King Saud University
College of Applied Medical Sciences
Biomedical Technology Department

BMT211: BIOMEDICAL ELECTRONICS I 4 (3-1-0)

Current Instructor: Dr. Mohamed Souheil Alabed
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Textbook(s) and/or Other Required Materials: Robert L. Boylestad, "Introductory Circuit Analysis", 11th edition, Prentice Hall, 2007

Extra references: Thomas Floyd, "Principles of Electric Circuits", Pearson Education

Course Description (catalog): Students completing this course will be able to analyze physical circuits through the use of Kirchhoff's laws and ideal circuit element models. An emphasis is placed on the formulation of nodal equations for linear resistive circuits as a foundation. Consequences of linearity are emphasized through superposition and Thevenin/Norton equivalents. Transient analysis of capacitive and inductive circuits is emphasized to promote understanding of time-domain linear circuit response. For linear circuits excited with sinusoidal sources, phasor and frequency domain analysis techniques for determining steady state response are emphasized. Application of complex power calculations is also highlighted. This course is aligned with the laboratory work, which is typically taken in the same semester.

Prerequisites: CHS 221-CLS 221-CHS 241-NURS 241
Co-requisite: None
Course Type: Mandatory

Course Learning Outcomes: This course is intended to provide basic knowledge and understanding of the fundamentals of electric circuits. The student should develop the ability to learn and apply several approaches used to analyze electric circuits, and develop the ability to be able to choose between various approaches. The students should extend their problem solving abilities.

Student Outcomes Covered by Course:
a. an ability to select and apply the knowledge, techniques, skills, and modern tools of biomedical technology to include the application of circuit analysis, analog and digital electronics, microcomputers, biomechanics, biomedical instrumentation systems, and safety in the building, testing, operation, and maintenance of biomedical equipment.
Students will demonstrate an understanding of basic theories of circuit analysis, including the concepts of basic element resistivity, conductivity, current, voltage, and power**.** Students will also demonstrate ability to solve problems using different methods of analysis including mesh analysis, superposition, and Norton/Thevenin theorems. Students will demonstrate an understanding of transients of the inductive and capacitive circuits, as well as an understanding of the concepts of average power, reactive power, apparent power and power factor. Students can apply electric network theory to serial and parallel resonance circuits.

b. an ability to select and apply a knowledge of mathematics, chemistry, physics, and biological sciences, engineering, and technology to building, testing, operation, and maintenance of biomedical equipment and the ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of biomedical systems.
Students will use mathematical and physical tools to understand and solve electric circuits. For example the student needs physics to be able to work with electrical (AC and DC) circuits, and trigonometry and complex number to work with AC electric circuits.

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.
In laboratory, students develop capabilities in both hand assembling basic AC and DC circuits as well as using computer to simulate and explore the behavior of electric circuits.

d. an ability to analyze, design, and implement biomedical systems, components or processes for broadly-defined engineering technology problems appropriate to program educational objectives.

e. an ability to function effectively as a member or leader on a technical team.

f. an ability to identify, analyze, and solve broadly-defined biomedical technology problems.
Students will demonstrate ability to solve problems using different methods of analysis including mesh analysis, superposition, and Norton/Thevenin theorems. Students will also demonstrate ability to use complex numbers to analyze and solve networks with different basic elements (RLC) in an AC electrical circuit

g. an ability to apply written, oral, and graphical communication in both technical and nontechnical environments; and an ability to identify and use appropriate technical literature.
h. an understanding of the need for and an ability to engage in self-directed continuing professional development.
i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.
j. a knowledge of the impact of engineering technology solutions in a societal and global context and an understanding of the clinical application of biomedical equipment.
k. a commitment to quality, timeliness, and continuous improvement.

Major Topics covered and schedule in weeks:

1. Introduction to circuit analysis Current and Voltage Resistance Ohm's Law, Power, and Energy
2. Series Circuits and Parallel Circuits
3. Series-Parallel Networks
4. Methods Of Analysis and Selected Topics (dc)
5. Network Theorem
6. Capacitors
7. Magnetic Circuits and Inductors
8. Series and Parallel AC Circuits
9. Series-Parallel ac Networks
10. Methods of Analysis and Selected Topics (ac)
11. Network Theorems (ac), power (ac)
12. Series Resonance and Parallel Resonance