BMED/ME 4757 Biofluid Mechanics (Elective)

Catalog Description: BMED/ME 4757 Biofluid Mechanics (3-0-3)

Prerequisites: AE 2020 Low Speed Aerodynamics or BMED 3300 Biotransport or CEE 3040 Fluid Mechanics or ME 3340 Fluid Mechanics

Crosslisted with AE, BMED, CHBE, and ME.

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: Krishnan B. Chandran, Stanley E. Rittgers, and Ajit P. Yoganathan, *Biofluid Mechanics: The Human Circulation*, 2nd Edition, CRC Press, 2012.

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 dynamic measurement techniques relevant to blood flow
11. Introduction to computational fluid dynamics

Course Outcomes:

Outcome 1: Understand physiologically relevant fluid and solid mechanics.

- 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.

- 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).

Outcome 4: Understand the use of computational techniques in simulating blood flow.

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.

Correlation between Course Outcomes and Student Outcomes:

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

GWW School of Mechanical 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, social, 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 life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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