U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July 2024 Semester End Main Examinations

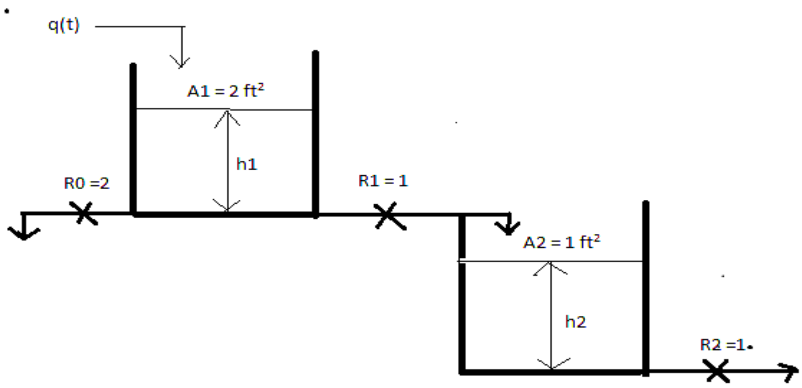
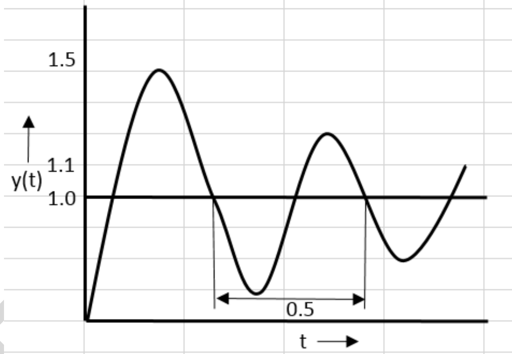
Programme: B.E.
Branch: Chemical Engineering
Course Code: 22CH5PCPCE
Course: Process Control Engineering

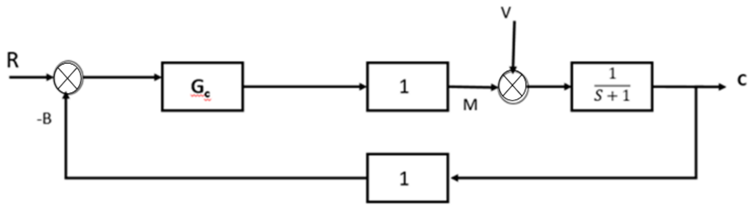
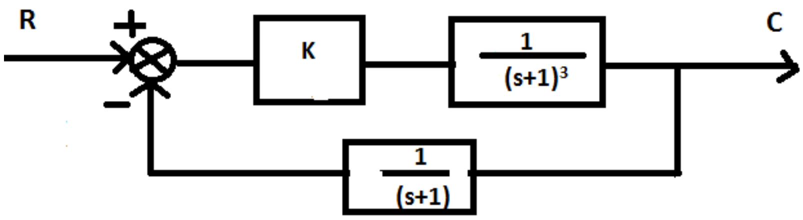
Semester: V
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Develop the transfer function for mercury in glass thermometer. State all the assumptions made and also plot the response curve by considering a step input and comment on the result.	*CO1*	*PO2*	**10**
	b)	Obtain the transfer function relating liquid level and inlet flow rate in a tank listing all the assumptions made for a system offering linear resistance. How do you modify the same for a nonlinear relationship between the outlet flow rate and liquid level in the tank?	*CO1*	*PO2*	**10**
		OR			
2	a)	A thermometer having first order dynamics is placed in a temperature bath at 45°C. After the thermometer reaches the equilibrium with the bath, the bath temperature is subjected to sinusoidal forcing function about its average temperature of 45°C with an amplitude of 15°C. If the period of oscillation is 30 sec/cycle and the time constant of the thermometer is 10 second, determine the following: i. Maximum and minimum temperatures indicated by the thermometer ii. Amplitude ratio iii. Phase lag in seconds	*CO2*	*PO3*	**10**
	b)	Starting from first principles, derive the transfer functions $H_1(s)/Q(s)$ and $H_2(s)/Q(s)$ for the liquid level system shown in the figure. The resistances are linear and $R_1 = R_2 = 1$. Note that two streams are flowing from tank 1, one of which flows into tank 2. You are expected to give numerical values of the parameters in the transfer functions.	*CO1*	*PO2*	**10**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			 Note: A_1= 2 ft^2; A_2=1ft^2, R_0=2, R_1=1, and R_2=1 for the above diagram.			
		UNIT II				
3	a)	Derive the transfer function between ΔP and manometer reading for a U tube manometer. State all the assumptions made		***CO1***	***PO2***	**12**
	b)	The experimental unit step response of a second order element shows a maximum value of 1.5, a second maximum of 1.1, an ultimate value of 1, and a cycle period of 0.5 seconds. Determine the damping parameter, and the time constant of the element.  		***CO2***	***PO3***	**08**
		OR				
4	a)	Obtain an expression for response of a critically damped second order system, when the system is given i) A step input ii) An impulse input		***CO2***	***PO3***	**12**
	b)	Explain the following with a neat sketch: i) Overshoot ii) Decay ratio iii) Rise time iv) Response time v) Period of oscillation		***CO2***	***PO3***	**08**
		UNIT III				
5	a)	Differentiate open loop and closed loop control system with example.		***CO1***	***PO2***	**4**

		b)	Obtain the transfer function and plot the response curves for a linear input in error in the case of proportional-derivative controller.	*CO3*	*PO4*	**6**
		c)	Draw the block diagram of a positive feedback servo problem labeling all the components. Also, derive the transfer function of the same.	*CO1*	*PO2*	**10**
			UNIT - IV			
	6	a)	 For the closed loop control system, show that the P controller does not provide ideal control for regulator problem but PI controller is ideal control for regulator problem.	*CO3*	*PO4*	**12**
		b)	Compare servo and regulator control modes. Enlist their applications.	*CO1*	*PO2*	**08**
			UNIT -V			
	7	a)	 For the control system given, i) Determine the value of K above which the system is unstable For the value of K for which the system is on the threshold of instability, determine the roots of the characteristic equation that lies on the imaginary axis	*CO4*	*PO4*	**08**
		b)	For the open loop transfer function $$G(s) = \frac{K}{s(s+5)(s+10)}$$ Sketch the root locus diagram.	*CO4*	*PO4*	**12**

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