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

BME-314: Medical Electronics II

Course Catalog

3 Credit hours (3 h lectures). Operational amplifiers and medical applications, oscillators types and applications, switching modes of transistor, TTL logic family, MOSFET logic circuits, logic transistors, regenerative logic circuits, digital to analog and analog to digital converters, medical applications of regenerative circuits and data converters.

Text Book(s)

Title	Electronic Circuit Analysis and Design
Author(s)	Donald A Neamen
Publisher	McGraw-Hill
Year	
Edition	4th edition: ISBN: 007-125443-9.
Title	Introduction to digital Microelectronics circuits
Author(s)	Goplan
Publisher	McGraw-Hill
Year	1994
Edition	3rd

References

Books	• Electronic Circuits, Discrete and integrated, D. L. Schilling and C. Belove. McGraw-Hill. • Microelectronics circuits; Adel Sedra and Kenneth Smith, Oxford Press, 1998. • Electronic Design, Circuits and Systems; Savant, Roden, Carpenter; IRWIN
Journals	• IEEE transactions on Electronics • IEEE Instrumentation and Measurements
Internet links	• http://www.artofelectronics.com/ • http://www.phys.ualberta.ca/~gingrich/phys395/notes/phys395.html • http://www.allaboutcircuits.com/ • http://claymore.engineer.gvsu.edu/~jackh/eod/electric/
Software	• PSPice • Electronics work Bench

Instructor	
Instructor	**Prof. Mashhour Bani Amer**
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Teaching Assistant
To be Assigned by BME Department

Objectives and Outcomes	
Objectives	**Outcomes**
Explain the concept and applications of operational amplifiers [1,2, 3,4].	Understand the concept, modes of operation and applications of operational amplifiers
Study the design of analog systems using operational amplifiers [1,2, 3,4].	Understand the methodology for using op-amps to design op-amp base amplifiers, oscillators and comparators. Students will understand how to apply this circuit in the medical instrumentation.
Understand the operating principle and parameters of TTL and MOSFET logic gates circuits [1,2, 3,4].	Understand the operating principle, design and applications of TTL and MOSFET logic gates
Understand the types, parameters and operation of multivibratrs [a].	Be familiar with the principle of astable, monostable and bi-stable multivibrators with their applications in biomedical engineering
Understand the use and operation of A/D and D/A converters [1,2, 3,4].	Be familiar with the principles of DTL, RTL and TTL logic gates

Topics Covered		
Week	**Topics**	**Chapters in Text**
1-2	**Operational Amplifiers** Theory of operation, inverting amplifier, summing amplifier, non-inverting amplifier, current to voltage converter, difference amplifier, instrumentation amplifier, integrator, differentiator, and oscillators	Chapter 7 (Text 1)
2-3	**Op-amp Based Oscillators** Conditions of oscillation, Wien bridge oscillator	Chapter 9 (Text 1)

Topics Covered		
Week	**Topics**	**Chepters in Text**
3-4	**Transistor-Transistor Logic (TTL) Family** BJT Inverter Voltage transfer characteristic, logic levels, noise margin, fan-out, transient response, switching speed, and basic TTL inverter, basic TTL NAND gate.	Chapter 4 (Text 2)
4-5	**MOSFET Logic Circuits** NMOSET inverter, complementary NMOSFET (CMOS) Inverter, MOSFET logic gates, interfacing CMOS and TTL logic gates.	Chapter 7 (Text 1)
5-6	**Regenerative Logic Circuits** Bistable multivibrator Monostable multivibrator Astable multivibrtor	Chapter 8 (Text 2)
7-8	**Analog-Digital Data Converters** Digital-to-Analog (D/A) converters Analog-to-Digital (A/D) converters	Chapter 9 (Text 2)

Evaluation		
Assessment Tool	**Expected Due Date**	**Weight**
Homework, Project	One week after homework problems are assigned	10%
First Exam	According to the BME Department schedule	25 %
Second Exam	According to the BME Department schedule	25 %
Final Exam	According to the University final examination schedule	40 %

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, followed by examples and/or a quiz covering the materials taught in the previous two weeks.

Policy

Attendance	Class attendance is required and applied according to the university regulations (**student's guide page 43**). Data support the idea that class attendance improves learning. It is very difficult as well as uninspiring for me to help a student who does not attend lectures. What is created in the classroom cannot be reenacted. Make-up tests will be done according to the university regulations. Please see student's guide pages 44-45.
Homework	Working homework problems is an essential part of this course and they represent a key opportunity to learn the subjects 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 0 (zero) for the homework contribution to your final grade. Team work is encouraged; however, the work one hands in must represent his/her own effort. Homework solutions will be discussed in class. There will be no handouts of homework solutions.
Project	**Abstract** Every group (2-3) must do a project. Each group must submit a project Abstract on November 15th, 2006. This Abstract should be at most one page and must include: Project title Introduction References **REPORT:** The report is due at the project presentations during the final week of classes. The submitted report should include a list of which student was responsible for each section of the report. **PRESENTATION AND DEMONSTRATION:** There will be a formal presentation and demonstration for each project. All presentations will be made during the final week of classes. The presentation should be limited to 10 minutes.
Student Conduct	All University regulations apply to this course. In particular, the policies concerning academic dishonesty and withdrawal from a course apply. **March 10**th is the last day to withdraw. I will sign drop slips without restriction.

Contribution of Course to Meeting the Professional Component

The course contributes to building the fundamental basic concepts, applications and design of medical electronics systems in Biomedical Engineering.

Relationship to Program Outcomes (%)

1	2	3	4	5	6	7
45	40			15		

Relationship to Biomedical Engineering Program Objectives Outcomes (%)

PEO1	PEO2	PEO3	PEO4
√	√		√

Prepared by: Prof. Mashhour Bani Amer
Last Modified : January 21, 2019