



**BME 541 BioMechanics and BioMaterials Lab**

**2013 Course Catalog**

1 Credit hours (3 h lab sessions). Application of biomechanics and biomaterials and relates them to specialty topics such as work biomechanics, biofluid mechanics, and rehabilitation engineering, Experiments covered includes Anthropometry and Goniometry, Posture Analysis, Gait Analysis, EMG and Muscle Biomechanics, Tensile Testing, Fatigue Testing, Creep Measurements.

**Textbooks**

BioMechanics and BioMaterials Lab Handouts, JUST-Biomedical Engineering Dept.

**References**

**Books**

- Lab handouts.
- Peterson, D.R., and Bronzino, J.D. (2008). Biochemechanics: Principles and Applications. 1<sup>st</sup> ed. CRC Press
- Biomaterials: An Introduction to Materials in Medicine. Ratner et al.

**Journals**

- Journal of Applied Biomechanics
- Biomaterials

**Internet links**

- <http://www.bmecentral.com/publications/>

**Instructor**

Instructor **Dr. Ruba Khnouf** , E-mail: rekhnouf@just.edu.jo

**Prerequisites**

Prerequisites by topic Introduction to Biomedical Materials  
 Prerequisites by course BME 440  
 Co-requisites by course -  
 Prerequisite for

**Evaluation**

Topics Covered		Experiments
Week	Topics	
1	Introduction to the Lab	
	<b>Part I: Biomechanics</b>	
2	Anthropometry and Goniometry	
3	Muscle BioMechanics	
4	Dynamic Goniometer	
5	Static and Vertical Jump Measurement Using Force Plate	
	<b>Part II: Mechanical Prosperities of Biomaterial</b>	
6	Tension and Compression Test	Lab Handout
7	Creep Test	
	<b>Part III: Biofluid Mechanics</b>	
8	Venturi Meter	
9	Flow Visualization	

Assessment Tool	Expected Due Date	Weight
Pre Lab Reports	Turned in at the beginning of the lab session	5%
Post Lab Reports	Turned in at the beginning of the lab session	15%
(The late submission policy for Post lab reports is as follows: <i>For each day -15%.maximum 3 days)</i>		

Quizzes and Performance	Quizzes are given at the beginning of each lab	10%
Mid Exam	According to the department schedule	20 %
Final Exam	According to the University final examination schedule	40 %
Project	Before the final exam	10%

### Objectives and Outcomes<sup>1</sup>

Objectives	Outcomes
1. Understand Anthropometric and goniometric measurements and their analysis [1, 6, 9]	1.1 Learn how to use the Anthropometer and the goniometer [1, 6] 1.2 Make and analyze anthropometric measurements [6, 9] 1.3 Compare data obtained with international averages and standards [6, 9]
2. Perform and apply biomechanical measurements in different postures and activities [1,6,8,9]	2.1 Make biomechanical measurements such as ground reaction forces and load cell force measurements at different joint angles [6, 9] 2.2 Relate the measurements taken to different postures [1,6,9] 2.3 Relate the obtained data with available biomechanical models [1,6,8]
3. Acquire and analyze gait signals [1,6,9]	3.1 Acquire gait signals using ground reaction forces and electrical goniometer [2, 6] 3.2 Relate the acquired signals with standard gait signals and understand their phases [1,6, 9] 3.3 Relate the acquired signal with specific anthropometric measurements [1,6,9]
4. Familiarize the students with material property static and dynamic measurements [1,6,8, 9]	4.1 Familiarize the student with the material testing station [6] 4.2 Understand different protocols and parameters that influence specific property measurements [1,6] 4.3 Make property measurements on a range of biomaterials and biological materials and compare to known values [1,6,8,9]
5. Recognize flow in different cases and its relation with human organ systems [1,6,8]	5.1 Overview the Laminar flow between two parallel plates [1,6] 5.2 Source in a Uniform Stream [6,8] 5.3 Sink in a Uniform Stream [6,8] 5.4 Source and Sink far apart in a uniform stream [6,8] 5.5 Flow through a diffuser [6,8]
6. Understand the principle of venturi meter [1,6,8]	6.1 Show the relationship between flow area, pressure head, velocity head, and head loss through an expansion [1,6] 6.2 Calculate the flow rate given the drop in pressure through the contraction and the area of the two cross-sections [1,6] 6.3 Familiarize the venturi effect and Bernoulli's theorem and relate its effect with human organ systems [1,6,8]
7. Encourage life long learning, foster teamwork and enhance student's communication skills. [1, 3, 4,5,7]	7.1 Design and conduct experiments in teams [4, 5] 7.2 Write a report for each experiment analyzing and explaining the results [1, 3, 6, 7]

### Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts and applications of cell and molecular biotechnology in Biomedical Engineering.

#### Relationship to Program Outcomes (%)

1	2	3	4	5	6	7	8	9
20		8	8	8	18	8	20	10

#### Relationship to Biomedical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4
√		√	√

Prepared by: Dr. Ruba Khnouf  
Last Modified: Feb 11, 2020

<sup>1</sup> Lower-case letters in brackets refer to the Program outcomes