Jordan University of Science and Technology
Faculty of Engineering
Biomedical Engineering Department

BME 342 BioFluid Mechanics

Course Catalog

3 Credit hours (3 h lectures). This course emphasizes the application of fluid mechanics principles to major human organ systems. Principles such as the conservation of energy and mass will be applied to various human body systems in addition to fundamental equations including continuum equations and Navier Stokes equations. The course will also cover the behavior of both Newtonian and Non-newtonian physiological fluids.

Textbooks

Rubenstein D. A., Yin W. and Frame M.D. (2015). *Biofluid Mechanics*, 2nd ed. Academic Press.

References

Books

1) Waite L., and Fine, J. (2007). *Applied Biofluid Mechanics*. Printice Hall.
2) Mazmuder J.N. (1992). *Biofluid Mechanics*.World Scientific Publishing

Journals

1) Journal of Biomechanics

Internet links

http://www2.imperial.ac.uk/~ajm8/BioFluids/
http://ocw.mit.edu/courses/biological-engineering/20-330j-fields-forces-and-flows-in-biological-systems-spring-2007/

Instructor

Instructor **Alaa Alrashdan, Ph.D,** E-mail**:** aarashdan@just.edu.jo

Prerequisites

Prerequisites by topic	General Physics, Ordinary Differential Equations
Prerequisites by course	PHYS 101, MATH 203
Co-requisites by course	-
Prerequisite for	BME 441

Topics Covered

Week	Topics	Chapters in Text
1	Course Introduction	Chapter 1
1-3	Fundementals of Fluid Mechanics	Chapter 2
4-6	Conservation Laws	Chapter 3
7	The heart and the cardiac cycle	Chapter 4
8-10	Blood Flow in Arteries and Veins	Chapter 5
11-12	Microcirculation	Chapter 6
13-15	Applications on other systems	Chapter 8,9

Evaluation

Assessment Tool	Expected Due Date	Weight
First Exam	According to the department schedule	25 %
Second Exam	According to the department schedule	25 %
Participation	According to Advisor instructions	10 %
Final Exam	According to the University final examination schedule	40 %

Objectives and Outcomes[1]	
Objectives	**Outcomes**
1. Understand the basics and fundementals of fluid mechanics [a]	1.1. Understand the basic concepts of fluid mechanics such as the contimuum model, kinematics, and conservation laws. [a] 1.2. Differentiate between fluid mechanics and biofluid mechanics scopes [a,l]
2. Explain the heart and cardiac cycles [a,l]	2.1. Understand cardiac physiology [a,l] 2.2. Identify the components and phases of the cadiac cycle [a,l] 2.3. Explain heart valves functions and the relation to their anatomy [a,l] 2.4. Relate different cardiovascular diseases to the anatomy and physiology of the cardiac system [a,b,l]
3. Differentiate biofluid properties and behavior [a,e,l]	3.1. Define viscosity. [a] 3.2. Differentiate between Newtonian and non-Newtonian fluids [a,e] 3.3. Explain the effect of different physiological parameters on the mechanical properties of biofluids [a, l]
4. Apply fluid mechanics principles on biofluid flows in arteries and veins [a,e,l]	4.1. Understand arterial and venous physiology [l] 4.2. Apply basic fluid mechanics concepts on venous and arterial flows [a,e,l]
5. Understand microcirculation and understand the fundamental difference between physiological mico and macrocirculation [a,e,l]	5.1. Identify the components of microcirculation and their control of local blood flow [a,l] 5.2. Differentiate macro from micro flow and understand when the each applies [a,e]] 5.3. Understand fluid phenomena in microcirculation such as capillary plug flow and Fahraus-Linqvist effect [a,e]
6. Apply fluid mechanics principles to physiological systems such as the renal and respiratory system [a,b,e,l]	6.1. Apply fluid mechanics pricinples to flows in the renal and respiratory system[a,b,e,l] 6.2. Understand the effect of the systems' anatomy and physiology on fluid behavior in that system [a,b,e,l]

Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts, applications, and design of biofluid mechanics and lays the foundation for more advanced courses such asphysiological fluid mechanics.

Relationship to Program Outcomes (%)

1	2	3	4	5	6	7	8	9
50	15				10		15	10

Relationship to Biomedical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4
√		√	√

[1] Lower-case letters in brackets refer to the Program outcomes

Prepared by: Alaa Alrashdan, Ph.D
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