King Saud University
College of Applied Medical Sciences
Department of Biomedical Technology
BMT 334 Biomedical Imaging Equipment 3 (2-1-0)

Current Instructor: Mohammad Nisar
Course Coordinator: Mohammad Nisar
Coordinator's email: mnisar@ksu.edu.sa

Textbook(s) and/or Other Required Materials:
Primary: Medical imaging physics, W. Hendee, E. R. Ritenour, fourth edition Willey-Liss, 2002.

- Biomedical Imaging Edited by K. Mudry, R. Plonsey and J. Bronzino; CRC press 2003.

Course Description (catalog):

In this course basic concepts and techniques used in different medical imaging modalities like X-ray, CT, Nuclear imaging, and ultrasound, their merits and demerits and application are discussed.

Prerequisites: BMT336
Co-requisite: None

Course Type: Mandatory

Course Learning Outcomes:
Upon completing BMT-334, students should have the following capabilities:

1. Knowledge of basics of digital imaging
2. Understanding of different modalities of imaging. X-ray, CT, Nuclear imaging, and Ultrasound.
3. Understand the design, technology and procedure of different medical imaging modalities.

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.

The ability to understand the basics of recording and processing images. Gain the knowledge and skill to understand the basic principles and design of different image modalities

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 ability of understandings basics of mathematical tools and software used in image processing and analysis.

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

The ability to record the images and use the image processing tools for analysis.

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.

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. Conventional x-ray imaging:
   X-ray Tube Components, Absorption coefficient, Effective Z, X-ray spectrum, Producing an Image, X-ray interaction with matter, Common detectors, Power generator, Measuring Focal Spot Size, quality of x-ray beam, digital imaging.
2. X-ray Computed Tomography (CT):
   Introduction, CT number, CT Scanner Generations, The principles of sectional imaging, Tomographic image reconstruction, Detectors, image artefacts, Gantry ,Data Acquisition.
3. Nuclear (Radioisotope) imaging:
   Choice of radioisotope for imaging, The production of radionuclides, The gamma camera, Gamma camera imaging**,** The role of Computers in radioisotope imaging, Spatial Resolution, Emission Computed Tomography (ECT), Single-photon emission computed tomography (SPECT), image reconstruction, positron emission tomography (PET), Annihilation reaction, Coincidence counting.
4. Ultrasound Imaging:
   Introduction to ultrasound, Basic Ultrasound Physics, Doppler Ultrasound physics, Basic of Ultrasound Instrumentation, Static Image Generation Using Ultrasound, Real Time Imaging (RTI), Doppler imaging, M-Mode imaging, Artifacts in Ultrasound imaging.