

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B. E. SEMESTER: V Bio-Medical Engineering

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

Subject Code: **150304**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
4	0	2	6	70	30	50

Sr. No	Course content
1.	Study of MATLAB tools
2.	Important concepts of control theory. i.e. Frequency domain, time domain, blocks diagram, time response analysis, etc.
3.	Introduction to Physiological control systems, Illustration- example of a physiological control system. Difference between engineering and physiological control systems.
4.	Art of modelling Physiological systems, linear models of physiological systems- distributed parameters versus lumped parameter models. Principle of superposition.
5.	Cardiovascular system modelling and simulation. Theoretical basis, model development, heart model, circulatory model, computational flow diagram of the cardiac system.
6.	Pulmonary mechanics modelling and simulation. Theoretical basis, model development, Lung tissue viscoelastance, chest wall, airways-full model of respiratory mechanics.
7.	Study of cardiopulmonary models.
8.	Eye movement system and Wetheimer's saccade eye model. Oculomotor muscle model. Linear muscle model.
9.	Simple models of muscle stretch reflex action, ventilatory control action, Lung mechanics and their SIMULINK implementation.
10.	Study of steady state analysis of muscle stretch reflex action, ventilatory control action by MATLAB tools.
11.	Study of transient response analysis of neuromuscular reflex model action by MATLAB tools.
12.	Study of frequency domain analysis of linearized model of lungs mechanics, circulatory control model and glucose insulin regulation model by MATLAB tools.

## **Reference Books:**

1. Physiological control systems: Analysis, Simulation and Estimation.  
By: Michael C.K.Khoo.  
Pub: Prentice Hall of India Pvt. Ltd. New Delhi.
2. Virtual Bioinstrumentation. Biomedical, Clinical and Healthcare applications.  
By: Jon B. Olansen and Eric Rosow.  
Pub: Prentice Hall PTR. Upper Saddle River, NJ.