

BMED/AE/CHE/ME 4757 Biofluid Mechanics (Elective)

Catalog Description: BMED 4757 Biofluid Mechanics (3-0-3)
Prerequisite(s): BMED 3310
Introduction to the study of blood flow in the cardiovascular system. Emphasis on modeling and the potential of flow studies for clinical research applications.

Textbook: Biofluid Mechanics: The Human Circulation 2nd edition, Chandran et al, CRC Press (2012), ISBN: 1439845166

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Topics Covered:

1. Review of fluid dynamics
2. Introduction to solid mechanics
3. Review of cardiovascular physiology
4. Blood rheology and blood vessel mechanics
5. Hydrostatics and steady flow models
6. Unsteady flow and non-uniform geometric models
7. Native heart valve dynamics
8. Prosthetic heart valve fluid dynamics
9. Vascular therapeutic techniques
10. Fluid dynamics measurement techniques relevant to blood flow
11. Introduction to computational fluid dynamics

Course outcomes:

Students who complete this course will be able to:

Outcome 1: Understand physiologically-relevant fluid and solid mechanics (Student Outcomes a and e)

- 1.1 Understand fluid and solid mechanics that are pertinent to blood flow in the heart and blood vessels
- 1.2 Understand cardiovascular physiology

Outcome 2: Apply fluid mechanical analyses relevant to biomedical engineering problems (Student Outcomes a, e, and k)

- 2.1 Conduct fluid mechanical analyses of human circulation, primarily applied to blood flow at the arterial level
- 2.2 Conduct fluid mechanical analyses of vascular implants (e.g., prosthetic valves) and measurements in the cardiovascular system

Outcome 3: Understand and analyze velocity measurement techniques relevant to blood flow (e.g., MRI, Ultrasound, Doppler) (Student Outcomes a, e, and k)

Outcome 4: Understand the use of computational techniques in simulating blood flow (Student Outcomes a, e, and k)

Outcome 5: Understand the process of literature review related to a given subject, preparation of a review article for publication and presenting it to a panel of 3-5 experts (Student Outcomes d, g, and i)

Correlation between course outcomes and student outcomes:

BMED 4757											
	Biomedical Engineering Student Outcomes										
Course outcomes	a	b	c	d	e	f	g	h	i	j	k
1.1	X				X						
1.2	X				X						
2.1	X				X						X
2.2	X				X						X
3	X				X						X
4	X				X						X
5				X			X		X		

The Wallace H. Coulter Department of Biomedical Engineering Student Outcomes:

- a. an ability to apply knowledge of mathematics, science, and engineering;
- b. an ability to design and conduct experiments, as well as to analyze and interpret data;
- c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, societal, political, ethical, health and safety, manufacturability, and sustainability;
- d. an ability to function on multidisciplinary teams;
- e. an ability to identify, formulate, and solve engineering problems;
- f. an understanding of professional and ethical responsibility;
- g. an ability to communicate effectively;
- h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- i. a recognition of the need for, and an ability to engage in lifelong learning;
- j. a knowledge of contemporary issues;
- k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;