Common Course Outline
RADT 242
Physical Principles of Magnetic Resonance Imaging (MRI)
4 Credits

The Community College of Baltimore County

Description

RADT 242 – 4 credits – Physical Principles of Magnetic Resonance Imaging (MRI) introduces the concepts of basic physics and instrumentation for MRI. Topics include system operation and components, image processing and display, image quality and artifacts, gradients, and imaging parameters. This course is delivered both online and in a classroom setting with lectures and discussion.

4 credits
Prerequisite: RADT 241 with a grade of C or higher

Overall Course Objectives

Upon completion of this course students will be able to:

1. describe the components of the MRI system hardware;
2. explain the mechanism by which MRI signal is produced and detected;
3. describe and apply the imaging parameters and options available to be used for optimal MRI imaging;
4. explain MRI tissue characteristics such as spin density, T1 and T2 relaxation;
5. describe and explain spatial localization and MRI image formation;
6. demonstrate high quality MRI images via routine quality control practices;
7. identify properties that affect image weighting and contrast;
8. identify spatial encoding and how it relates to MR image formation;
9. describe the physical instrumentation and equipment used in MR image formation;
10. describe common pulse sequences used in evaluation of the different areas of the body;
11. identify common artifacts that may present on the MR image;
12. describe techniques in manipulating MRI parameters to optimize image quality; and
13. explain proper selection of coils to optimize image quality.

Major Topics

I. Instrumentation
   A. Electromagnetism
   B. Radiofrequency System
   C. Gradient System
II. Fundamentals
   A. Nuclear Magnetism
   B. Tissue characteristics
   C. Spatial Localization

III. Quality Control
   A. Cause and Appearance of Artifacts
   B. Slice Thickness
   C. Spatial/Contrast Resolution
   D. Signal to Noise
   E. Center Frequency
   F. Transmit Gain
   G. Geometric Accuracy
   H. Equipment Inspection
      1. Coils
      2. Cables
      3. Door seals
IV. Pulse sequences
   A. Spin Echo
   B. Inversion Recovery
   C. Gradient Recall Echo (GRE)
   D. Calibration Scans
V. Data Manipulation
   A. K-space Mapping & Filling
   B. Fourier Transformation
VI. Post Processing
   A. Maximum Intensity Projection (MIP)
   B. Multiplanar Reconstruction (MPR)
   C. Subtraction
   D. Volume Rendering
   E. Cardiac Analysis
VII. Special Procedures
   A. Magnetic Resonance Angiography (MRA) / Magnetic Resonance Veinography (MRV)
   B. Functional Techniques
   C. Diffusion
   D. Perfusion
   E. Spectroscopy
   F. Functional MRI (fMRI)
   G. Dynamic Imaging
VIII. Sequence Imaging Parameters and Options
   A. Image Quality
   B. Contrast
      1. T1Weighted
      2. T2 Weighted

Course Requirements

Grading/exams: Grading procedures will be determined by the individual faculty member but will include:

Minimum of 2 discussion board postings
Minimum of 8 quizzes
Minimum of 3 homework assignments
A comprehensive final exam

Students are required to utilize appropriate academic resources.

Grading

A minimum score of 75% is required to pass this course. The American Registry of Radiologic Technologists (ARRT) has established a minimum scaled passing score of 75. The MRI certificate program has developed standards of grading that are consistent with grading systems of other programs. Letter grades will be distributed according to the following standards:

92 - 100 A
83 - 91 B
75 – 82 C
65 - 74 D
below 65 F

Other Course Information

This course is a blended course, which includes classroom and online instruction.

This course is a required course in the MRI certificate program within the Radiography department. It is a 10 week course and is offered only in the spring semester.