	Apply	3
	UNIT - II **TRANSFER FUNCTION REPRESENTATION**		
	Part – A (Short Answer Questions)		
1	What is block diagram? What is the basis for framing the rules of block diagram reduction technique?	Understanding	2
2	What is a signal flow graph?	Analyze	2
3	What is transmittance?	Analyze	2
4	What is sink and source?	Analyze	2
5	Write Masons Gain formula.	Evaluate	2
	Part – B (Long Answer Questions)		
1	Derive the transfer function of a field controlled d.c. servomotor and develop its block diagram. State the assumptions made if any.	Creating & Analyse	2
2	Derive the transfer function of an armature controlled d.c. servomotor and develop its block diagram	Evaluate	2
3	Derive the transfer function of a.c. servomotor and explain about its torque speed characteristics.	Evaluate	2
4	With the help of neat sketches, explain the construction and working principle of synchro transmitter and receiver. Derive the transfer function for synchro?	Analyse	2
5	(a)Explain the differences between AC servomotor and DC servomotor? (b)Explain the practical applications of servomotors?	Evaluate	2
6	Determine the overall transfer function C(S)/R(S) for the system shown in fig	Evaluate	2

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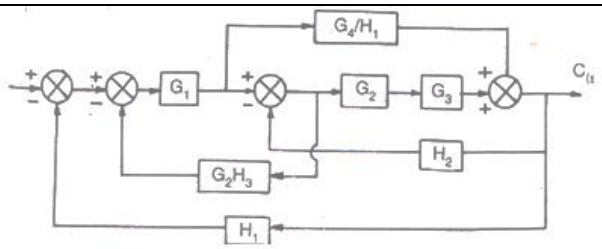
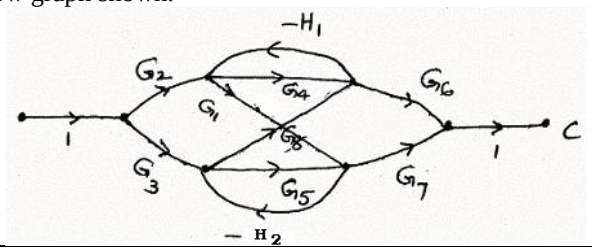
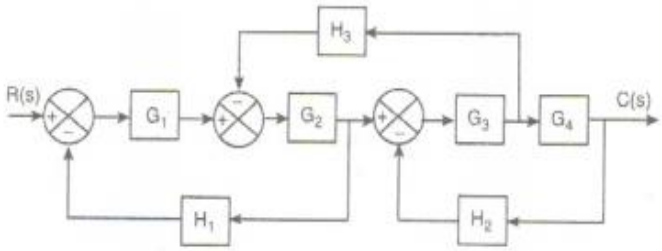
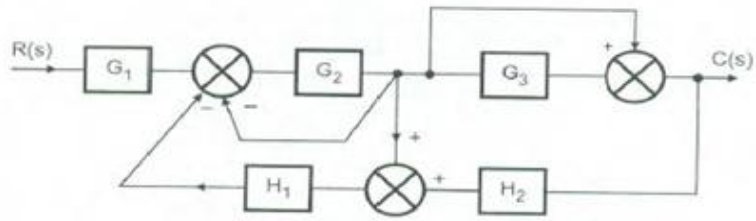
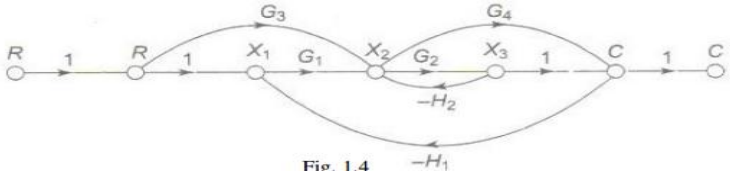
			
7	Discuss Mason's gain formula. Obtain the overall transfer function C/R from the signal flow graph shown. 	Evaluate	2
8	Determine the transfer function C(S)/R(S) of the system shown below fig. 2.3 by block diagram reduction method 	Evaluate	2
9	Reduce the given block diagram and hence obtain the transfer function C(s) / R(s) 	Evaluate	2
10	For the signal flow graph shown below fig.1.4, find the overall gain  Fig. 1.4	Evaluate	2
	UNIT – III **TIME RESPONSE ANALYSIS**		
	Part – A (Short Answer Questions)		
1	What is Proportional controller and what are its advantages?	Analyze	3
2	What is the drawback in P-controller?	Remember	3
3	What is integral control action? What is the advantage and disadvantage in integral controller?	Evaluate & Remember	3
4	What is PI, PD, PID controller?	Analyze	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
5	Define Damping ratio. How the system is classified depending on the value of damping?	Analyze	3
	Part – B (Long Answer Questions)		
1	(a)Explain about various test signals used in control systems? (b)Define time constant and explain its importance?	Creating & Analyze	3
2	(a)Derive the expression for time domain specification of a under damped second order system to a step input?	Evaluate	3
3	(a)Derive the transient response of under damped second order system when excited by unit step input? (b)Derive the transient response of un damped second order system when excited by unit step input?	Evaluate	3
4	(a)Derive the transient response of over damped second order system when excited by unit step input? (b)Derive the transient response of critically damped second order system when excited by unit step input?	Analyse	3
5	A unity feedback system has $G(s) = \frac{40(S+2)}{S(S+1)(S+4)}$ Determine (i) Type of the system (ii) All error coefficients and (iii) Error for the ramp input with magnitude 4	Creating & Analyse	3
6	For a unity feedback system whose open loop transfer function is G(s) = 50/(1+0.1s)(1+2s) , find the position, velocity & acceleration error Constants.	Evaluate	3
7	A unity feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{S(S+10)}$ Determine gain 'K' so that system will have a damping ratio of 0.5. For this value of 'K' determine settling time, peak overshoot and time to peak overshoot for a unit step input. Also obtain closed loop response in time domain	Evaluate	3
8	The open loop transfer function of a unity feedback system is given by $G(s) = \frac{K}{S(TS+1)}$ where K and T are positive constants. By what factor should the amplifier gain be reduced so that the peck overshoot of unit step response of the system is reduced from 75% to 25%?	Analyse	3
9	A unity feed-back system is characterized by the open-loop transfer function: $G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$. Determine the steady-state errors for unity-step, unit-ramp and unit-acceleration input. Also find the damping ration and natural frequency of the dominant roots.	Analyse	3
	UNIT – IV **STABILITY ANALYSIS IN S-DOMAIN**		
	Part – A (Short Answer Questions)		
1	Define BIBO Stability. What is the necessary condition for stability?	Analyze	4
2	What is characteristic equation? How the roots of characteristic equation are related to stability?	Understand	4
3	What is the relation between stability and coefficient of characteristic polynomial?	Analyze	4
4	What will be the nature of impulse response when the roots of characteristic equation are lying on imaginary axis?	Evaluate	4
5	What will be the nature of impulse response if the roots of characteristic equation are lying on right half s-plane?	Evaluate	4
	Part – B (Long Answer Questions)		
1	Define the terms (i) Absolute stability (ii) marginal stability (iii) conditional stability (iv) stable system (v) Critically stable system (vi) conditionally stable system?	Creating & Analyze	4
2	State Routh's stability criterion. State their advantages? What are the limitations of	Evaluate	4

S. No	Question	Blooms Taxonomy Level	Course Outcome
	Routh Hurwitz criteria?		
3	(a)what are the necessary conditions to have all the roots of characteristics equation in the left half of s-plane? (b)Check the stability of the given characteristic equation using Routh's method $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$	Evaluate	4
4	By means of Routh criterion ,determine the stability represented by characteristic equation ,$s^4+2s^3+8s^2+4s+3=0$	Analyse	4
5	The open loop transfer function of a unity feedback system is given by $G(s) = \frac{K}{S(1+0.25S)(1+0.4S)}$.find the restriction on k so that the closed loop system is absolutely stable.	Evaluate	4
6	With the help of Routh Hurwitz criterion comments upon the stability of the system having the following characteristic equation $S^6+s^5-2s^4-3s^3-7s^2-4s-4=0$	Creating & Analyze	4
7	A unity feedback system has an open loop transfer function $G(s) = \frac{K}{(s+2)(s^2+4s+5)}$. Use RH test to determine the range of positive values of K for which the system is stable	Evaluate	4
8	Find the range of K for stability of the system with characteristic equation $s^4+3s^3+3s^2+2s+k=0$	Evaluate	4
9	For the unity feedback system the open loop T.F. is $G(s) = \frac{K}{S(1+0.6S)(1+0.4S)}$ Determine(a) Range of values of K, marginal K (c) Frequency of sustained oscillations	Evaluate	4
10	How many roots does each of the following polynomials have in the right half of the s-plane. $s^4+2s^3+4s^2+8s+15$The system having characteristic equation2 $s^4+4s^2+1=0$ (i) the number of roots in the left half of s-plane (ii) the number of roots in the right half of s-plane (iii)The number of roots on imaginary axis use RH stability criterion.	Evaluate	4
	UNIT - V **FREQUENCY RESPONSE ANALYSIS**		
	Part – A (Short Answer Questions)		
1	What is frequency response? What are advantages of frequency response analysis?	Analyze & Understand	5
2	What are frequency domain specifications?	Analyze	5
3	Define Resonant Peak.	Analyze	5
4	What is Bode plot? What are the advantages of Bode Plot?	Analyze	5
5	Define gain margin	Analyze	5
	Part – B (Long Answer Questions)		
1	What is frequency response? What are advantages of frequency response analysis?	Creating & Analyze	5
2	(a)write short notes on various frequency domain specifications (b) Derive expression for resonant peak and resonant frequency and hence establish correlation between time and frequency response.	Evaluate	5
3	Explain the steps for the construction of Bode plot? What are the advantages of Bode Plot?	Evaluate	5
4	Explain with the examples (i) Minimum phase function (ii) Non-minimum phase function (iii) All pass function	Analyse	5
5	Sketch the Bode plot for the open loop transfer function $G(s) = \frac{10(S+3)}{S(S+2)(S^2+4S+100)}$	Evaluate	5

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6	Given damping ratioξ=0.7 and ω_n=10 rad/sec find the resonant peak, resonant frequency and band width.	Evaluate	5
7	For a second order system with unity feedback $G(s) = \frac{200}{s(s+8)}$.find various frequency domain specifications.	Evaluate	5
8	Sketch bode phase angle plot of a system $G(s)=\frac{1}{(1+s)(1+2s)}$	Evaluate	5
9	Draw the exact bode plots and find the gain margin and phase margin of a system represented by $G(s)H(s)= \frac{10(s+1)}{s\,(s+0.05)(s+3)(s+5)}$	Evaluate	5
10	Draw the exact bode plots and find the gain margin and phase margin of a system represented by $G(s)= \frac{10(s+1)}{s\,(s+0.05)(s+3)(s+5)}$,H(S)=1	Evaluate	5

Prepared by: Dr.S.Vathsal

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