



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

Biomedical Instrumentation, BME 411

Course Catalog

BME411 Biomedical Instrumentation (3 C.H.)
 The fundamental principles of operation and general concepts that are applicable to all instrumentation, the commercial development of medical instruments and regulations of medical devices, It covers the measurements of biopotentials such as ECG, EEG, and EMG, cardiovascular dynamics- pressure, heart sounds, flow and volume of blood, respiratory dynamics- pressure, flow, and concentration of gases, Devices used in therapy such as pacemakers, defibrillators, cochlear prosthesis, transcutaneous electrical nerve stimulation, total artificial heart, lithotripsy, infant radiant warmers, drug infusion pumps, ventilators and anesthesia machines.

Text Book(s)

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| Title | Medical Instrumentation; Application and Design |
| Author(s) | John G. Webster |
| Publisher | John Wiley |
| Year | 2009 |
| Edition | 4 th edition |

References

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| Books | <ol style="list-style-type: none"> 1. Introduction To Biomedical Equipment Technology, Fourth Edition; Joseph J. Carr, John M. Brown. 2001 by Prentice-Hall, Inc. 2. Principles of Biomedical Instrumentation and Measurement. R. Aston; Merrill. 3. Applied Clinical Engineering. B. Feinberg; Prentice-Hall, Inc. 4. Introduction to Biomedical Electronics. J. Dubovy; McGraw-Hill. 5. Principles of Applied Biomedical Instrumentation. L. Geddes and L. Baker; John Wiley. 6. Textbook of Medical Physiology. A. Guyton; Saunders. 7. Essentials of Physiology. J. Lamb et al; Blackwell. |
| Journals | <ul style="list-style-type: none"> • Annals of Biomedical Engineering • Journal of Medical Engineering and Technology • Computer Programs and Methods in Medicine • 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 Neural Systems and Rehabilitation Engineering • Physics in Medicine and Biology • Physiological Measurement |

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| 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 |
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| Instructor | |
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| Instructor | Dr. Rabah Al abdi |
| Office location | C5-L1 |
| Office phone | 720-1000, Extension: 22288 |
| Office hours | To be announced |
| Email | rmaalabdi@just.edu.jo |

| Prerequisites | |
|--------------------------------|---------------------------------------|
| Prerequisites by topic | Medical Electronics II and Physiology |
| Prerequisites by course | BME 312, MED 236A |
| Co-requisites by course | ----- |

| Evaluation | | |
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| Assessment Tool | Weight | Expected Due Date |
| Homework & Quizzes | 10% | One week after homework problems are assigned |
| First Exam | 25 % | According to the department schedule |
| Second Exam | 25 % | According to the department schedule |
| Final Exam | 40 % | According to the University final examination schedule |

| Topics Covered | | |
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| Week | Topics | Chapters in the Text book |
| 1-3 | Basic Concepts of Medical Instrumentation | Chapter 1 |
| 4-5 | Biopotential Amplifiers | Chapter 6 |
| 6-8 | Blood Pressure and Sound | Chapter 7 |
| 9-11 | Measurements of Blood Flow and Volume | Chapter 8 |
| 12-14 | Measurements of the Respiratory System | Chapter 9 |
| 15-16 | Therapeutic and Prosthetic devices | Chapter 13 |

| Objectives and outcomes | |
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| Objectives | Outcomes |
| 1. Appreciate the role of Biomedical Engineering and develop living ethics [6] | 1.1 Recognize the significance of biomedical engineering field of study. 1.2 Recognize the different careers biomedical engineers can pursue. 1.3 Identify some morals and Engineering Ethics. |

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| 2. Acquaint basic design concepts essential to the understanding of biomedical engineering [1,2,3,5] | 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. Appreciate the applications and limitations of instrumentation in clinical environments [1,2,6,8,9] | 3.1 Recognize that physiological parameters can not be measured the same way as physical parameters 3.2 Identify problems encountered with medical profession 3.3 Define the different operational modes of biomedical instruments 3.4 Classify biomedical instruments |
| 4. Understand the different problem types and problem- solving approaches in engineering, biology, and medicine [1,2,4,5,6] | 4.1 Recognize the different types of interference affecting measurements with biomedical instruments 4.2 Explain the elimination methods of interfering and modifying inputs. |
| 5. Describe the types of research studies and biostatistical parameters used in investigating medical instruments and therapy [1,4,6,9] | 5.1 Explain the application of statistics to medical data 5.2 Evaluate diagnosis procedures 5.3 Assist clinical decision making 5.4 Present medical data 5.5 Drawing inferences from data |
| 6. Describe the generalized static and dynamic characteristics of instrument performance [2,6] | 6.1 Evaluate instrument design 6.2 Recognize the difference between ideal and real instrument performance |
| | 6.3 Compare between commercially available instruments 6.4 Recognize the dependence of instrument performance on interferences |
| 7- Encourage life long learning, foster teamwork and enhance students' communication skills [3,4,7] | 7.1. Recognize the role of self- teaching 7.2. Identify the basics of team dynamics 7.3. Present the basic elements of communicating with others 7.4. Explain barriers to effective communication |
| 8. Understand the engineering methods used to measure blood pressure, sound, flow and other parameters from living systems [1,2,4,6,8,9] | 8.1. Explain direct measurements methods 8.2. Present the harmonic analysis of blood pressure waveforms 8.3. Introduce the measurement of system response 8.4. Investigate the Effects of system parameters on the system response 8.5. Present the Bandwidth requirements for measuring blood pressure 8.6. Introduce the typical pressure waveform distortion 8.7. Define Heart sounds 8.8. Define Phonocardiograph 8.9. Recognize Cardiac catheterization |
| 9. Develop engineering models that describe cardio vascular and respiratory function [1,2,4,6,8,9] | 9.1. Knowledge of Mathematical models for Extra vascular BP measurement system and Respiratory systems |

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| 10. Understand the principle and design of therapeutic and prosthetic devices [1,2,4,6,8,9] | 10.1. Learn the design and operation of pacemakers; Baby incubators; Lithotripters; Ventilators, Infusion pumps...Ect |
| 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 Biomedical instrumentation.

Relationship to Program Outcomes (%)

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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 15 | 10 | 5 | 10 | | 20 | 10 | 15 | 15 |

Relationship to Biomedical Engineering Program Objectives

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|--------------|--------------|--------------|--------------|
| PEO 1 | PEO 2 | PEO 3 | PEO 4 |
| √ | | | √ |

| Teaching & Learning Methods | |
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| <ul style="list-style-type: none"> ✓ The form of participatory and active learning methods will be conducted via Direct instruction, Brainstorming, Lecturing, Individual participation, and Projects. ✓ 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 | |
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| 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 |

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| 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 |
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| Contribution of Course to Meeting the Professional Component |
| The course contributes to building the fundamental basic concepts in Biomedical Instrumentation |

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| ABET Category Content | |
| Engineering Science | |
| Engineering Design | 3.0 Credits |

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| Relationship to biomedical Engineering Program Objectives | |
| | All of the course objectives contribute to the program objectives. |
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Last modified: Oct-15-2019 By Dr. Rabah M. Al abdi