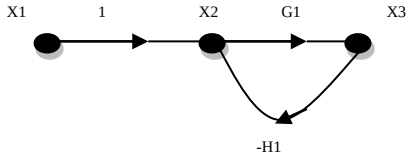
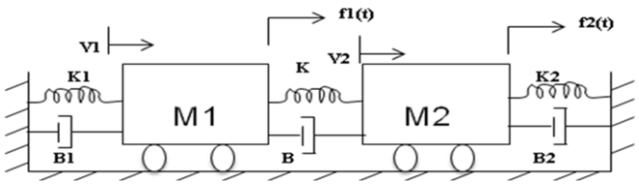
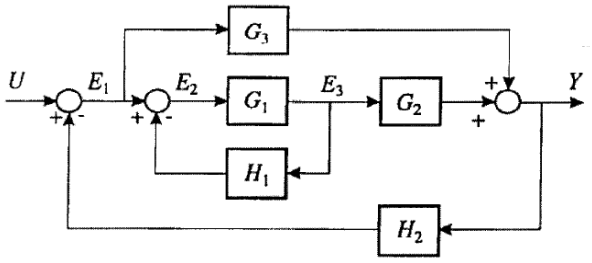
Karunya UNIVERSITY
(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

Reg.No. _____

End Semester Examination – Nov/Dec - 2016

Code : 12EC220 **Semester : 2016-17 ODD**
Sub. Name : Modern Control Systems **Duration : 3 hrs**
Max. marks : 100

Q. No.	Questions	Marks
	PART-A(10X1=10 MARKS)	
1.	Name the types of feedback used in closed loop system.	(1)
2.	In a signal flow graph, a node with all incoming edges is known as ----------	(1)
3.	Draw wave form for unit step input.	(1)
4.	What is the damping ratio value for the following cases? Undamped case Underdamped case	(1)
5.	In a Bode plot for $G(s) = \frac{1}{S}$, the slope of the line is ---------- db/dec.	(1)
6.	Mention any two frequency domain specifications.	(1)
7.	If output is bounded for any bounded input is called ----------	(1)
8.	---------- is the formula for calculating centroid.	(1)
9.	Write general equation for state and output .	(1)
10.	What is state variable?	(1)
	PART B(5 X 3= 15 MARKS)	
11	Write Mason's gain formula and calculate transfer function for the following signal flow graph  	(3)
12	Define positional, velocity and acceleration error constant. (1+1+1)	(3)
13	Define gain margin and phase margin.	(3)
14	Write the transfer function of PI,PD and PID controllers.	(3)
15	What are the advantages of state space equation representation?	(3)
	PART C(5 X 15= 75 MARKS)	
16. a.	Write differential equations governing the mechanical system shown in figure. Also draw the force current and force voltage analogous circuit.  	(15)
	(OR)	

17.	a.	For the following block diagram, find the transfer function .  	(15)
18.	a.	Derive the Responses of second order system for undamped case and critically damped case when the input is UNIT STEP.	(15)
		(OR)	
19.	a.	Consider second order system with following transfer function $$G(S) = \frac{25}{(S^2 + 6S + 25)}$$ Obtain the rise time, peak time, maximum overshoot and the settling time when the system is subjected to unit-step input.	(15)
20.	a.	Sketch the Bode plots of the following transfer function. $$\mathrm{G(S)} = \frac{100}{\mathrm{s}(1 + 0.1\mathrm{s})(1 + 0.2\mathrm{s})}$$ Determine the gain cross over frequency, phase cross over frequency, Phase Margin and Gain margin.	(15)
		(OR)	
21.	a.	Draw polar plot for the following unity feedback control system whose open loop transfer function is given by $$\mathrm{G(S)} = \frac{1}{\mathrm{S}(1 + \mathrm{S})(1 + 2\mathrm{S})}$$ Determine the gain margin and phase margin.	(15)
22.	a.	Test the stability of the system with the following characteristic equation by Routh's test. $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$.	(8)
	b.	A unit-feedback system is characterized by the open-loop transfer function $$G(s) = \frac{K}{s(s+3)(s+7)}$$ Using the Routh criterion, calculate the range of values of K for the system to be stable.	(7)
		(OR)	
23.	a.	Sketch the root locus for the open loop transfer function of unity feedback control system given below $$G(S)H(S) = \frac{K}{S(S+2)(S+4)}$$	(15)
24.	a.	Find the Eigen vectors of the given matrix A=$\begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix}$	(15)
		(OR)	
25.	a.	Define Controllability and observability.	(4)
	b.	Write Controllability and observability criterion.	(6)
	c.	Write state space representation for the following state equation. $$\dot{x}_1 = x_1 - 2x_2 + 2u$$ $$\dot{x}_2 = 4x_1 - 5x_2 + u$$ $$y = x_1 + x_2$$	(5)

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