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

BME 542: Prosthetics and Orthotics

Course Description

3 Credit hours (3 h lectures). Human movement, biomechanics, skeletal and muscular anatomy, comparative anatomy, muscle physiology, and locomotion. Engineering design of artificial limbs.

Text Book(s)

Title	Prosthetics and Orthotics
Author(s)	Shurr, D., Michael, J.
Publisher	Prentice Hall
Year	2001
Edition	2nd Edition

References

Books	- Lusardi, M., Nielsen, C. "Orthotics and Prosthetics in Rehabilitation", Butterworth-Heinemann. - Bronzino, J. "The Biomedical Engineering Handbook." Boca Raton, FL: CRC Press. - Williams, M. & Lissner, H. "Biomechanics of Human Motion" Philadelphia: Saunders. - Fung, Y.C. (1996). "Biomechanics: Properties of Living Tissues." Springer-Verlag - Fung, Y.C. (1993). "First Course in Continuum Mechanics of Physical and Biological Engineers and Scientists." 3rd Ed. Prentice-Hall. - Any textbook in human anatomy and physiology.
Journals	- Journal of Prosthetics and Orthotics. - Critical Reviews in Rehabilitative Medicine.
Internet links	- http://www.bmecentral.com/publications/ - http://www.sciencedirect.com - http://www.elsevier.com - http://www.springer.com - http://www.scholar.google.com

Prerequisites	
Prerequisites by topic	Physiology, Anatomy, Biomechanics, Biomaterials.
Prerequisites by course	BME440, MED 236A
Co-requisites by course	N/A
Prerequisite for	None

Objectives and Outcomes[1]	
Objectives	**Outcomes**
Appreciate the role of Prosthetics and Orthotics in Biomedical Engineering [1,2,7]	Appreciate the role of Prosthetics and Orthotics in Biomedical Engineering and build an appreciation for the applications of engineering in biology and medicine.
Introduce anatomical and physiological concepts essential to the understanding of prosthetics [1,2,6,7]	Identify Basic Concepts in anatomy and physiology Appreciate the levels of structural organization Identify the organ systems and their role in homeostasis Apply anatomical positions and terminology when describing body parts and positions
Identify the various aspects of the musculoskeletal system that allow limb function [3,7]	Learn the function of each component of the musculoskeletal system in allowing motion, weight bearing, and manipulation of the environment.
Apply material property and mechanics principles to the analysis of limbs and their prosthesis [1,2,6,7]	Ability to analyze the various materials, mechanics, and methods in prosthetic construction and analysis
Comprehend the biomechanics of the gait cycle and limb function [2,6,7]	Apply gait analysis to the study and evaluation of lower limb prosthesis function and performance
Apply different prosthetic design criteria to the prosthetic limb based on the type of amputation [2,4,7]	Apply the different principles and techniques acquired during the class to the design of various types of limb prosthesis, depending on the site of application and required function
Make measurements of myoelectric signals, process and interpret the data for myoelectric control [1,2,5].	Acquire and Analyze myoelectric signals from functioning muscle groups in order to control powered prosthesis Identify the problems associated with the interaction between the living and non-living materials and systems

Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts and applications of Anatomy, Physiology, Biomaterials, and Biomechanics to the field of Prosthetics and Orthotics design

Relationship to Program Outcome (%)

1	2	3	4	5	6	7	8	9
15	22	4	10		12	17	18	2

Relationship to Biomedical Engineering Program Objectives

PEO1	PEO2	PEO3	PEO 4
√	√	√	√

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

Evaluation		
Assessment Tool	**Expected Due Date**	**Weight**
First Exam	See Dept. Schedule	25 %
Second Exam	See Dept. Schedule	25 %
Quizzes	Thorough the Semester in a weekly basis	10 %
Final Exam	According to the University final examination schedule	40 %

Policy	
Attendance	Attendance will be checked at each class. University regulations will be strictly followed for students exceeding the maximum number of absences. In addition, points will be deducted from the participation grade for excessive absence.
Student Conduct	It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Cheating will not be tolerated in this course. University regulations will be pursued and enforced against any cheating student.

Topics Covered		
Week	**Topics**	**References**
1	- Discuss Syllabus and Course Structure - Introduction - Basic Concepts (Human Body)	Hand Out Lec Notes (Marieb)
2	- Anatomical Positions, directional terms, cavities, …etc. - Tissue distribution, structure, and function	Lec. Notes (Marieb)
3	- Bone and the skeletal system	Lec. Notes (Marieb)
4	- Joints and mobility	Lec. Notes (Marieb)
5	- Muscle Structure, mechanics, and properties	Lec. Notes (Marieb)
First Exam (See dept. schedule)		
6	- Upper and lower limb muscle anatomy - Control of limb movement	Lec. Notes (Marieb)
7	- Solve Problems / Discussion - Prosthetics: Methods, materials, and mechanics	Ch2 Shurr
8	- Biomechanics of human limbs and the gait cycle	Ch3 Shurr & Lec. Notes
9	- Transtibial Prosthesis	Ch4 Shurr
10	- Transfemoral Prosthesis	Ch5 Shurr
Second Exam (See dept. schedule)		
11	- Upper Limb Prosthetics	Ch7 Shurr
12	- Solve Problems / Discussion - Origin and Nature of Myoelectric Signals	Lec. Notes
13	- Signals and Signal Processing for Myoelectric Control	Lec. Notes
14	- Future of Myoelectric Prosthesis	Lec. Notes
Final Exam		

Teaching & Learning Methods

- Active learning, where students should be active and involved in the learning process inside the classroom, will be emphasized in the delivery of this course.
- Different active learning methods/approaches such as: Engaged Learning, Project-Based Learning, Cooperative Learning, Problem-based Learning, Structured Problem-solving, will be used.
- The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. PowerPoint presentations will be prepared for the course materials.
- A typical lecture would start with a short review (~ 5 minutes) using both PowerPoint presentations and the blackboard. This review will also depend on discussions which will gauge the students' digestion of the previous material. Then, the students would have a lecture on new materials using PowerPoint presentations and blackboard. The lecture presentation will be paused every 15 – 20 minutes with brainstorming questions and discussions that will allow the students to reflect and think in more depth about what they learned in that presentation. Then, some example problems will be presented and discussed with the students to illustrate the appropriate problem solving skills that the students should learn. The lecture will be continued for another 15 – 20 minutes.