



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

BME 466, Biomedical Engineering Design

Course Catalog

3 Credit hours (3 h lectures, Department Elective).

Detailed description of the engineering design definition, process, fundamental idea generation, decision, and comparison tools, It includes problem definition, concept generation, design requirements, design specifications, evaluation, design validation, regulations, liability, and safety, The implementation of engineering design principles in solving biomedical problems using the student's background in engineering and biomedicine with an emphasis on biomedical instrumentation circuit design to solve presented problems.

Text Book(s)

Title	Design of Biomedical Devices and Systems
Author(s)	Paul H. King, Richard C. Fries,
Publisher	Marcel Dekker, Inc.
Year	2003
Edition	2 nd edition

References

Books	<ol style="list-style-type: none">1. Dym, C. L. 2000. Engineering Design: A Project Based Introduction. New York, John.2. Moore, J. H., Davis, C. C., and Coplan, M. A. 1989. Building Scientific Apparatus: A Practical Guide to Design and Construction. Addison-Wesley.3. Pahl, G., Beitz, W. 1988. Engineering Design, A Systematic Approach. London, Springer-Verlag.4. Wilcox, A. 1990. Engineering Design For Electrical Engineers. Englewood Cliffs N.J., Prentice- Hall.5. Burgess, J. 1986. Designing for Humans: The Human Factor in Engineering. Princeton, Petrocelli Books.
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Journals	<ul style="list-style-type: none"> • Annals of Biomedical Engineering • Journal of Medical Engineering and Technology • Computer Programs and Methods in Medicine • Biomaterials • Clinical Biomechanics • Dental Materials • Journal of Biomechanics • Medical Engineering and Physics • IEEE EMBS Book Series • IEEE Engineering in Medicine and Biology Magazine • IEEE Transactions on Biomedical Engineering • IEEE Transactions on Information Technology in Biomedicine • IEEE Transactions on Medical Imaging • IEEE Transactions on Nanobioscience • IEEE Transactions on Neural Systems and Rehabilitation Engineering • Physics in Medicine and Biology
Internet links	<ul style="list-style-type: none"> • http://www.bmes.org/ • http://arjournals.annualreviews.org/loi/bioeng?cookieSet=1 • http://www.aami.org/publications/BIT/index.html • http://www.biophysj.org/ • http://emb-magazine.bme.uconn.edu/ • http://emb-magazine.bme.uconn.edu/ • http://www.iee.org/Publish/Journals/ProfJourn/MBEC/ • http://spie.org/app/Publications/index.cfm?fuseaction=journals&type=jbo • http://www.biomedical-engineering-online.com/start.asp

Instructor	
Instructor	Dr. Rabah Al abdi
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Prerequisite	
Prerequisites by topic	Introduction to Biomedical Engineering (pass), Physioanatomy lab, and Medical Electronics II
Prerequisites by course	BME 201, MED236A, BME314
Co-requisites by course	-----

Evaluation		
Assessment Tool	Weight	Expected Due Date
Term project	30%	End of the semester
Midterm Exam	30 %	According to the department schedule
Final Exam	40 %	According to the University final examination schedule

Topics Covered		
Week	Topics	Chapters in the Text
1	Introduction to Biomedical Design	Chapter 1
2	Fundamental Design Tools	Chapter 2
3	Design management, Documentation, and Reporting	Chapter 3
4	Product Definition, Documentation, and Development	Chapter 4, 5, 6
5	Computer-Aided Design	Chapter 7
5	Human Factors Issues	Chapter 8
6	Industrial Design	Chapter 9
6	Biomaterials and Materials Selection	Chapter 10
7	Safety Engineering: Devices and Processes	Chapter 11
8	Prototyping and Testing	Chapter 12
8	Quality Control and Improvement, Reliability, and Liability	Chapter 13
9	The Food and Drug Administration	Chapter 14
9	Licensing, Patents, Copyright, and Trade	Chapter 15
10	Premarket Testing and Validation	Chapter 16
11	System Testing	Chapter 17
12	Regulation Tracking	Chapter 18
13	Manufacturing and Quality Control	Chapter 19
14	Product Issues	Chapter 20
15	Professional Issues	Chapter 21
16	Miscellaneous Issues	Chapter 22

Objectives and outcomes	
Objectives	Outcomes
1. Appreciate the role of Biomedical Engineering in society [1,2,4,5]	1.1. Recognize the significance of biomedical engineering field of study. 1.2. Recognize the different careers biomedical engineers can pursue.
2. Acquaint basic design concepts essential to the understanding of biomedical engineering and to provide exposure to a wide range of biomedical engineering technology [1,2,5,7,8,9]	2.1 Define the technical vocabulary associated with instrumentation and design 2.2. Define the design process stages 2.3. Define the factors affecting the biomedical design

3. Encourage lifelong learning, foster teamwork and enhance students' communication skills [1,2,5]	3.1. Recognize the role of self- teaching 3.2. Identify the basics of team dynamics 3.3. Present the basic elements of communicating with others 3.4. Explain barriers to effective communication
4. To provide students with practical experience of biomedical instrumentation design by coaching them through the design process of a particular device for real problem [1,2,5,6]	4.1. Given the input from clients, students are capable to provide design formulation and detailed design specifications 4.2. Generate and evaluate design concepts 4.3. Identify the general principles of design and design practices of
5. To teach students design management [1,2,4,7,8,9]	5.1. Given the design specification students are capable to plan the entire design process
6. To teach students the legal and regulatory aspects of the design process [4]	6.1. Given the design specifications and concepts students are capable to create the finalized design, build and test the prototype 6.2 Understand the larger FDA regulatory framework for medical devices and the relationship between design and the rest of the process 6.3 Get familiar and adapt the engineering code of ethics
7. Analyze problems involving design process [1,2,6,8,9]	7.1. . Recognize the need of integration between engineering and life science for solving biomedical engineering problems
8. To cultivate an innovative attitude [1,2,6,8,9]	8.1 Generate and evaluate design concepts 8.2 Identify the use of Brainstorming
9. To teach students safety aspects of design [1,2,4,6,8,9]	9.1 Recognize the safety measures taken during the design process 9.2 Explain the different types of protection
Numbers in brackets refer to the Program outcomes	

Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts and applications of design for medical devices, systems, and processes.

Relationship to Program Outcomes (%)

1	2	3	4	5	6	7	8	9
13	10	2	10	20	20	10	10	10

Relationship to Biomedical Engineering Program Objectives

PEO 1	PEO 2	PEO 3	PEO 4
√	√	√	√

Teaching & Learning Methods

- ✓ The form of participatory and active learning methods will be conducted via Direct instruction, Brainstorming, Lecturing, Individual participation, and Project.
- ✓ PowerPoint presentations will be prepared for the course materials.
- ✓ A typical lecture would start with a short review with discussions to measure the students' digestion of the previous material. Then, the students would have a lecture on new materials.
- ✓ The lecture presentation will be paused when needed with brain storming sessions that will allow students to reflect and think in more depth about what they learned in the lecture.
- ✓ Example problems will be presented and discussed with the students to illustrate the appropriate problem solving skills that the students should learn.

Policy

Attendance	Attendance will be checked at the beginning of each class. University regulations will be strictly followed for students exceeding the maximum number of absences (20%).
Homework	Working homework problems is an essential part of this course and they represent a key opportunity to learn the subjects presented and discussed. All homework problems assigned during a given week are due at the beginning of class on the second meeting of the following week unless otherwise stated. Late homework will not be accepted. Failure to turn in this particular homework on time will result in a grade of zero for the homework contribution to your final grade. Teamwork is encouraged; however, the work one hands in must represent his/her own effort. Homework solutions will be discussed with the teaching assistant
Quizzes	Quizzes will be part of this course. No make-up quizzes will be conducted
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 on any cheating student

Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts in Biomedical Instrumentation

ABET Category Content

Engineering Science	
Engineering Design	3.0 Credits

Relationship to biomedical Engineering Program Objectives

	All of the course objectives contribute to the program objectives.