Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – SUMMER • 2014

Subject Code: 150304 **Date: 24-06-2014**

Subject Name: Modeling and Simulation of Biological Systems

Time: 10:30 pm to 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Briefly describe the results of simple lung mechanics model for 15 & 60 breaths /min with neat sketch. What effects does the model adepts while increasing the frequency of respiration ventilator?	**07**
	(b)	Describe the Closed-Loop Analysis of Lungs and Controller Combined.	**07**
Q.2	**(a)**	Briefly explain the gas exchanger model with appropriate equations.	**07**
	(b)	Give difference: Distributed Parameter versus Lumped Parameter.	**07**
		OR	
	(b)	Give difference: Engineering & Physiological Control System	**07**
Q.3	**(a)**	Draw a velocity vs. time graph for 10º saccade. Label and explain below given terminologies. 1. Saccade Duration 2. Latent Period 3. Saccade magnitude 4. Peak Velocity 5. Time at peak velocity	**07**
	(b)	Draw the plots and explain the Closed-Loop Analysis of Heart and Systemic Circulation Combined.	**07**
		OR	
Q.3	**(a)**	Derive the equations for time to peak overshoot (t_p) & time at peak velocity (t_{mv}) from westheimer's saccadic eye model.	**07**
	(b)	Draw and explain the steady-state analysis of glucose regulation under a) Normal conditions b) Type-I diabetes c) Type-II diabetes	**07**
Q.4	**(a)**	Draw the simplified model of cardiac output regulation and derive mathematical expressions for the model.	**07**
	(b)	Draw and explain the graphical representation of steady-state operating point.	**07**
		OR	
Q.4	**(a)**	Explain nonlinearity in model with appropriate examples.	**07**
	(b)	Explain neuromuscular reflex model with neat sketch.	**07**
Q.5	**(a)**	Describe the difference between static and dynamic analysis with appropriate examples.	**07**
	(b)	Draw and explain the frequency responses of glucose-insulin regulation model in conditions simulating a typical normal human and a Type-2 diabetic.	**07**
		OR	
Q.5	**(a)**	Derive the Relationship between Transient and Frequency Responses.	**07**
	(b)	Draw and explain the graphical analysis of the steady-state regulation of ventilation during (a) normoxia (PI02 == 150mm Hg) and (b) exposure to mild hypoxia through ascent to altitude.	**07**

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