



**King Saud University**  
**College of Applied Medical Sciences**  
**Department of Biomedical Technology**  
**BMT414 Biomedical Electronics VI      3 (2-1-0)**

**Current Instructor:** Eng. Mohammad Shaaban and Dr. Ali Saad.

**Course Coordinator:** Dr. Ali SAAD

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**Textbook(s) and/or Other Required Materials:** Medical instrumentation Application and design, third edition, John Webster, John Wiley & Sons, 2007.

**Course Description :** This course terminate the coverage of the electronic courses, it is an application to medical instrumentation mainly electronic instruments. It covers the main medical instruments used in hospital, like defibrillators, pacemakers, electrical surgery instruments. It describes also method for ablation and instruments used for it. MRI principles and instrument design and analysis are described. EEG, EMG and Catheterization & Cardiac Output are also taught.

<http://faculty.ksu.edu.sa/alisaad/Pages/BMT414.aspx>

**Prerequisites:** BMT 315

**Co-requisite:** None

**Course Type:** Mandatory

**Language of Teaching :** English.

**Credit Hours:** 3.

**Course Learning Outcomes:**

Upon completing BMT414, students should have the following capabilities:

- Study a large group of electronic medical instruments existing at the hospital.
- Develop an ability to design and analyze medical instruments.
- To be able to conduct standard tests and measurements; to conduct, and interpret experiments; and to apply experimental results to improve processes.
- Ability to communicate by reading, understanding and prepare a report and presentation of a published research paper.

**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 select and apply knowledge, techniques, skills of electronics and electrical engineering principle to include circuit analysis, analog and digital electronics to medical instruments such as defibrillator, Peacemaker, electro surgery unit, ablation, medical laser, ENG, EMG signal acquisition and amplification.

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 select and apply knowledge of mathematics, in defibrillator design calculus integral, log and exponential to select the exact value of the capacitor of the defibrillator circuit. Bernoulli differential equation is applied in the cardiac output measurement methods. Probability/statistics are applied to the bio-signal measurement and estimation like EEG, EMG, ENG. Fourier Transform are applied in the MRI image formation process.

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.

Covered in practical sessions

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

Students analyze the block diagram of several medical instruments (Defibrillators, Pacemakers) taught in the course. The design is applied to defibrillators and pacemakers, students design the system and calculate the values of the components.

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 identify, analyze, and solve broadly-defined problems related to medical instrumentation systems including defibrillators, pacemakers.

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.

A project was introduced to apply written, oral and graphical communication, it consist of choosing a recent journal paper (ISI published less than 5 years old), related to the content of the course and a written report and oral presentation are mandatory for the evaluation of the project.

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.

Covered through course project

### Major Topics covered and schedule in weeks:

1. Defibrillators
2. Cardioversion
3. Pacemakers
4. Electrosurgery instruments
5. Ablation methods and instruments
6. Medical L-A-S-E-R instruments
7. EEG Brain signal measurement and analysis
8. EMG muscle signal measurement methods
9. Catheterization & Cardiac Output
10. Magnetic Resonance Imaging (MRI)