INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Dundigal, Hyderabad - 500 043

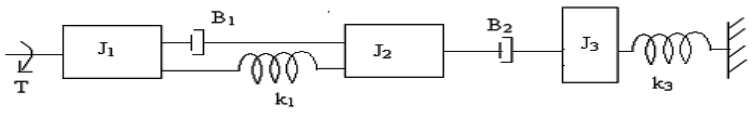
ELECTRONICS AND COMMUNICATION ENGINEERING

ASSIGNMENT QUESSSTION BANK

Course Name	:	**CONTROL SYSTEMS**
Course Code	:	**A50217**
Class	:	III B. Tech I Semester
Branch	:	Electronics and Communication Engineering
Year	:	2017 – 2018
Course Faculty	:	Dr. K Nehru, Professor, Mr. N Nagaraju, Assistant Professor, ECE Department

OBJECTIVE

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**		
1	What is control system?	Understand	1
2	Define open loop control system	Understand	1
3	Define closed loop control system.	Understand	1
4	Define transfer function.	Remember	1
5	What are the basic elements used for modeling mechanical rotational system?	Remember	1
6	Explain open loop & closed loop control systems by giving suitable Examples & also highlights their merits & demerits.	Understand	1
7	Explain the difference between Open loop and Closed loop systems?	Remember	1
8	Illustrate at least three applications of feedback control systems?	Remember	1
9	Explain the classification of control systems?	Remember	1
10	Explain the advantages of systems with feedback? what are the effects of feedback On the performance of a system? Briefly explain?	Remember	1
11	Write the differential equations governing the Mechanical rotational system shown in fig. Draw the Torque-voltage and Torque-current electrical analogous circuits. 	Apply	1
12	Write the differential equations governing the Mechanical system shown in fig. and determine the transfer function	Apply	1

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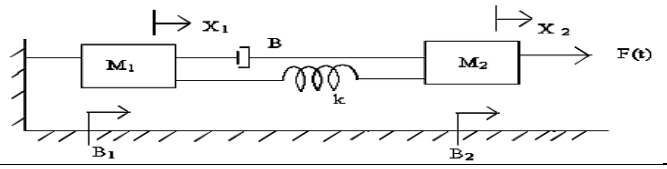
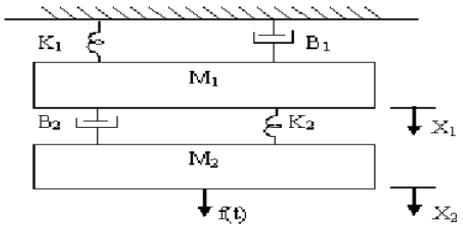
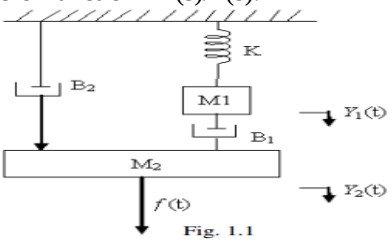
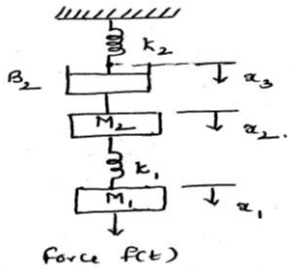
			
13	Obtain the transfer function X1(s)/F(s) for the mechanical system as shown in figure 	Apply	1
14	Write the differential equations governing the mechanical system shown below and determine the transfer function Y1(s)/F(s).  Fig. 1.1	Apply	1
15	Draw the electrical analogous circuit of the mechanical system shown below 	Apply	1
TRANSFER FUNCTION REPRESSENTATION			
16	What is block diagram? What is the basis for framing the rules of block diagram reduction technique?	Understand	1
17	What is a signal flow graph?	Understand	1
18	What is transmittance?	Understand	1
19	What is sink and source?	Understand	1
20	Write Masons Gain formula.	Understand	1
21	Derive the transfer function of a field controlled d.c. servomotor and develop its block diagram. State the assumptions made if any.	Understand	1
22	Derive the transfer function of an armature controlled d.c. servomotor and develop its block diagram	Understand	1
23	Derive the transfer function of a.c. servomotor and explain about its torque	Evaluate	1

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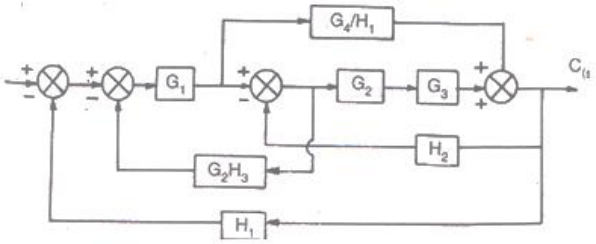
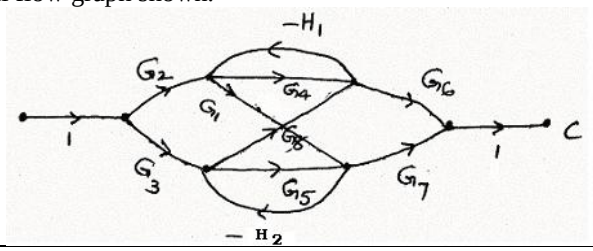
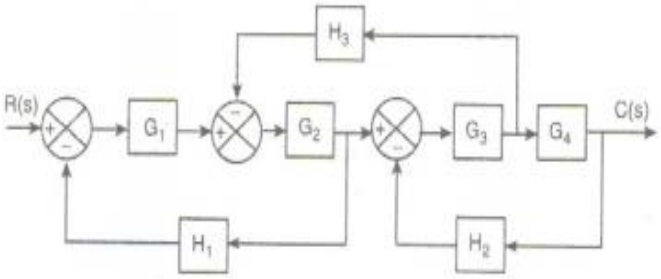
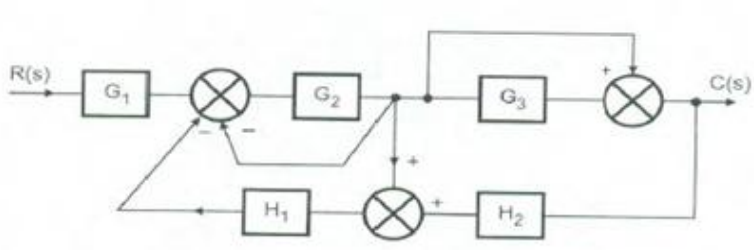
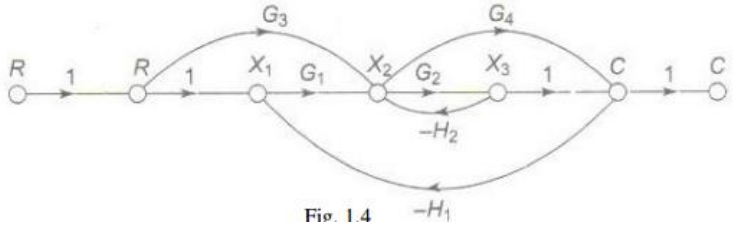
	speed characteristics.		
24	With the help of neat sketches, explain the construction and working principle of synchro transmitter and receiver. Derive the transfer function for synchro?	Analyze	1
25	(a)Explain the differences between AC servomotor and DC servomotor? (b)Explain the practical applications of servomotors?	Evaluate	1
26	Determine the overall transfer function C(S)/R(S) for the system shown in fig 	Evaluate	1
27	Discuss Mason's gain formula. Obtain the overall transfer function C/R from the signal flow graph shown. 	Evaluate	1
28	Determine the transfer function C(S)/R(S) of the system shown below fig. 2.3 by block diagram reduction method 	Evaluate	1
29	Reduce the given block diagram and hence obtain the transfer function C(s)/R(s) 	Evaluate	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
30	For the signal flow graph shown below fig.1.4, find the overall gain  Fig. 1.4	Evaluate	1
	UNIT - II **TIME RESPONSE ANALYSIS**		
1	What is integral control action? What is the advantage and disadvantage in integral controller?	Remember	2
2	What are the test signals?	Remember	2
3	What is the time response of the first order system?	Remember	2
4	What is the time response of the second order system?	Remember	2
5	Define Damping ratio. How the system is classified depending on the value of damping?	Analyze	2
6	(a)Explain about various test signals used in control systems? (b)Define time constant and explain its importance?	Analyze	2
7	(a)Derive the expression for time domain specification of a under damped second order system to a step input?	Evaluate	2
8	(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	2
9	(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?	Analyzes	2
10	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	Analyze	2
11	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	2
12	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	2
13	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%?	Analyze	2
14	A unity feed-back system is characterized by the open-loop transfer function:	Analyze	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
	$G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$. 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.		
	UNIT – III **STABILITY ANALYSIS IN S-DOMAIN**		
1	Define BIBO Stability. What is the necessary condition for stability?	Analyze	3
2	What is characteristic equation? How the roots of characteristic equation are related to stability?	Understand	3
3	What is the relation between stability and coefficient of characteristic polynomial?	Analyze	3
4	What will be the nature of impulse response when the roots of characteristic equation are lying on imaginary axis?	Evaluate	3
5	What will be the nature of impulse response if the roots of characteristic equation are lying on right half s-plane?	Evaluate	3
6	Define the terms (i) Absolute stability (ii) marginal stability (iii) conditional stability (iv) stable system (v) Critically stable system (vi) conditionally stable system?	Remember	3
7	State Routh's stability criterion. State their advantages What are the limitations of Routh Hurwitz criteria?	Evaluate	3
8	(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	3
9	By means of Routh criterion ,determine the stability represented by characteristic equation ,$s^4+2s^3+8s^2+4s+3=0$	Analyze	3
10	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	3
11	With the help of Routh Hurwitz criterion comments upon the stability of the system having the following characteristic equation $S^6+s^5-2s^4-3s^3-7s^2-4s-4=0$	Create	3
12	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	3
13	Find the range of K for stability of the system with characteristic equation $s^4+3s^3+3s^2+2s+k=0$	Evaluate	3
14	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	3
15	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	3
	UNIT-IV		

S. No	Question	Blooms Taxonomy Level	Course Outcome
	FREQUENCY RESPONSE ANALYSIS		
1	What is frequency response? What are advantages of frequency response analysis?	Understand	4
2	What are frequency domain specifications?	Understand	4
3	Define Resonant Peak.	Understand	4
4	What is Bode plot? What are the advantages of Bode Plot?	Understand	4
5	Define gain margin	Understand	4
6	What is lead lag controller techniques.	Understand	4
7	What is frequency response? What are advantages of frequency response analysis?	Understand	5
8	(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
9	Explain the steps for the construction of Bode plot? What are the advantages of Bode Plot?	Evaluate	5
10	Explain with the examples (i)minimum phase function (ii) non-minimum phase function (iii) all pass function	Analyze	5
11	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
12	What is Proportional controller and what are its advantages?	Analyze	3
13	What is the drawback in P-controller?	Analyze	3
14	What is PI, PD, PID controller?	Analyze	3
15	What are the polar plots?	Analyze	3
16	Given damping ratioξ=0.7 and ω_n=10 rad/sec find the resonant peak, resonant frequency and band width.	Evaluate	4
17	For a second order system with unity feedback $G(s) = \frac{200}{s(s+8)}$.find various frequency domain specifications.	Evaluate	4
18	Sketch bode phase angle plot of a system $G(s)=\frac{1}{(1+s)(1+2s)}$	Evaluate	4
19	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	4
20	Draw the exact polar plots $G(s)= \frac{10(s+1)}{s\,(s+0.05)(s+3)(s+5)}$,H(S)=1	Evaluate	4
	UNIT-V **STATE SPACE ANALYSIS OF CONTINUOUS SYSTEM**		
1	Define observability?	Evaluate	5
2	Define controllability?	Evaluate	5
3	What are Eigen values?	Evaluate	5
4	What are draw backs of transfer function model analysis	Analyze	5
5	What is state, state variable and state vector?	Remember	5
6	What are the properties of state transition matrix?	Understand	5
7	Write properties of state transition matrix?	Understand	5

S. No	Question	Blooms Taxonomy Level	Course Outcome
8	State and explain controllability and observability?	Analyze	5
9	Explain the state variable and state transition matrix?	Remember	5
10	Write shot notes on formulation of state equations?	Analyze	5
11	Derive the expression for the calculation of the transfer function from the state variables for the analysis of system?	Apply	5
12	Write short notes on canonical form of representation .list its advantages and disadvantages?	Evaluate	5
13	consider the system described by the state equation $X(t)=\begin{bmatrix}1 & e^{-t}\\ 0 & -1\end{bmatrix}x(t)+\begin{bmatrix}0\\ 1\end{bmatrix}u(t)$	Remember	5
14	determine the state controllability and observability of the following system $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-3 & -1\\ -2 & 1.5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 4\end{bmatrix}u$ C=[0 1]	Apply	5
15	examine the observability of the system given below using canonical form $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 1 & 1\\ 0 & -2 & -3\end{bmatrix}\begin{bmatrix}x1\\ x2\\ x3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u$ $Y=[3\ 4\ 1]\begin{bmatrix}x1\\ x2\\ x3\end{bmatrix}$	Remember	5
16	linear time invariant system is described by the following state model. Obtain the canonical form of the state model. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-1 & 1\\ 1 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u$ and $y=[1/3 \quad -1/3]$	Analyze	5
17	convert the following system matrix to canonical form $A=\begin{bmatrix}1 & 2 & 1\\ -1 & 0 & 2\\ 1 & 3 & -1\end{bmatrix}$	Evaluate	5
18	a linear time invariant system is described by the following state model.obtain the canonical form of state model $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-1 & 0\\ 0 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 1\end{bmatrix}u$ and $y=[-1 \quad -2]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$	Evaluate	5

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