

Updated 08/03/2023



WACO, TEXAS

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**COURSE SYLLABUS**

**AND**

**INSTRUCTOR PLAN**

**RADIOGRAPHIC IMAGING EQUIPMENT**

**RADR 2309\_201**

**MICHELLE MORPHIS**

**NOTE: This is an 8-week course.**

# RADIOGRAPHIC IMAGING EQUIPMENT

RADR 2309\_201

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## **Course Description:**

Studies the equipment and physics of x-ray production, basic x-ray circuits, and the relationship of conventional and digital equipment components to the imaging process.

Semester Hours 3 (3 lec/1 lab)

## **Prerequisites and/or Corequisites:**

Successful completion of RADR courses in Semester 1, with a grade of a “C” or better.

## **Course Notes and Instructor Recommendations:**

Students should commit to reading the assigned chapters of each unit before lecture. The 8-week course will encompass group activities, lectures, videos, and lab activities to ensure a diverse learning experience. A variety of assessments will be given to prepare the student for unit exams. If Brightspace is down, please email the instructor to bring awareness to the problem. If Brightspace is down for more than 24 hours, the instructor will notify students via email with further instructions.

## **Instructor Information:**

Instructor Name: Michelle Morphis

MCC E-mail: mmorphis@mclennan.edu

Office Phone Number: (254) 299-8584

Office Location: CSC, C-117

Office/Teacher Conference Hours: Regular office hours are as posted on office door.

Please schedule appointments by phone or email.

## **Required Text & Materials:**

Title: Radiologic Science for Technologists

Author: Stewart Carlyle Bushong

Edition: 12th

Publisher: Moby Elsevier

ISBN: 978-0-323-66134-8

**MCC Bookstore Website:** <http://www.mclennan.edu/bookstore/>

## **Methods of Teaching and Learning:**

Title: Radiologic Science for Technologists

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## **Course Objectives and/or Competencies:**

### I. Essential Concepts of Radiologic Science:

1. Identify the difference between matter and energy.
2. Define electromagnetic radiation and ionizing radiation.
3. Explain how x-rays were discovered.
4. Discuss human injury caused by radiation.
5. Discuss the derivation of scientific systems of measurement
6. List basic radiation protection equipment.

### II. Basic Physics Primer

1. Define quantities, derived quantities, and special quantities in radiologic science.
2. State Newton's three fundamental laws of motion
3. Define properties of mechanics
4. Recognize and calculate formulas associated with mechanics

### III. Structure of Matter

1. Relate the history of the atom.
2. Identify the structures of the atom. (F02)
3. Describe electron shells and instability within atomic structure.
4. Define radioactivity and recognize characteristics of alpha and beta particles.
5. Explain the difference between the two forms of ionizing radiation – particulate and electromagnetic.

### IV. Electromagnetic Energy (Radiation)

1. Identify the properties of photons.
2. Explain and solve the inverse square law.
3. Define wave theory and quantum theory.
4. Discuss the electromagnetic spectrum.

### V. Electromagnetism

#### *Electricity*

1. Identify the electric charges of protons and electrons.
2. Define electrification and state examples.
3. List the laws of electrostatics.
4. Name examples of conductors, insulators and superconductors.
5. Describe electric circuits and recognize circuit element symbols.
6. Define direct and alternating current.
7. Identify units of electric potential and electric power.

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8. Explain and solve Ohm's Law.

## *Magnetism*

1. Discuss the history and discovery of naturally occurring magnetic materials.
2. Define magnetic dipole.
3. List the three classifications of magnets.
4. Identify the interactions between matter and magnetic fields.
5. List and discuss the four laws of magnetism.

## *Electromagnetism*

1. Discuss the development of the battery.
2. Relate the experiments of Oersted in defining the relationship between magnetism and electric current.
3. Describe the helix, solenoid and electromagnetic induction.
4. Identify the laws of electromagnetic induction.
5. Describe electromechanical devices.
6. Describe the different types of transformers.
7. Explain and solve the Transformer Law.

## VI. The X-ray Imaging System

1. Identify the components of the operator's console.
2. Explain the operation of the high voltage generator, including the autotransformer, filament transformer and the rectification system.
3. Relate the important differences between single-phase and three-phase power, including voltage ripple and patient exposure dose.
4. Define the power rating in watts.

## VII. The X-ray Tube

1. Describe the different support designs for the x-ray tube.
2. List the parts of the housing that protect the x-ray tube.
3. Identify the components of the X-ray tube.
4. Describe the cathode and the filament current.
5. Describe the parts of the anode and the induction motor.
6. Define the line focus principle and the heel effect.
7. Identify why tungsten is used for the target.
8. Identify the three main causes of tube failure.
9. Explain and use the tube rating charts.

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## VIII. X-ray Production

1. Discuss the interactions between electrons and the x-ray target.
2. Explain how mAs, kVp, added filtration, target material and voltage ripple affect x-ray emission spectra.

## IX. X-ray Emission

1. Define radiation quantity in relation to intensity in roentgens.
2. Define radiation quantity in relation to mAs.
3. List and define the factors affecting the quantity of x-rays in the beam.
4. Explain x-ray quality or penetrability.
5. List and discuss the factors affecting the quality of the x-ray beam.

## X. X-ray Interaction with Matter

1. List and describe the five interactions that occur between x-ray and matter.
2. Compare and contrast the features of Compton's Scattering with the Photoelectric Effect.
3. Explain the relationship between atomic number and K-shell binding energy.
4. Describe differential absorption.
5. Define attenuation.

## XXV. Fluoroscopy

1. Discuss the development of fluoroscopy.
2. Explain visual physiology and its relationship to fluoroscopy.
3. Describe the components of an image intensifier.
4. List the approximate kilovolt peak levels for common fluoroscopic examinations.
5. Discuss the role of the television monitor and the television image in forming fluoroscopic images.

## XX. Digital Display Device

1. Recognize an AAPM TG 18 and importance to the radiologic technologist
2. Recognize various test patterns on digital display device performance assessment
3. Recall quality control tests and schedule

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### **Course Attendance/Participation Guidelines:**

As outlined by both the MCC and Health Profession Division policies, regular and punctual attendance is expected of all students, and a complete record of attendance will be kept by each instructor for the entire length of each course. Students will be counted absent from class meetings missed, beginning with the first official day of classes. Students, whether present or absent, are responsible for all material presented or assigned for a course and will be held accountable for such materials in the determination of course grades.

In addition, as specifically stated in the MCC Health Professions policy on attendance in didactic courses, a student will be dropped if a cumulative of 15% of class meetings are missed due to unexcused reasons. Please refer to the full MCC Attendance policy and the MCC Health Professions Division policy for full details.

If a student is not in attendance in accordance with the policies/guidelines of the class as outlined in the course syllabus as of the course census date, faculty are required to drop students from their class roster prior to certifying the respective class roster. A student's financial aid will be re-evaluated accordingly and the student will only receive funding for those courses attended as of the course census date.

**A student who accumulates 3 unexcused absences will be withdrawn from the course.**

### **Partial Attendance**

A student will be counted as tardy when arriving after the start of posted class time. The student may wait outside the door and come inside at break, typically 45-50 minutes after class begins.

A tardy will be given if a student is present for at least 2 hours of class. Otherwise, an absence will be assigned, even if the student was present for a period of time. If a student should leave early, the same rule applies as a tardy.

An absence will be applied when a student has reached two tardies or two times leaving early.

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## Course Outline or Schedule:

*This is a guide for the semester. If due dates change, the professor will inform the student in class and/or on Brightspace.*

## Course Grading Information:

RADR 2309 Spring 2024	Content	Assigned Reading	Exam
1	Module 1: Chapters 1,2 & 3	CH 1, 2, & 3	Module 1 CH ,1,2 & 3 Sun - 3/17
2	Module 2: Chapters 4 & 5	CH 4 & 5	Module 2 CH 4 & 5 Sun-3/24
3	Module 3 : Chapters 6 & 7	CH 6 & 7	
4	Continue Module 3: Chapter 7 Module 4: Chapter 8	CH 8	Module 3 CH 6 & 7 Wed- 4/3
5	Module 4: Chapters 9 & 10	9 & 10	
6	Module 5: Chapter 25	CH 25	Module 4 CH 8,9, & 10 Mon- 4/15
7	Module 5: Chapter 26	CH 26	Module 5 CH 25 Wed- 4/24
8	FINALS WEEK		May 1 FINAL EXAM

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Grading Area	Percentage of Course Grade
Assignments	10%
Quizzes	30%
Module Exams	35%
Comprehensive final exam	25%
Total Course Grade	100%

### Course Grading Information:

Throughout the course, grades in Brightspace will indicate grades with a decimal following such as, 85.3, 89.5 etc. These grades will remain as posted in the grade book but the final course grade will be rounded up or down to the nearest score depending on the number in the tenth place only. If a score is .5 to .9 the grade will be rounded up to the next number. If a score is .4 or below to .1, it will remain that number. (Example: 89.5 will be posted as a 90, where 89.4 will remain an 89)

The course grade will be applied to the following scale:

90% -	100%	A
80% -	89%	B
75% -	79%	C
60% -	74%	D
59%	or less	F

**\*This is an RT course—C is the minimum acceptable grade. Any grade below 75 is considered a failing grade for this program. In order to progress through the program, you must meet the minimum acceptable grade requirement.**

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These grades will remain as posted in the grade book but the final course grade will be rounded up or down to the nearest score depending on the number in the tenth place after the decimal. If a score is .5 to .9 the grade will be rounded up to the next number. If a score is .4 or below to .1, it will remain that number. (Example: 89.5 will be posted as a 90, where 89.4 will remain an 89)

**Exams:** Some exams will be given online via Brightspace. It is necessary that you have a stable internet connection and working technology. The exams are timed according to the number and content of the questions. If an exam is not started and finished on time, it may result in a zero. It is the responsibility of the student to maintain updates on their personal computers.



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### **Respondus Lockdown Browser:**

The browser must be downloaded prior to taking an exam

[Download Respondus Browser \(Click Here\)](#)

When using Respondus Lockdown Browser to complete exams, the student must follow these rules:

- Student will read and follow all instructions of Respondus prior to beginning the exam.
- The student will use a flat surface such as a desk or table and a chair. The student must remain seated throughout the length of the exam.
- When performing the environment scan, it must be done slowly to include a 360-degree view of the room and the entire surface where the computer is located.
- The student will be in view of the camera throughout the exam and allow recording of sound throughout the exam.
- All problems will be communicated to the instructor during the exam and an email with explanation should follow after the completion of the exam.
- Students should always strive to look at the monitor. Any eye movement that indicates cheating may result in the student retaking the exam in person. Should cheating be found, the student will receive a zero and risk being removed from the program.
- Do not wear caps, hats or other head coverings that will cast a shadow onto your face
- Do not take exam in a dark room. Avoid backlighting situations, such as sitting with your back to a window. Always have light in front of your face, not behind your head.
- Choose an environment that is distraction-free. This includes people, television, animals, or any other item that will draw your eyes away from the monitor.
- Do not take exam with laptop computer in your lap. Instead, place it on a flat surface. Be careful not to move the laptop during the exam. This may result in lack of face detection.

The instructor may remove Respondus testing privileges if the student does not comply with the rules or experiences more than one problem with testing away from campus.

If a student fails to take the exam during the allotted time frame, a zero will be given with no opportunity to re-take the test. This only applies to tests that are not begun and completed during the time frame. If a technology glitch occurs when taking the exam at the Testing Center, the student must report the issue to a designated staff member. If the Testing Center is not used and the student is taking an exam via Brightspace, a technology glitch must be reported to the instructor immediately through email or phone. The instructor may test you over any material covered in lecture, power point presentations, assigned reading, or class discussions. Attendance is very important to assure that you are well prepared for testing.

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A comprehensive final will be given at the end of the semester. It is important to start the exam as instructed by the instructor. If a student experiences a delay in starting the exam and fails to notify the instructor, a zero will be given. If the comprehensive exam is given in the classroom and the student is late and does not notify the instructor prior the start time of the exam, a zero will be given. Unless the instructor approves reason for delay, all comprehensive final exams will include a 10-point deduction if exam is not started on time. All final exams must be completed by the deadline. Otherwise, the student will submit the exam without the opportunity to complete the remainder of the exam. Medical emergencies are situations in which the instructor will work with the student to make up the exam without any penalty.

### **Brightspace Use and Activity**

The instructor of this course intends to utilize Brightspace as a communication tool and for course features such as announcements, resources, grades, and assessments. It is the student's responsibility to check Brightspace daily to ensure successful completion of each assignment and to receive important announcements about the course.

### **Late Work and Make Up Work Policies:**

Late assignments will be given a **10 point deduction on the first day missed and five points on the 2<sup>nd</sup> day missed**. On the **3<sup>rd</sup> day**, the student will not be allowed to submit assignments and **will be given zero (0) points** for the missed assignment.

**All in-class quizzes** are expected to be completed in the time slot given in class. **In-class quizzes are not allowed to be made up. All other quizzes may be taken 1 day late with a 10 point penalty.**

**Make-up exams will only be allowed under certain circumstances and is up to the discretion of the instructor. If a missed exam occurs due to illness, military, or funeral reasons, documentation may be necessary for consideration to take the exam. Considering the nature of a missed exam, the instructor may decide to replace the missed unit exam with the grade of the final exam instead of offering a make-up exam. Only one unit exam can be swapped with the final exam and must be approved by the course instructor.**

### **Performance Goal, Expectation, and Requirements**

The Radiologic Technology program coursework is designed to provide students with a structured comprehensive curriculum that prepares them for a career as a professional health care provider. It is imperative that students develop and maintain a strong knowledge base of course material and competencies to be successful.

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Therefore, the minimum grade expectation of all coursework and assessments in this course is to achieve an 80% or higher. Students that do not achieve the minimum grade of 80% will be required to complete an activity of remediation assigned by the instructor immediately following. The activity requirements will vary as they will be customized according to factors such as the students' needs, the purpose of the assignment, its content, etc., and the instructor will maintain all records of completion. Students that fail to complete the required remediation activities will receive an "Incomplete" ("I") grade for the course, regardless of overall passing grade point average, until all work is submitted. An "Incomplete" ("I") in any course must be resolved prior to the start of the following semester or the resulting grade will convert to an "F" and the student will not pass the course.

**All remediation for exams must be submitted through Brightspace 1 week from the due date of the exam. Any late remediation will result in a 5-point deduction of the respective exam.**

### **Student Behavioral Expectations or Conduct Policy:**

#### **Performance Goal, Expectation, and Requirements**

The Radiologic Technology program coursework is designed to provide students with a structured comprehensive curriculum that prepares them for a career as a professional health care provider. It is imperative that students develop and maintain a strong knowledge base of course material and competencies to be successful.

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**All remediation for exams must be submitted through Brightspace 1 week from the due date of the exam. Any late remediation will result in a 5-point deduction of the respective exam.**

### **[Click Here for the MCC Attendance/Absences Policy](https://www.mclennan.edu/highlander-guide/policies.html)**

**(<https://www.mclennan.edu/highlander-guide/policies.html>)**

Click on the link above for the college policies on attendance and absences. Your instructor may have additional guidelines specific to this course.

10/09/2023



## **ACADEMIC RESOURCES/POLICIES**

### **Accommodations/ADA Statement:**

Any student who is a qualified individual with a disability may request reasonable accommodations to assist with providing equal access to educational opportunities. Students should contact the Accommodations Coordinator as soon as possible to provide documentation and make necessary arrangements. Once that process is completed, appropriate verification will be provided to the student and instructor. Please note that instructors are not required to provide classroom accommodations to students until appropriate verification has been provided by the Accommodations Coordinator. For additional information, please visit [www.mclennan.edu/disability](http://www.mclennan.edu/disability)

Students with questions or who require assistance with disabilities involving physical, classroom, or testing accommodations should contact:

[disabilities@mclennan.edu](mailto:disabilities@mclennan.edu) (254)299-8122  
Room 319, Student Services Center

### **Title IX:**

We care about your safety, and value an environment where students and instructors can successfully teach and learn together. If you or someone you know experiences unwelcomed behavior, we are here to help. Individuals who would like to report an incident of sexual misconduct are encouraged to immediately contact the Title IX Coordinator at [titleix@mclennan.edu](mailto:titleix@mclennan.edu) or by calling, Dr. Claudette Jackson, (Accommodations/Title IX) at (254) 299-8465. MCC employees are mandatory reporters and must report incidents immediately to the Title IX Coordinator. Individuals may also contact the MCC Police Department at (254) 299-8911 or the MCC Student Counseling Center at (254) 299-8210. The MCC Student Counseling Center is a confidential resource for students. Any student may report sexual harassment anonymously by visiting <http://www.lighthouse-services.com/mclennan/>

Additionally, Title IX provides rights and protections for pregnant and newly parenting students. Go to McLennan's Title IX webpage at [www.mclennan.edu/titleix/](http://www.mclennan.edu/titleix/). It contains more information about definitions, reporting, confidentiality, resources, and what to do if you or someone you know is a victim of sexual misconduct, gender-based violence or the crimes of rape, acquaintance rape, sexual assault, sexual harassment, stalking, dating violence, or domestic violence.

**Student Support/Resources:**

MCC provides a variety of services to support student success in the classroom and in your academic pursuits to include counseling, tutors, technology help desk, advising, financial aid, etc. A listing of these and the many other services available to our students is available at <http://www.mclennan.edu/campus-resource-guide/>

Academic Support and Tutoring is here to help students with all their course-related needs. Specializing in one-on-one tutoring, developing study skills, and effectively writing essays. Academic Support and Tutoring can be found in the Library and main floor of the Learning Commons. This service is available to students in person or through Zoom. You can contact the Academic Support and Tutoring team via Zoom or email ([ast@mclennan.edu](mailto:ast@mclennan.edu)) by going to our website (<https://www.mclennan.edu/academic-support-and-tutoring/>)

College personnel recognize that food, housing, and transportation are essential for student success. If you are having trouble securing these resources or want to explore strategies for balancing life and school, we encourage you to contact either MCC CREW – Campus Resources Education Web by calling (254) 299-8561 or by emailing [crew@mclennan.edu](mailto:crew@mclennan.edu) or a Success Coach by calling (254) 299-8226 or emailing [success@mclennan.edu](mailto:success@mclennan.edu).

Paulanne's Pantry (MCC's food pantry) provides free food by appointment to students, faculty and staff. To schedule an appointment, go to <https://calendly.com/paulannespantry-mcc/15min>.

The CREW, Success Coaches, and Paulanne's Pantry are all located on the second floor of the Student Services building in Success Coaching Services.

**MCC Foundation Emergency Grant Fund:**

Unanticipated expenses, such as car repairs, medical bills, housing, or job loss can affect us all. Should an unexpected expense arise, the MCC Foundation has an

emergency grant fund that may be able to assist you. Please go to <https://www.mclennan.edu/foundation/scholarships-and-resources/emergencygrant.html> to find out more about the emergency grant. The application can be found at [https://www.mclennan.edu/foundation/docs/Emergency\\_Grant\\_Application.pdf](https://www.mclennan.edu/foundation/docs/Emergency_Grant_Application.pdf)

**MCC Academic Integrity Statement:**

Please view our [Academic integrity statement](#) for more information about academic integrity, dishonesty, and cheating. The unauthorized use of artificial intelligence (AI) for classwork can be a violation of the College's General Conduct Policy. Whether AI is authorized in a course and the parameters in which AI can be used in a course will be outlined by each instructor.

**Minimum System Requirements to Utilize MCC's D2L|Brightspace:**

Go to <https://www.mclennan.edu/center-for-teaching-and-learning/Faculty-and-Staff-Commons/requirements.html> for information on the minimum system requirements needed to reliably access your courses in MCC's D2L|Brightspace learning management system.

**Minimum Technical Skills:**

Students should have basic computer skills, knowledge of word processing software, and a basic understanding of how to use search engines and common web browsers.

**Backup Plan for Technology:**

In the event MCC's technology systems are down, you will be notified via your MCC student email address. Please note that all assignments and activities will be due on the date specified in the Instructor Plan, unless otherwise noted by the instructor.

**Email Policy:**

McLennan Community College would like to remind you of the policy (<http://www.mclennan.edu/employees/policy-manual/docs/E-XXXI-B.pdf>) regarding college email. All students, faculty, and staff are encouraged to use their McLennan email addresses when conducting college business.

A student's McLennan email address is the preferred email address that college employees should use for official college information or business. Students are expected to read and, if needed, respond in a timely manner to college emails. For more information about your student email account, go to [www.mclennan.edu/studentemail](http://www.mclennan.edu/studentemail).

**Instructional Uses of Email:**

Faculty members can determine classroom use of email or electronic communications. Faculty should expect and encourage students to check the college email on a regular basis. Faculty should inform students in the course syllabus if another communication method is to be used and of any special or unusual expectations for electronic communications.

If a faculty member prefers not to communicate by email with their students, it should be reflected in the course syllabus and information should be provided for the preferred form of communication.

**Email on Mobile Devices:**

The College recommends that you set up your mobile device to receive McLennan emails. If you need assistance with set-up, you may email [Helpdesk@mclennan.edu](mailto:Helpdesk@mclennan.edu) for help.

You can find help on the McLennan website about connecting your McLennan email account to your mobile device:

- [Email Setup for iPhones and iPads](#)
- [Email Setup for Androids](#)

**Forwarding Emails:**

You may forward emails that come to your McLennan address to alternate email addresses; however, the College will not be held responsible for emails forwarded to an alternate address that may be lost or placed in junk or spam filters.

For more helpful information about technology at MCC, go to [MCC's Tech Support](#) or email [helpdesk@mclennan.edu](mailto:helpdesk@mclennan.edu).

**Disclaimer:**

The resources and policies listed above are merely for informational purposes and are subject to change without notice or obligation. The College reserves the right to change policies and other requirements in compliance with State and Federal laws. The provisions of this document do not constitute a contract.