U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

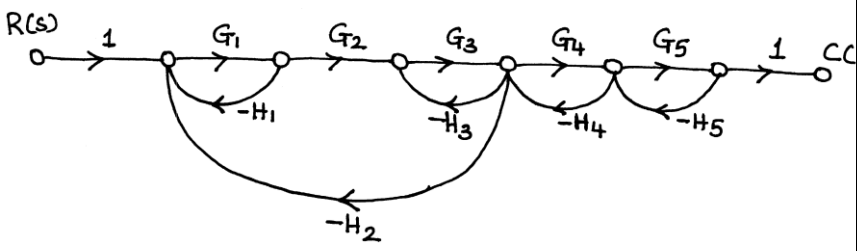
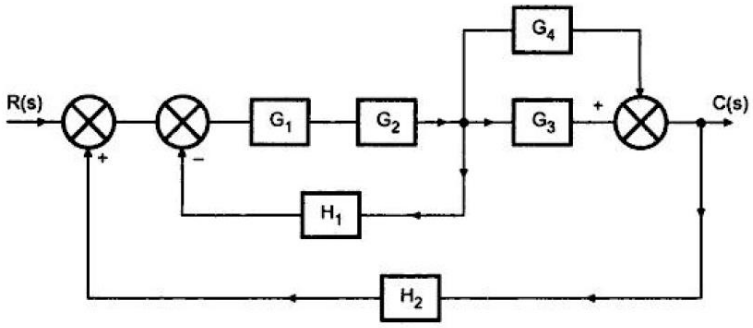
Programme: B.E. **Semester: IV**

Branch: Medical Electronics Engineering **Duration: 3 hrs.**

Course Code: 23MD4ESPCS / 22MD4ESPCS / 19ML4PCPCS **Max Marks: 100**

Course: Physiological Control System

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)	Differentiate between physiological and engineering control system and illustrate the same with relevant examples.	*CO1*	*PO1*	**10**
	b)	Compute C(s)/R(s) using Mason's gain formula for the signal flow graph shown in fig 1.(b)  Fig.1.b	*CO1*	*PO3*	**10**
		OR			
2	a)	Obtain C(s)/R(s) of the system shown in fig 2.a using block diagram reduction.  Fig.2.a	*CO1*	*PO3*	**10**
	b)	Illustrate the working of muscle stretch reflex with a neat schematic and block diagram.	*CO1*	*PO1*	**10**

			UNIT - II			
	3	a)	Derive the expression for steady state error.	*CO2*	*PO2*	**05**
		b)	The unity feedback system is characterized by an open loop transfer function **G(s) =** $\frac{K}{s(s+10)}$ .Determine the gain K ,so that the 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.	*CO2*	*PO2*	**08**
		c)	Illustrate the process involved in the regulation of glucose and insulin.	*CO2*	*PO2*	**07**
			OR			
	4	a)	Consider a unity feedback system with a closed loop transfer function $\frac{C(s)}{R(s)} = \frac{Ks+b}{s^2+as+b}$. Determine the open loop transfer function G(s). Show that the steady state error with unit ramp input is given by $\frac{(a-K)}{b}$.	*CO2*	*PO2*	**10**
		b)	Define the following terms: i) Delay Time ii)Rise Time iii)Peak Time iv)Peak Overshoot	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a)	A unity feedback control system has an open loop transfer function $G(s) = \frac{K}{s(s^2+4s+13)}$. Sketch the root locus.	*CO3*	*PO3*	**12**
		b)	Elaborate on the stability analysis of the pupillary light reflex with suitable functional diagram and linearized model.	*CO2*	*PO2*	**08**
			OR			
	6	a)	For a system with characteristic equation **$F(S) = S^6+3S^5+4S^4+6S^3+5S^2+3S+2=0$,** examine the stability of the system	*CO3*	*PO3*	**08**
		b)	State the rules for the construction of the root locus.	*CO2*	*PO2*	**12**
			UNIT - IV			
	7	a)	Draw the hypothesis for the Kao's Cross-circulation Experiment.	*CO2*	*PO2*	**12**
		b)	Explain the process of the Starling heart lung preparation.	*CO2*	*PO2*	**08**
			OR			
	8	a)	Discuss the basic problems in physiological system analysis.	*CO2*	*PO2*	**10**
		b)	Briefly explain the closed loop identification of the respiratory control system.	*CO2*	*PO2*	**10**

			UNIT - V			
	9	a)	Enumerate the advantages of the frequency response analysis.	*CO3*	*PO3*	**08**
		b)	Define the following terms i)Gain Margin ii)Phase margin iii)Gain crossover frequency iv)Phase crossover frequency.	*CO3*	*PO3*	**04**
		c)	Describe the frequency response of circulatory control system model.	*CO3*	*PO3*	**08**
			OR			
	10	a)	Plot the Bode diagram for the following transfer function $\boldsymbol{G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}}$ and obtain the gain and phase cross over frequencies.	*CO3*	*PO3*	**14**
		b)	Discuss the frequency response of glucose –insulin regulation.	*CO3*	*PO3*	**06**

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