U.S.N.										

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

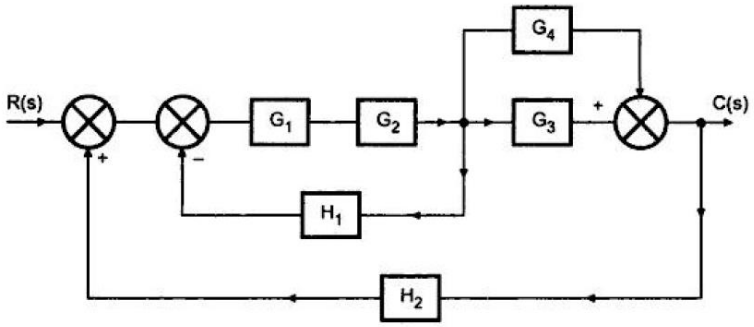
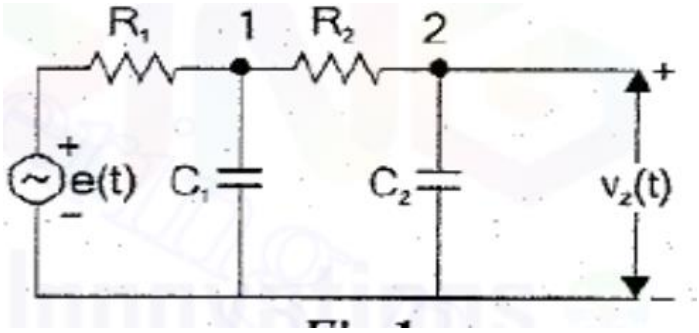
Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 23MD4ESPCS / 22MD4ESPCS **Max Marks: 100**
Course: Physiological Control Systems

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

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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Obtain C(s)/R(s) of the system shown in fig 1.a using block diagram reduction.  Fig.1a	CO1	*PO3*	**10**
	b)	Differentiate between physiological and Engineering control system. Illustrate the same with relevant examples.	CO1	*PO3*	**10**
		OR			
2	a)	Illustrate the working of muscle stretch reflex with a neat schematic and block diagram.	CO1	*PO3*	**10**
	b)	Obtain the Transfer Function **V2(s)/E(s)** of the electrical network shown in **Fig 2**.  Fig 2b	CO1	PO3	**10**

			UNIT - II			
	3	a)	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*	*PO3*	**10**
		b)	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*	*PO3*	**10**
			OR			
	4	a)	Define the following: i) Rise time ii) Settling time iii) Maximum overshoot iv) Damping ratio	CO2	PO3	**08**
		b)	With a relevant block diagram and waveforms, elaborate on the chemical regulations of the ventilation.	CO2	PO3	**12**
			UNIT - III			
	5	a)	Elaborate on the stability analysis of the pupillary light reflex with suitable functional diagram and linearized model.	*CO3*	*PO3*	**08**
		b)	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**
			OR			
	6	a)	Define the term "Asymptotically stable system". Using Routh Criterion, test the stability of the system represented by the characteristics equation, $s^5+4s^4+8s^3+8s^2+7s+15=0$	CO3	PO3	**08**
		b)	A unity feedback control system has an open loop transfer function, **G(S) =** $\frac{K}{s(s^2+6s+10)}$ Find i). Poles and Zeroes, ii). The Root Locus on the real axis. iii). Angle of Asymptotes and Centroid. Also sketch the root locus for the transfer function **G(S).**	CO3	PO3	**12**
			UNIT - IV			
	7	a)	Explain the process of the Starling heart lung preparation	*CO4*	*PO3*	**08**

		b)	Identify and explain the various non-parametric identification methods.	*CO4*	*PO3*	**12**
			OR			
	8	a)	Mention the three fundamental problems in system analysis and identification of the same in closed loop systems.	CO4	PO4	**10**
		b)	"Both neural and humoral factors are involved in the regulation of cardiac output during muscular activity". Justify this statement with Kao's cross circulation experiments.	CO4	PO4	**10**
			UNIT - V			
	9	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 advantages of frequency response analysis.	*CO3*	*PO3*	**06**
			OR			
	10	a)	Describe the frequency response of circulatory control system model.	*CO3*	*PO3*	**06**
		b)	Discuss the frequency response of glucose –insulin regulation	*CO3*	*PO3*	**10**
		c)	Specify the significance of gain and phase margin.	*CO3*	*PO3*	**04**

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