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PES UNIVERSITY

PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

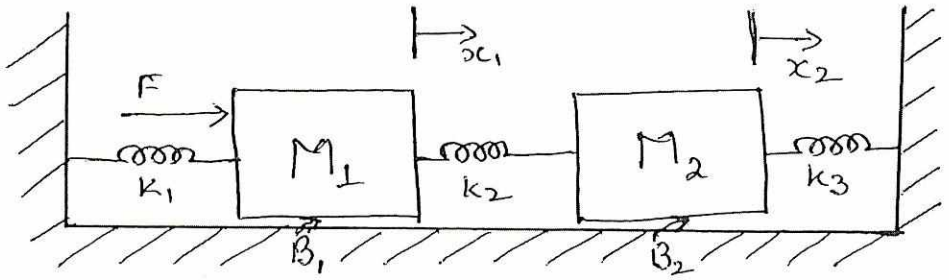
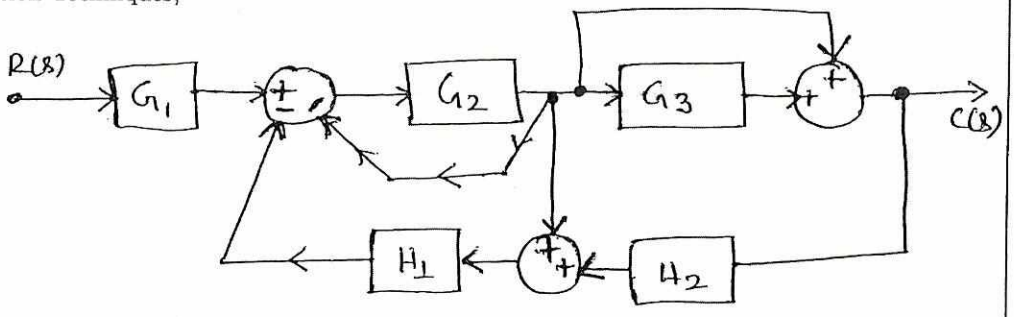
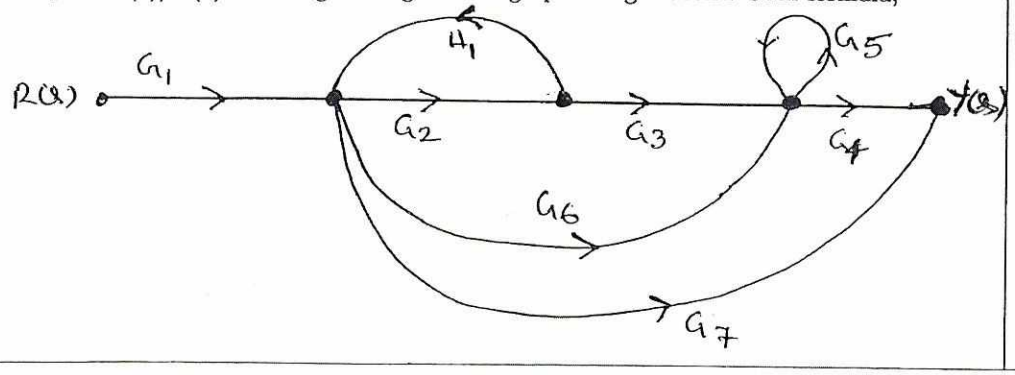
UE15EC335

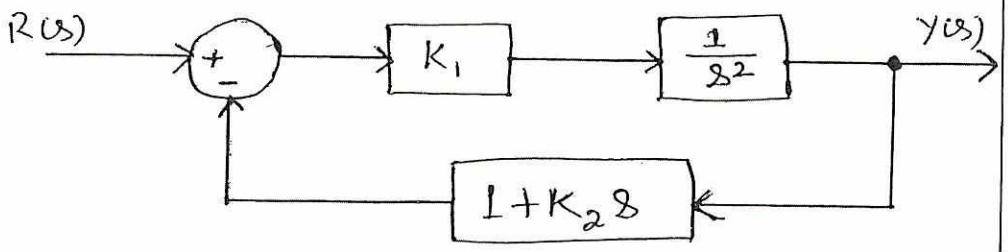
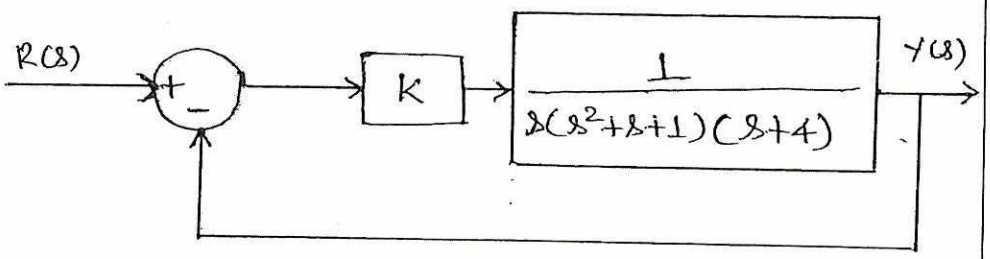
May 2018: END SEMESTER ASSESSMENT B.Tech. ECE VI Semester

ESA

UE15EC335 - CONTROL SYSTEMS

Time: 3 hours | *Answer All Questions* | Max Marks: 100

1	a	For the given physical system, draw the equivalent mechanical network. Derive the governing differential equations and express them in s-domain using Laplace Transforms assuming zero initial conditions. Draw the equivalent Force - Current and Force - Voltage Analogous circuits; 	6m
	b	Evaluate $C(s)/R(s)$ for the given Block diagram architecture using Block Diagram Reduction Techniques; 	7m
	c	Compute $Y(s)/R(s)$ for the given Signal-flow graph using Mason's Gain formula; 	7m

2	a	Consider the control system shown below. Evaluate K_1 and K_2 such that the peak overshoot (M_p) is 25 % and peak time (t_p) is 4 Seconds; 	5m
	b	The open-loop transfer function for a system is given as; $$G(s)H(s) = \frac{K}{s^2(s+2)(s+3)}$$ It is desired to have a steady-state error of 10 for an input given by $1+10t+\frac{40}{2}t^2$. Evaluate the value of K to achieve this steady-state error.	5m
	c	Consider the control system given below. Applying Routh - Hurwitz Criterion, evaluate the value / range of K for which the closed-loop system is (i) Unstable, (ii) Marginally stable and (iii) Absolutely stable. Also compute the frequency of sustained oscillations when the system is marginally stable. 	10m
3	a	Sketch the Root Locus for a system whose open-loop transfer function is given by; $$G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+3)}$$ Calculate the value / range of K for which the closed-loop system is (i) Unstable, (ii) Marginally stable and the frequency of sustained oscillations and (iii) Absolutely stable.	10m
	b	A unity-feedback system has the following open-loop transfer function; $$G(s)H(s) = \frac{242(s+5)}{s(s+1)(s^2+5s+121)}$$ Sketch the approximate Bode Magnitude and Phase plots. From the plots, evaluate ω_{gcf}, ω_{pcf}, Gain Margin and Phase Margin. Comment on the closed-loop stability.	10m
4	a	A feedback control system has the following open-loop transfer function; $$G(s)H(s) = \frac{40}{(s+4)(s^2+2s+2)}$$ Obtain the Nyquist Plot; comment on the closed-loop stability while applying Nyquist Stability Criterion. Also evaluate the Gain Margin.	10m