

# Hemodynamics and cardiovascular mechanics

## ***Course***

2 hrs lecture + 1 hr exercises

Professor: Nikos Stergiopoulos

Tel: 3-8346

Email: nikolaos.stergiopoulos@epfl.ch

Assistant: Sokratis Anagnostopoulos

## ***Exam***

written, 2 hrs, «open book»

## ***Books; notes:***

1. Snapshots of Hemodynamics (2<sup>nd</sup> edition)
2. Course notes (to be distributed)

## ***Other books***

1. Blood flow in Arteries, McDonald
2. Hemodynamics, Milnor, Wilkins & Wilkins Baltimore

# Hemodynamics and cardiovascular mechanics

- Introduction
- Basic principles of hemodynamics
  - Blood rheology
  - Laminar & turbulent flow
  - Arterial stenoses
  - Pulsatile flow
  - Wall elasticity
- Cardiac hemodynamics
  - cardiac muscle
  - Pumping function of heart
  - Cardiac power and energy
- Arterial hemodynamics
  - Wave propagation & reflection
  - Wave analysis
  - Models of the arterial system

# Program of study

Week	Date	Topics	Subject
1	18.Feb.25	Introduction to Biomechanics. Introduction to the physics and physiopathology of the cardiovascular system. Blood rheology.	
2	25.Feb.25	The Law of Poiseuille. Resistance. The Bernoulli equations. Laminar flow and turbulence.	Biofluid mechanics
3	04.Mar.25	Fluid mechanics of arterial stenoses. Analysis of coronary stenosis and flow reserve.	
4	11.Mar.25	Dimensional analysis.	
5	18.Mar.25	Pulsatile flow and Womersley's theory.	
6	25.Mar.25	Wall composition. Elasticity. Compliance. Law of Laplace.	Arterial wall mechanics
7	01.Apr.25	Prestress. Active properties. Vasomotion	
8	08.Apr.25	The cardiac cycle. Mechanics of cardiac muscle.	Cardiac mechanics
9	15.Apr.25	Pressure-volume relation. Varying elastance. Pump function graph. Cardiac work and power. Cardiac oxygen consumption. Cardiac efficiency.	
10	29.Apr.25	Wave travel. Wave transmission and reflection.	
11	06.May.25	Input impedance. Waveform analysis.	Arterial wave propagation and arterial tree models
12	13.May.25	Windkessel models.	
13	20.May.25	Transfer function	
14	27.May.25	Simulation lab	