

Washtenaw Community College Comprehensive Report

MRI 101 MRI Safety, Instrumentation, and Quality Assurance Effective Term: Fall 2022

Course Cover

College: Health Sciences

Division: Health Sciences

Department: Allied Health

Discipline: Magnetic Resonance Imaging

Course Number: 101

Org Number: 15600

Full Course Title: MRI Safety, Instrumentation, and Quality Assurance

Transcript Title: MRI Safety, Instrum & Qual Assu

Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission:

Change Information:

Course title

Course description

Outcomes/Assessment

Objectives/Evaluation

Rationale: Changes needed to accommodate updates to the program.

Proposed Start Semester: Fall 2022

Course Description: In this course, students are introduced to the principles of magnetic resonance imaging (MRI) safety for the patient as well as for occupational and ancillary personnel. The potential hazards and biological effects associated with the MRI environment and MRI procedures will also be discussed. Topics include magnetism, properties of magnetism, magnetic resonance (MR) system components, MR magnets, radio frequency (RF) systems, gradient systems, system shielding, patient screening, contrast agents, and safety zones. In addition, students receive a comprehensive overview of the MRI quality assurance program. Topics include personnel qualifications, the quality control program, safety policies and image quality specific to MRI. The title of this course was previously MRI Safety. This course contains material previously taught in MRI 135.

Course Credit Hours

Variable hours: No

Credits: 2

Lecture Hours: Instructor: 30 **Student:** 30

Lab: Instructor: 0 **Student:** 0

Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 30 **Student:** 30

Repeatable for Credit: NO

Grading Methods: Letter Grades

Audit

Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Requisites

Enrollment Restrictions

Admission to Magnetic Resonance Imaging (MRI) program.

Corequisite

MRI 126

General Education

Request Course Transfer

Proposed For:

Student Learning Outcomes

1. Identify the MRI safety protocols for patients, personnel, MR zones, implants and other devices used in the MRI environment.

Assessment 1

Assessment Tool: Outcome-related questions on the departmental final exam

Assessment Date: Fall 2023

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of the students will score 70% or higher on the outcome-related questions.

Who will score and analyze the data: Departmental faculty

2. Identify the potential hazards and biological effects associated with the Magnetic Resonance Imaging (MRI) environment and MRI procedures.

Assessment 1

Assessment Tool: Outcome-related questions on the departmental final exam

Assessment Date: Fall 2023

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of the students will score 70% or higher on the outcome-related questions.

Who will score and analyze the data: Departmental faculty

3. Define the roles of the medical director, medical physicist, and technologist in the MRI quality assurance program.

Assessment 1

Assessment Tool: Outcome-related questions on the departmental final exam

Assessment Date: Fall 2023

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of the students will score 70% or higher on the outcome-related questions.

Who will score and analyze the data: Departmental faculty

4. Identify the concepts of quality control testing and the annual system performance evaluation of MRI equipment.

Assessment 1

Assessment Tool: Outcome-related questions on the departmental final exam

Assessment Date: Fall 2023

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of the students will score 70% or higher on the outcome-related questions.

Who will score and analyze the data: Departmental faculty

Course Objectives

1. Identify the basic properties of magnetism.
2. Define gauss (g), tesla (T) and the electromagnetic spectrum.
3. Describe the three basic types of magnets and give the advantages and disadvantages of each.
4. Discuss the differences in low-, mid-, high- and ultra-high field systems.
5. Explain the functionality of the radio frequency system in MRI.
6. Explain the functionality of the gradient system in MRI.
7. Explain the functionality of the shim system in MRI.
8. Explain the functionality of the ancillary equipment in MRI.
9. Discuss the elements of safety management that ensure an MR facility operates safely.
10. Describe the purpose and the general elements that make up a Magnetic Field Safety Program.
11. Explain the protocols for proper screening and preparation of patients for MRI procedures.
12. List the screening questions asked of patients before they can enter the MRI scan room.
13. Identify the type of radiation used in MRI.
14. List the effects of RF exposure on the human body.
15. Discuss the effects of static and transverse magnetic fields on the human body.
16. Identify potential hazards in the MR environment.
17. Describe when and how to quench the magnet and handle other emergencies in the MR environment.
18. Describe and compare the safety concerns associated with both the external and internal (to the magnet) areas of the magnetic field.
19. Explain why ferromagnetic objects that might be in a patient's body are potential sources of injury.
20. List and briefly describe the types of medically implanted metal objects that might be found in a patient's body and can be a potential hazard when the patient is placed in a magnetic field.
21. List and briefly describe the types of accidentally embedded metal objects that might be found in a patient's body, which can be a potential hazard when the patient is placed in a magnetic field.
22. Describe the procedure for determining if a specific medical device, such as a surgical clip, is a potential hazard when the patient is placed in a magnetic field.
23. Describe completely the procedures to be followed to prevent hazardous metal objects from being brought into the magnetic field area.
24. Identify the conditions that can produce skin burns during an MRI acquisition and describe the steps needed to prevent them.
25. Discuss the purpose and benefits of MRI accreditation.
26. Describe the process leading to the American College of Radiology (ACR) MRI accreditation.
27. Discuss what it means for an MRI facility to be accredited by the ACR.
28. Identify the time limit for the ACR MRI accreditation.
29. Identify the key elements of an effective MRI quality assurance (QA) program.
30. Outline the MRI quality assurance program recommended by the ACR.
31. List the credentials necessary for physicists, physicians and technologist for the ACR MRI accreditation.
32. Discuss the responsibilities of technologists regarding the ACR MRI accreditation process.

33. Review the required quality control tests that are to be performed by the MRI technologists in accordance with the ACR MRI accreditation process.
34. Identify the clinical images that must be submitted to the ACR for the MRI accreditation process.
35. List the normal range of values expected from the MR phantom quality assurance test.
36. List the steps required to prepare the MR phantom for scanning and completing the weekly quality assurance scan.
37. Determine high and low contrast values based on the quality assurance scan.
38. Measure the geometry of the phantom from the quality assurance scan.
39. Discuss the most common artifacts found on magnetic resonance images.
40. Evaluate the quality assurance MR scan for image artifacts.
41. Determine table positioning accuracy using the phantom scan.
42. Describe the MRI annual systems performance evaluation process.
43. Discuss why quality control matters in the MRI environment.
44. Discuss the requirements for maintaining the ACR MRI accreditation.
45. Discuss the ramifications of failing to meet the MRI accreditation standards.

New Resources for Course

MagResource- MRI Safety Worldwide subscription website provided to students by the college.

Course Textbooks/Resources

Textbooks

McRobbie, Donald W. . *Essentials of MRI safety*, 1 ed. Hoboken: Wiley-Blackwell, 2020, ISBN: 9781119557173.

Westbrook, C., Talbot, J. . *MRI In Practice* , 5 ed. Hoboken, N.J. : Wiley, 2018, ISBN: 9781119391968.

Manuals

Periodicals

Software

Equipment/Facilities

Off-Campus Sites

<u>Reviewer</u>	<u>Action</u>	<u>Date</u>
Faculty Preparer: <i>Catherine Blaesing</i>	<i>Faculty Preparer</i>	<i>Jan 02, 2022</i>
Department Chair/Area Director: <i>Kristina Sprague</i>	<i>Recommend Approval</i>	<i>Jan 10, 2022</i>
Dean: <i>Shari Lambert</i>	<i>Recommend Approval</i>	<i>Jan 10, 2022</i>
Curriculum Committee Chair: <i>Randy Van Wagnen</i>	<i>Recommend Approval</i>	<i>Feb 16, 2022</i>
Assessment Committee Chair: <i>Shawn Deron</i>	<i>Recommend Approval</i>	<i>Feb 23, 2022</i>
Vice President for Instruction: <i>Kimberly Hurns</i>	<i>Approve</i>	<i>Feb 23, 2022</i>

Washtenaw Community College Comprehensive Report

MRI 101 MRI Safety Effective Term: Fall 2015

Course Cover

Division: Math, Science and Health

Department: Allied Health

Discipline: Magnetic Resonance Imaging

Course Number: 101

Org Number: 15600

Full Course Title: MRI Safety

Transcript Title: MRI Safety

Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission: New Course

Change Information:

Rationale: This is a required course for the Magnetic Resonance Imaging (MRI) curriculum.

Proposed Start Semester: Fall 2015

Course Description: In this course, students are introduced to the principles of Magnetic Resonance Imaging (MRI) safety for the patient as well as occupational and ancillary personnel. The potential hazards and biological effects associated with the MRI environment and MRI procedures will also be discussed. Topics include magnetism, properties of magnetism, MR system components, MR magnets, radio frequency (RF) systems, gradient systems, system shielding, patient screening, contrast agents, and safety zones.

Course Credit Hours

Variable hours: No

Credits: 2

Lecture Hours: Instructor: 30 **Student:** 30

Lab: Instructor: 0 **Student:** 0

Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 30 **Student:** 30

Repeatable for Credit: NO

Grading Methods: Letter Grades

Audit

Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Requisites

Enrollment Restrictions

Admission to Magnetic Resonance Imaging (MRI) program.

Corequisite

MRI 125

General Education

Request Course Transfer

Proposed For:

Student Learning Outcomes

1. Identify the MRI safety protocols for patients, personnel, Magnetic Resonance (MR) zones, implants and other devices used in the Magnetic Resonance Imaging (MRI) environment.

Assessment 1

Assessment Tool: Departmental final exam

Assessment Date: Fall 2018

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: answer key

Standard of success to be used for this assessment: 80% of the students will score 70% or higher on each related outcome question.

Who will score and analyze the data: Departmental Faculty

2. Identify the potential hazards and biological effects associated with the Magnetic Resonance Imaging (MRI) environment and MRI procedures.

Assessment 1

Assessment Tool: Departmental final exam

Assessment Date: Fall 2018

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: answer key

Standard of success to be used for this assessment: 80% of the students will score 70% or higher on each related outcome question.

Who will score and analyze the data: Departmental Faculty

Course Objectives

1. Identify the basic properties of magnetism.
Matched Outcomes
2. Define gauss (g), tesla (T) and the electromagnetic spectrum.
Matched Outcomes
3. Describe the three basic types of magnets and give the advantages and disadvantages of each.
Matched Outcomes
4. Discuss the differences in low-, mid-, high- and ultra-high field systems.
Matched Outcomes
5. Explain the functionality of the radio frequency system in Magnetic Resonance (MR) imaging.
Matched Outcomes
6. Explain the functionality of the gradient system in Magnetic Resonance (MR) imaging.
Matched Outcomes
7. Explain the functionality of the shim system in Magnetic Resonance (MR) imaging.
Matched Outcomes
8. Explain the functionality of the ancillary equipment in Magnetic Resonance (MR) imaging.
Matched Outcomes
9. Discuss the elements of safety management that ensure a Magnetic Resonance (MR) facility operates safely.
Matched Outcomes
10. Describe the purpose and the general elements that make up a Magnetic Field Safety Program.
Matched Outcomes
11. Explain the protocols for proper screening and preparation of patients for Magnetic Resonance Imaging (MRI) procedures.
Matched Outcomes

12. List screening questions asked of patients before they can enter the Magnetic Resonance Imaging (MRI) scan room.
Matched Outcomes
13. Identify the type of radiation used in Magnetic Resonance (MR) imaging.
Matched Outcomes
14. Explain what happens when RF (radio frequency) is pulsed into the body.
Matched Outcomes
15. List the effects of RF (radio frequency) exposure in terms of human responses.
Matched Outcomes
16. Discuss the investigations and findings on the effects of static and transient magnetic fields on the human body.
Matched Outcomes
17. Identify potential hazards in the Magnetic Resonance (MR) environment.
Matched Outcomes
18. Describe when and how to quench the magnet and handle other emergencies in the MR environment.
Matched Outcomes
19. Describe and compare the safety concerns associated with both the external and internal (to the magnet) areas of the magnetic field.
Matched Outcomes
20. Explain why ferromagnetic objects that might be in a patient's body are potential sources of injury.
Matched Outcomes
21. List and briefly describe the types of medically implanted metal objects that might be found in a patient's body and can be a potential hazard when the patient is placed in a magnetic field.
Matched Outcomes
22. List and briefly describe the types of accidentally imbedded metal objects that might be found in a patient's body and can be a potential hazard when the patient is placed in a magnetic field.
Matched Outcomes
23. Describe the procedure for determining if a specific medical device, such as a surgical clip, is a potential hazard when the patient is placed in a magnetic field.
Matched Outcomes
24. Describe completely the procedures to be followed to prevent hazardous metal objects to be brought into the magnetic field area.
Matched Outcomes
25. Identify the conditions that can produce skin burns during an MRI acquisition and describe the steps to take to prevent them.
Matched Outcomes

New Resources for Course

Course Textbooks/Resources

Textbooks

Shellock, F. *Reference Manual for Magnetic Resonance, Safety, Implants, and Devices.*, ed. Los Angeles:Biomedical Research Publishing Group, 2014

Bushong, Stewart. *Magnetic Resonance Imaging Physical and Biological Principles*, 3 ed. Elsevier Health Sciences, 2003, ISBN: 9780323014854.

Westbrook, C. & Roth, C. & Talbot, J. . *MRI In Practice* , 4 ed. Wiley, 2011, ISBN: 9781444337433.

Manuals

Periodicals

Software

Equipment/Facilities

Level III classroom

Testing Center

<u>Reviewer</u>	<u>Action</u>	<u>Date</u>
Faculty Preparer: <i>Connie Foster</i>	<i>Faculty Preparer</i>	<i>Nov 18, 2014</i>
Department Chair/Area Director: <i>Connie Foster</i>	<i>Recommend Approval</i>	<i>Nov 18, 2014</i>
Dean: <i>Kristin Brandemuehl</i>	<i>Recommend Approval</i>	<i>Nov 19, 2014</i>
Vice President for Instruction: <i>Bill Abernethy</i>	<i>Approve</i>	<i>Jan 05, 2015</i>