

**Learning Outcomes:**

The educational objectives of the course are to educate students to attain the following:

- Use of principles of control theory and system analysis to better understand the processes involved in physiological regulation.
- Understanding of physiological models on the basis of lumped parameter and distributed parameter.
- Understanding of time domain and frequency domain analysis.
- Implementation of models on a simulation platform.

**SYLLABUS**

<b>Unit No.</b>	<b>Topics</b>	<b>Lectures (Hours)</b>
<b>1</b>	<b>INTRODUCTION:</b> Introduction to physiological control system, Physiological control system analysis, difference between engineering and physiological control system, Feedback and feed forward physiological control system, Applications of control theory to physiological systems.	<b>7</b>
<b>2</b>	<b>MATHEMATICAL MODELING</b> <b>Modeling techniques:</b> Generalized system properties, Models with combinations of system elements and compartmental modeling, linear model of physiological system, Distributed parameters verses lumped parameter models, Principal of super position.	<b>7</b>
<b>3</b>	<b>STEADY STATE ANALYSIS OF PHYSIOLOGICAL SYSTEM</b> Close loop verses open loop system, Steady state analysis of Muscle stretch reflex, Regulation of Cardiac output, Regulation of Glucose - Insulation, Chemical regulation of Ventilation, Implementation & analysis of models using SIMULINK.	<b>7</b>
<b>4</b>	<b>TIME DOMAIN ANALYSIS:</b> Transient response first and second order, Transient response analysis of linearized lung mechanics, Transient response analysis of neuromuscular reflex motion model by Simulink.	<b>7</b>
<b>5</b>	<b>FREQUENCY DOMAIN ANALYSIS:</b> Frequency response analysis of linearized lung mechanics, circulatory control system, glucose insulin regulation by using MATLAB tool.	<b>7</b>
<b>6</b>	<b>STABILITY ANALYSIS:</b> Pupillary light reflex and Cheyne-Stokes breathing stability analysis.	<b>5</b>
<b>7</b>	Modeling of thermoregulatory system, eye movement system and wetheimer's saccade eye model, Oculomotor muscle model, Linear muscle model and Semicircular canal model.	<b>5</b>

**Term Work and Practical shall be based on the above syllabus.**

**Text Books:**

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

**Reference Books:**

1. Biological control system analysis By: Milsum john H.  
Pub: McGraw Hill
2. Virtual Bioinstrumentation Biomedical, Clinical and Healthcare applications.  
By: Jon B. Olansen and Eric Rosow.  
Pub: Prentice Hall PTR. Upper Saddle River, NJ.