King Saud University
College of Applied Medical Sciences
Department of Biomedical Technology

BMT432 Special Topics in Biomedical Instrumentation   4 (3-1-0)

Current Instructor: Eng. Emad Amin and Dr. Lahbib Abdulaziz Soualmi
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Textbook(s) and/or Other Required Materials: Handouts, Web Pages, Journal papers.

Course Description (catalog): Image Guided Surgery (**IGS**) is a highly interdisciplinary field. This course is intended to expose students to the **IGS** and its wide range of applications. It is designed to provide a comprehensive coverage of major state-of-the-art equipment and applications of **IGS** at an advanced level. The goal is to provide exposure to real applications of this technology with the underlying theoretical basis

Prerequisites: BMT 315
Co-requisite: None
Course Type: Mandatory

Course Learning Outcomes:
Upon completing **BMT432**, students should have the following capabilities:
1. Expand knowledge about **IGS** principles and methods.
2. Gain understanding of **IGS** technology and the domains of its application.
3. Understand the basics and fundaments of **IGS**.
4. Illustrative examples are used to ensure a good understanding of the **IGS**
5. The core of the course is corroborated by lab sessions and lab assignments to ensure the good understanding of the basic principles.

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.
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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.
The students are using their basic knowledge of mathematics, science, engineering, and technology to comprehend the principals of **IGS** and synthesize the special requirements about imaging data, processing and application to meet surgical needs.

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.
Students are requested to manipulate the type of data used in IGS during Lab sessions. For each Lab assignment a report is submitted with the results and the used programming code.

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.

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.
The students are requested to prepare, present and debate a course project in a subject related to IGS.
h. an understanding of the need for and an ability to engage in self-directed continuing professional development.
Throughout the session, the student is pushed to take action to collect the needed material and information for the different tasks required in the courses, labs and the project.
i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.
Through hospital visits, initiate and discuss subjects of interest with specialists from other disciplines.
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.
The students learn the current standards of interactive **IGS** and its great impact on the surgical field. The students learn how this technology is helping in improving the patient's surgical outcome.
k. a commitment to quality, timeliness, and continuous improvement.
The students learn how to achieve their work in a specified period of time without altering the quality of the work.

Major Topics covered and schedule in weeks:
1. Introduction to Matlab: Object Oriented Programming language for Image Processing.
2. The central Nervous System: Cerebrum, Cerebellum and Brain Stem.
3. The Spine and the Spinal Cord.
4. Introduction to Image Guided Surgery: Theory & Principals.
5. Visit to the Image Guided Neurosurgery Unit in King Fahad Medical City.
6. Imaging Data Acquisition and Processing.
7. Image fusion and registration techniques.
8. Image Segmentation Techniques.
9. Three-dimensional Image Based Volume Rendering.
10. Three-dimensional Stereotaxic Space and Associated Topics.
11. Attend a live Image Guided Neurosurgical Operation in King Fahad Medical City.