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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 120002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025
Fifth Semester
Biomedical Engineering
U19BM509 – BIO CONTROL SYSTEMS
(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define an open-loop control system.	2	K1	CO1
2.	Compare engineering and physiological control systems.	2	K2	CO1
3.	Define breakaway point of a root locus.	2	K1	CO2
4.	State the necessary and sufficient conditions for stability.	2	K1	CO2
5.	Define gain margin and phase margin of control system.	2	K1	CO3
6.	Enlist the advantages of frequency domain analysis.	2	K2	CO3
7.	Sketch the diagram of the endocrine system.	2	K2	CO4
8.	Identify the various organs involved in the respiratory system.	2	K2	CO4
9.	Define mean circulatory pressure.	2	K1	CO5
10.	Recall the functions of the automatic nervous system.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Compare and contrast block diagram and signal flow graph representations of control systems. Highlight their advantages and limitations.	13	K2	CO1

(OR)

	b)	Analyze a physiological control system (e.g., blood pressure regulation) and model it using a linear transfer function. Explain the role of feedback in maintaining homeostasis.	13	K2	CO1
12.	a)	Explain the Routh-Hurwitz criterion in detail and apply it to a fourth-order characteristic equation to check stability.	13	K3	CO2
		(OR)			
	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 and comment on the range of K for stability.	13	K3	CO2
13.	a)	The open loop transfer function of a unity feedback system is given by $G(s) = 1/s(1+s)(1+2s)$. Sketch the polar plot and determine the gain margin and phase margin.	13	K3	CO3
		(OR)			
	b)	Sketch the Bodeplot for the following transfer function and determine phase margin and gain margin $G(S) = 75(1+0.2s)/s(s^2+16s+100)$.	13	K3	CO3
14.	a)	Describe the cardiovascular heart model and explain its significance in modeling blood circulation.	13	K2	CO4
		(OR)			
	b)	Develop a temperature control model of the human body and analyze the response to a sudden environmental temperature change.	13	K2	CO4
15.	a)	Develop a simple model of muscle stretch reflex action and explain its components.	13	K4	CO5
		(OR)			
	b)	Explain transient response analysis of a neuromuscular reflex model with an illustrative example.	13	K3	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16.	a) A patient is fitted with an insulin pump to regulate blood glucose. The pump measures blood glucose and injects insulin automatically. Identify whether this system is open-loop or closed-loop. Justify your answer. Draw a block diagram representing the glucose-insulin feedback system. Compare the physiological control in this system with a standard engineering control system, highlighting the differences.	15	K2	CO1

(OR)

- b) Develop and analyze a simple model for cardiac output regulation. Determine its steady-state response and discuss physiological implications. 15 K4 CO5
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