

GUJARAT TECHNOLOGICAL UNIVERSITY

Biomedical Engineering

B. E. SEMESTER: VII

Subject Name: **Physiological System Modeling**

Subject Code: **170302**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
3	0	2	5	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	Introduction to Physiological control systems, Illustration- example of a physiological control system. Difference between engineering and physiological control systems.	5
2.	Art of modeling Physiological systems, linear models of physiological systems- distributed parameters versus lumped parameter models. Principle of superposition, Laplace transforms and transfer functions, Impulse response and linear convolution, Analysis using MATLAB and SIMULINK.	5
3.	Cardiovascular system modeling and simulation. Theoretical basis, model development, heart model, circulatory model, computational flow diagram of the cardiac system, software development. Analysis using MATLAB and SIMULINK.	6
4.	Pulmonary mechanics modeling and simulation. Theoretical basis, model development, Lung tissue viscoelastance, chest wall, airways-full model of respiratory mechanics. Pulmonary system software development-computational flow diagram. Analysis using MATLAB and SIMULINK.	6
5.	Interaction of Pulmonary and Cardiovascular models. Computational flow diagram for cardiopulmonary software development. Analysis using MATLAB and SIMULINK.	5
6.	Time domain analysis of linear control system: Open loop versus closed loop dynamics and other consideration. Transient response using MATLAB. Stability analysis by RH criteria, Root locus, Nyquist criteria. Study of cheyne-stokes breathing Model. Study of transient response analysis of neuromuscular reflex model.	7

7.	Frequency Domain analysis of linear control system: Frequency domain analysis using MATLAB and SIMULINK. Study of frequency domain analysis of linearized model of lungs mechanics, circulatory control model and glucose insulin regulation model by MATLAB tools.	7
8.	Eye movement system and Wetheimer's saccade eye model. Oculomotor muscle model. Linear muscle model.	5
9.	Simple models of muscle stretch reflex action, ventilatory control action, Lung mechanics and their SIMULINK implementation and MATLAB tools.	5
10.	Identification of Physiological control systems: Non parametric and Parametric Identification methods. Problems in parameter estimation, Identification of closed loop system and opening loop technique. Case study of blood glucose regulation and respiratory control under closed loop conditions.	5

The Practical And Term Work Will Be Based On The Topics Covered In The Syllabus.

Text Book:

1. Physiological control systems: Analysis, Simulation and Estimation.
By: Michael C.K.Khoo., Pub: Prentice Hall of India Pvt. Ltd. New Delhi.