

CASPER COLLEGE COURSE SYLLABUS

RDTK 1955 H1

**MRI Principles I: Physics of Magnetic Resonance Imaging**

Semester/Year: **FA 2015**

Lecture Hours: 3

Lab Hours: 0

Credit Hours: **3**

Class Time: 9:00 am Listed  
Saturdays

Days: 9/12, 10/13, 11/21

Room: TBA

Instructor's Name: Misty Dibble

Instructor's Contact Information: Home Phone: 237-6027  
Cell Phone: 259-6245

Email: [dibble@bresnan.net](mailto:dibble@bresnan.net)

**Office Hours:** I am best reached by cell, texting, email via Moodle.

**Course Description:**

This unit provides the student with a comprehensive overview of MR imaging principles. Topics include the history of MR, nuclear MR signal production, tissue characteristics, pulse sequencing, imaging parameters/options and image formation.

This course is required to understand the basic principles of MR image acquisition. The course provides information on the fundamentals of MR image acquisition. This information is useful to enable the student to maximize MR image quality by understanding the fundamentals of MR imaging. Other areas covered include: magnetism, properties of magnetism, MR system components, MR magnets (permanent, resistive, superconducting, hybrid), radio frequency (RF) systems, gradient systems, shim systems and system shielding.

**Statement of Prerequisites:** Admission into MRI program, RDTK 1940 Introduction to MRI

**Goal:** The goal of this course is to provide the student with a general knowledge of MRI physics. Students will appreciate the many aspects of the field outlined in this course as it relates to their experience in clinical education.

**Outcomes:**

Upon completing this course, the student will be able to:

1. Know the researchers who provided the means for MR imaging.
2. Describe various nuclei in a magnetic field.
3. Explain how an image is acquired in MR (nuclei in a magnetic field, excitation, relaxation).
4. Explain how an MR signal is produced and detected.
5. Explain MR tissue characteristics, such as spin density and T1 and T2 relaxation.
6. Understand the behavior of various nuclei in the magnetic field and/or during the application of the radio frequency pulse.
7. Understand the concept of resonance and excitation in MR.
8. Understand the concept of relaxation in MR.
9. Apply the principle of pulse sequences and image formation to appropriate clinical applications.
10. Describe and apply the imaging parameters and options available to the user for optimal MR imaging.
11. Understand magnetism and magnetic properties.
12. Define gauss (G), tesla (T) and the electromagnetic spectrum.
13. Describe the three basic types of magnets and give the advantages and disadvantages of each.
14. Discuss the differences in low-, mid-, high- and ultra-high field systems.
15. Describe field strength in relation to image quality (image contrast, SNR and artifacts).
16. Explain the functionality of the radio frequency system in MR imaging.
17. Explain the functionality of the gradient system in MR imaging.
18. Explain the functionality of the shim system in MR imaging.
19. Explain the functionality of the ancillary equipment in MR imaging.
20. Compare MR instrumentation to other imaging modalities.

**Methodology:** Lecture, case study, research

Evaluation Criteria: Exams, quizzes , demonstration, research problems

**Grade Scale:** Grade percentage scale:     A = 92-100  
  B = 83- 91  
  C = 75- 82  
  F = 0- 74

\*\*\* NO LATE assignments or test without prior approval. Assignments that are late will be marked down 10 points per day.

There will be a quiz during every Saturday class. This may or may not be directly out of the material, but will cover the current and past topics. These are to prepare you for the upcoming registry.

**Total course points= 710 points This will change**

Chapter Review Questions: (160 points)

1. Ch. 9=25 points
2. Ch. 2= 50 points
3. Ch. 3= 50 points
4. Ch. 4= 35 points

Quizzes/Tests: (350)

1. Ch.1 Review: 50 Points
2. Equipment and Instrumentation: 100 points
3. Radiofrequency and Gradients: 100 points
4. Image Production: 100 points
5. Saturday Quizzes 50 points each x 3

Final Comprehensive Exam: 200 points

**Required Text, Readings, and Materials:**

1. MRI in Practice, Catherine Westbrook, Wiley-Blackwell, 4<sup>th</sup> ed. 2011
2. Handbook of MRI Technique, Catherine Westbrook, Wiley-Blackwell, 3<sup>rd</sup> ed. 2008

**Class Policies: Last Date to Change to Audit Status or to Withdraw with a W Grade: (college deadline or yours, if different) (Your attendance policy, exam, homework, assignment make-up policy, anything particular to your class)**

**Student Rights and Responsibilities:** Please refer to the Casper College Student Conduct and Judicial Code for information concerning your rights and responsibilities as a Casper College Student.

**Chain of Command:** If you have any problems with this class, you should first contact the instructor to attempt to solve the problem. If you are not satisfied with the solution offered by the instructor, you should then take the matter through the appropriate chain of command starting with the Department Head/Program Director, the Dean, and lastly the Interim Vice President for Academic Affairs.

**Academic Dishonesty - Cheating & Plagiarism:** Casper College demands intellectual honesty. Proven plagiarism or any form of dishonesty associated with the academic process can result in the offender failing the course in which the offense was committed or expulsion from school. See the **Casper College Student Code of Conduct**.

ADA Accommodations Policy: It is the policy of Casper College to provide appropriate accommodations to any student with a documented disability. If you have a need for accommodation in this course, please make an appointment to see me at your earliest convenience.

SCHEDULE: This is subject to change! Two of the main reason. Weather and student needs. I base the whole class on you (students) id we need to spend more time on a particular subject we will, if we need an additional Saturday class I will offer it. This will not be mandatory. I am here to help you.

## **Topic 1**

August 25 -September 1

Assignment One: Basic Principles of MRI: Review Chapter 1 in both books. The assignment will be a quiz in class September 12.

Required Reading:

MRI in Practice, Chapter 1

Handbook of MRI Technique Chapter 1

Review Chapter One in the text MRI in Practice and read Chapter 1 in the Handbook of MRI Technique. Be prepared to take a quiz covering material reviewed in the chapter including important terminology pertinent to MRI.

Quiz will be taken on first day of on campus class. 50 points

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## **Topic 2**

September 3-15

Due Date Sept 15

Required Class September 12 50 points In Class Quiz, Patient safety, Chapter 1, Contrast Media

In Class: Review Chapter 1, Lecture Chapter 2, Lecture Chapter 3, & In Class Quiz

## Assignment: Image Weighting and Contrast

Required Reading:

MRI in Practice, Chapter 2

Hand book of MRI Technique Chapter 3

Assignments: 50 points each

Complete the chapter review questions located in the link below and submit for grading by instructor.

Assignment Chapter Two Review Questions: Image Weighting and Contrast

Assignment: Pulse Sequences

In Class Quiz

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### **Topic 3**

September 16-29

Due Date: Sept 29th

Quiz must be taken by Sept 29th

Image Production Parameters

Module Assignment: Modules may take a minute to load

View module covering Image Production Parameters. Be sure to take notes over the module to use while taking the quiz.

Take quiz reviewing this module: 100 Points

Quiz: Image Production Parameters

Image Production Parameters Module URL

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### **Topic 4**

September 30 - October 13

Due Date October 13

Required Class October 10 50 points in Class Quiz Encoding Image formation, and Image Weighting Chapters 2 and 3

Assignment: Encoding and Image Formation

Required Reading:  
MRI in Practice, Chapter 3

Assignment: 50 Points

Complete the chapter review questions located in the link below and submit for grading by instructor.

Assignment Review Questions Chapter Three

In Class Quiz

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## **Topic 5**

October 14-27

Due Date October 27

Assignment: Parameters and Trade Offs

Required Reading:

MRI in Practice, Chapter 4

Handbook of MRI Technique, Chapter 2

Assignment: 35 Points

Complete the chapter review questions located in the link below and submit for grading by instructor.

Assignment Review Questions Chapter Four

Handbook of MRI Technique notecards Assignment

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## **Topic 6**

October 28- November 3rd

Assignment Due Date: November 3rd

Assignment Two: Equipment and Instrumentation

Required Reading:

MRI in Practice, Chapter 9

Assignment: 25 points

Complete the chapter review questions located in the link below and submit for grading by instructor.

Assignment Chapter Nine Review Questions

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## **Topic 7**

November 4-17

Due Date: Nov 17th

Quiz must be taken by Nov 17th

Equipment and Instrumentation

Module Assignment: Modules may take a minute to load

View module covering Equipment and Instrumentation. Be sure to take notes over the module to use while taking the quiz.

Take quiz reviewing this module: 100 points

Quiz: Equipment and Instrumentation

Module: MRI Equipment and Instrumentation URL

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## **Topic 8**

November 18-Dec 2

Due Date Dec 1st

Quiz must be taken by Dec 2st

Required Class November 21st 50 pts in class Quiz Chapter 4 and Chapter 9

Holiday Break November 26-27

## Radio-frequency and Gradients

Module Assignment: Modules may take a minute to load

View module covering Radio-frequency and Gradients. Be sure to take notes over the module to use while taking the quiz.

Take quiz reviewing this module: 100 points

Quiz: Radiofrequency and Gradients

Module: Radiofrequency and Gradients URL

In class Quiz

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## **Topic 9**

Dec 3-8 Review

Chapter 1-4 10 & 11

Assignment:50pts

Complete short answer, multiple choice, true/false questions

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## **Topic 10**

December 7-10

Test must be taken by December 10th

2 Hour time limit

Final Exam: 200 Points

Comprehensive final exam