

Course Number: 28175

Course Name: Biofluid Mechanics

Course Type: Theory
Prerequisite: -
Level: Graduate
Group: Energy Conversion

Type & Max Unit: 3
Corequisite:-
First Presentation:
Last Edition: Nov., 2017

Objectives:

The purpose of this course is understanding physiologically relevant fluid mechanics problems in our body such as blood flow in the heart and blood vessels, or generally in cardiovascular systems as well as respiratory system.

Topics:

1-Introduction to cardiovascular fluid mechanics

- Cardiovascular physiology
- Laminar flow of Newtonian fluid in a rigid pipe in steady and pulsatile condition
- Fluid mechanics of vessel bifurcations
- Blood rheology and viscoelastic fluid
- Non-Newtonian blood flow in an elastic vessel
- Flow in a curved tube

2- Simulation of blood flow in cardiovascular system

- Non-Newtonian fluid modeling
- Flow in an elastic tube
- Flow-Solid interaction
- Electrical analogy of blood flow and zero-D modeling
- One-dimensional modeling of blood flow

3-Other biofluids in a human body

- Flow in a kidney
- Simulation of hemodialysis system
- Mass transfer across capillary vessels.

4- Physiology and simulation of respiratory systems

- Introduction to breathing physiology and airways
- ventilatory patterns and air flow in the lung
- The diffusion of pulmonary gases
- Oxygen and carbon dioxide diffusion across the alveolar
- particle deposition in respiratory systems

References:

- Biofluid Mechanics, by: *J. N. Mazumdar, World Scientific Pub. Co., NJ, 1992.*
 Biofluid Mechanics, The human circulation (*Chandran & Yoganathan & Rittgers-2007*)
 Applied Biofluid Mechanics (*L. Waite and J. Fine-2007*)
 Biofluid Dynamics, Principles and selected applications (*C. Kleinstreuer-2006*)
 Cardiopulmonary Anatomy & Physiology, (T. D. Jardins, 4th ed., 2002)