

BME495G

Course Syllabus

1. *Department:* Biomedical Engineering

Number: BME495C 590C

Credit Hours: 3

Title: Cardiovascular Biomechanics I

2. *Course Description:*

Bioengineering principles are developed and applied to the cardiovascular system. Anatomy of human cardiovascular system, form and function of blood (fluids), and blood vessels (solids) from an engineering perspective. Comparative anatomy and allometric scaling principles. Cardiovascular molecular and cell biology. Overview of continuum mechanics. Normal, diseased, and engineered replacement tissues are considered.

3. *Prerequisite(s):* ECE 331, BME 302 and BME 342

4. *Textbook(s) and/or other required material:*

Optional Textbook: Biomechanics: Mechanical Properties of Living Tissues

Supporting Materials: Selected articles, MATLAB.

5. *Course objectives. By the end of this course, the student should be able to: (use demonstrative verbs)*

1. Describe the vascular system and differentiate between healthy and diseased states.

2. Derive Pouseille's, Bernoulli's, Navier-Stokes, and Stokes equations from first principles and describe assumptions and appropriate application of each in vascular modeling.

3. Describe the constitutive model considerations and parameter estimations for modeling blood vessels.

4. Describe the relationship between hemodynamics and vascular

disease

5. Describe the active remodeling of blood vessels
6. Describe the molecular regulation of flow and pressure.

6. *Topics covered (give the number of lectures per topic, as well as the total number of lectures per semester):*

1. Introduction; Overview of Vascular Physiology (2)
2. Fluids: Continuum and Blood properties
3. Fluids: Conservation Laws (2)
4. Fluids: Quality of flow (laminar, turbulent),
5. Fluids: Shear
6. Solids: Continuum and Vessel Properties (2)
7. Solids: Stresses and Strains (basic)
8. Solids: Pressure vessels
9. Solids: Constitutive models (3)
10. Solids: Anisotropic models
11. Vascular Biology: Regulation (2)
12. Vascular Biology: Mechanotransduction (2)
13. Vascular Biology: Atherosclerosis
14. Vascular Biology: Impact of vascular devices

7. *Class/laboratory schedule (sessions per week and duration of each session):*

Two 90-minute lectures per week.

Date of preparation and person(s) who prepared this description:

Brooke Steele, Aug. 22, 2006.