Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 150304 **Date: 15/05/2017**

Subject Name: Modelling & Simulation of Biological Systems (Institute Elective - II)

Time: 02:30 PM to 05:00 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)**	Explain mathematical model of linear muscle mechanics model.	**07**
	(b)	Draw and describe the graphs of linear muscle mechanics model.	**07**
Q.2	**(a)**	Describe the characteristics of system elements that can be used for modelling.	**07**
	(b)	Difference: Physiological control systems vs. Engineering control systems	**07**
		OR	
	(b)	Difference: Lumped Parameter vs. Distributed Parameters	**07**
Q.3	**(a)**	Explain the graphical method for finding equilibrium point with appropriate example.	**07**
	(b)	Write a short note on Principle of superposition.	**07**
		OR	
Q.3	**(a)**	Explain the frequency response of glucose-insulin model for normal and abnormal subjects with appropriate graphs.	**07**
	(b)	Describe the transient response analysis of neuromuscular reflex model.	**07**
Q.4	**(a)**	What is mean circulatory pressure? Derive mathematical representation of venous return using mean circulatory pressure.	**07**
	(b)	"The negative feedback in physiological control system is embedded within the characteristics of the system." Justify the statement with appropriate examples.	**07**
		OR	
Q.4	**(a)**	Draw and explain the cardiac output and venous return curves.	**07**
	(b)	"A true static equilibrium never really exists for physiological systems" Justify the statement with appropriate examples.	**07**
Q.5	**(a)**	Describe the steady state analysis of muscle stretch reflex action with appropriate diagrams.	**07**
	(b)	Draw and explain the Westheimer's saccadic eye movement model. Derive the mathematical formulas of time to Peak Overshoot and maximum velocity.	**07**
		OR	
Q.5	**(a)**	Explain the frequency domain analysis of linearized model of lungs mechanics.	**07**
	(b)	Draw and explain linear muscle model with mathematical formulas.	**07**

****