

Montgomery College
Takoma Park Campus
Radiology Technology Program
Syllabus RADT 101
Fall 2018

Course Title: Radiologic Technology I

Credit Hours: 4

Pre/co-requisite: Mathematics foundation
RADT 111.120

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Program Web page: www.montgomerycollege.edu/rt

Course information: Power points/other documents located on Blackboard . Collaborate links will be placed on Blackboard

<u>Class Hours:</u>	Lecture	CRN 21322 M,W	1:00 pm to 2:15 pm
	Lab-	CRN 21323 M	2:16 pm to 3:55 pm
	Lab	CRN 21701 W	2:16 pm to 3:55 pm

Texts: Radiologic Science for Technologists, Physics, Biology and Protection 11th Edition, Bushong, Elsevier

Digital Radiography and PACS Revised 2nd edition

Christi Carter

Blackboard quizzes as indicated in BB and in course outline

Course Description: An introductory course to the science of medical radiographic exposure techniques. Topics such as X-ray formation, X-ray interaction with matter, components necessary for image formation, automatic processing, densitometry, radiation protection, scatter radiation, factors controlling scatter radiation, digital/computed radiology, and mobile radiography will be covered. In addition, basic atomic structure and fundamental physics will be covered at the start of the course to ensure the student has a basic foundation upon which to build. **PREREQUISITE(S):** Admission to the radiologic (x-ray) technology program or consent of program coordinator. **PRE- or COREQUISITE(S):** **RADT 111, and RADT 120. Mathematics foundation. Assessment Level(s): ENGL 101/ENGL 101A, READ 120. Three hours lecture, two hours laboratory each week. Formerly RT 101. 4 semester hours**

Course Outcomes:

Upon course completion, a student will be able to:

1. Define and comprehend the fundamental properties of physics.
2. Identify key historical facts in the discovery of ionizing radiation.
3. List basic radiation protection equipment.
4. Compare and contrast image production methods (conventional vs DR and/or CR).
5. Evaluate the need for ALARA and the principle factors of occupational and patient protection.
6. Apply the application of electromagnetic radiation in diagnostic imaging.
7. Apply in simulated setting the function of x-ray room components.
8. Discuss the differences in the high voltage generator design.
9. Compare and contrast the different electron interactions that occur in the production of ionizing radiation.
10. Evaluate the five different interactions between x-ray and matter.
11. Break down the sequence as radiation exits the patient and produces an image on conventional film (historically), computed radiology system and a digital radiology system.
12. Discuss the effects the technical factors have on the production of a diagnostic image.
13. Apply the technical factors to produce a diagnostic image in a simulated environment.

Based on outcomes noted above the student will be able to:

(History)

1. Identify the difference between matter and energy
2. Define electromagnetic radiation and specifically, ionizing radiation.
3. Explain how x-rays were discovered accidentally.
4. Discuss human injury caused by radiation.
5. List basic radiation protection equipment.
6. Describe a brief history of modern radiography (to include DR and CR) and discuss what behaviors are required of a radiographer.
7. Discuss time, distance and shielding in reference to radiation protection.

(Radiographic units)

1. List and define units of radiation measurement and absorbed dose

(Foundational physics)

1. Discuss the derivation of scientific systems of measurement
2. List the three systems of measurements.
3. Identify nine categories of mechanics
4. Relate the history of the atom .

5. Identify the structure of the atom.
6. Describe electron shells and instability within atomic structure.
7. Discuss radioactivity and the characteristics of alpha and beta particles that can ionize matter.
8. Explain the difference between particulate and electromagnetic ionizing radiation.

(Electromagnetic Radiation)

- 1) Define and identify photons and their relationship to electromagnetic radiation
- 2) Compare wavelength, frequency and amplitude as it relates to the electromagnetic spectrum
- 3) Identify the properties of the electromagnetic spectrum
- 4) Discuss the concepts of wave-particle duality, visible wave properties and radiation attenuation.
- 5) Calculate the inverse square law
- 6) Devine the properties of matter and energy

(X-ray room and tube components)

1. Identify the components of the console or control panel.
2. Explain the operation of the high-voltage generator, including the autotransformer, the filament transformer and the rectifiers.
3. Relate the major differences between single and three phase power, including voltage ripple.
4. Define the power rating unit.
5. Describe the six support designs for the x-ray tube.
- 6 List the parts of the housing that protects the x-ray tube.
7. Identify the components for the glass or metal envelope that make up the x-ray tube.
8. Discuss the cathode and filament currents.
9. Describe the parts of the anode and the induction motor.
10. Define the line focus principle and the heel effect.
- 11 Identify the three causes of x-ray tube failure.
12. Explain the use of tube rating charts to prevent tube failure.

(Radiation production and interactions)

1. Discuss the interactions between electrons and the x-ray target.
2. Identify the graphs depicting the x-ray emission spectra for characteristic and Bremsstrahlung radiation.
3. Explain how mAs, kVp, added filtration, target material and voltage ripple affect x-ray emission spectra.
4. Describe each of the five x-ray interactions with matter.
5. Define and compare differential absorption and attenuation.
6. Explain the effect of atomic number and mass density of tissue on the differential absorption of the x-ray beam.
7. Discuss why radiologic contrast agents are used to highlight soft tissue structures and organs in the human body.

(Quantity and Quality)

1. Define radiation quantity in relation to intensity in roentgens.
2. Define radiation quantity in relation to mAs.
3. List and discuss 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

(Radiographic Image production and processing)

Digital Systems

1. Discuss the implications differences and functions of CR systems and DR systems
2. Recognize, define and apply common terminology specific to digital systems
3. Describe the steps of image production in a CR system
4. Describe the steps of image production in a DR system
5. Discuss post processing options
6. Recognize the importance of exposure level numbers and its relationship to exposure
7. Evaluate and contrast how the image is captured in CR and in DR
8. Discuss image receptors in CR.
9. Describe PACs and its value in a filmless system
10. Define quantum mottle and its association with filmless systems
11. Identify the layers of a CR Image receptor
12. Identify the layers of a DR detector (indirect and direct)
13. Discuss how a histogram applies to pre image production and post image production

(Scatter Production and Grids/Beam restriction)

1. Identify types of x-ray production/interaction that are responsible for remnant radiation.
2. List three factors that contribute to scatter radiation.
3. Discuss three devices developed to minimize scatter radiation.
4. Recognize the relationship between scatter radiation and image contrast.
5. Explain the components of grid construction.
6. Calculate grid ratio, grid frequency, contrast improvement factor, Bucky factor and selectivity
7. Describe types of grids.
8. Discuss the common errors using grids.
9. Evaluate the circumstances for proper grid selection.
10. Discuss the advantages and disadvantages of the use of grids in relation to patient radiation exposure.

(Technique, patient factors)

1. List the four prime exposure factors.
2. Discuss the relationship between mAs and kVp in relation to receptor exposure (beam quality) and contrast (beam quantity.)

3. Describe equipment characteristics that are secondary factors in changing the to receptor exposure (beam quality) and contrast (beam quantity.)
 4. List the four patient factors and explain their affects on radiographic technique.
 5. Discuss the four image quality factors of brightness/receptor exposure(optical density), (gray scale) contrast, spatial resolution (image detail), and distortion and how they are used to describe the characteristics of a radiograph.
 6. Identify the three types of technique charts.
 7. Explain the automatic-exposure control/APR relationship.
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General Syllabus Information

Important Student Information Link

*In addition to course requirements and objectives that are in this syllabus, Montgomery College has information on its web site (see link below) to assist you in having a successful experience both inside and outside of the classroom. It is important that you read and understand this information. The **link below provides** information and other resources to areas that pertain to the following: student behavior (student code of conduct), student e-mail, the tobacco free policy, withdraw and refund dates, disability support services, veteran services, how to access information on delayed openings and closings, how to register for the Montgomery College alert System, and finally, how closings and delays can impact your classes. If you have any questions please bring them to your professor. As rules and regulations change they will be updated and you will be able to access them through the link. If any student would like a written copy of these policies and procedures, the professor would be happy to provide them. By registering for this class and staying in this class, you are indicating that you acknowledge and accept these policies.*

<http://cms.montgomerycollege.edu/mcsyllabus/>

Please refer also to the [Radiology Technology Student Handbook and Clinical Education Plan](#) for general college policies.

Additional Classroom policies

Electronic Devices

While the use of recording devices and laptops are permitted for lecture and labs the instructor will be recording most lectures on Collaborate which records audio and information shared on the overhead via the instructor computer. During lecture and labs, cell phones or other electronic devices need to be set on silent or vibrate mode and students are not to be using electronic devices for non-academic purposes (**texting, serving the net, posting on social media-see next page for the social media policy**) . If a student must respond to a cell phone call during class time, they must leave the

classroom or lab to do so. Extended absence from the lecture or lab to return a call may be recorded as an unexcused absence and this may impact the student's ability to continue in the lab or lecture that day. Students are urged to use discretion in returning calls during class time. **NO CELL PHONES OR LAP TOPS MAY USED DURING AN EXAMINATION. ALL CELL PHONES MUST BE TURNED OFF PRIOR TO THE BEGINNING OF EXAMINATIONS AND PLACED IN A BACKPACK OR OTHER TYPE OF CARRIER ALONG WITH TEXTBOOKS AND/OR LAPTOP ON THE FLOOR NEXT TO THE STUDENT. NO LAP TOPS WILL BE ALLOWED OUT OF THEIR CASES DURING EXAMINATIONS**

Cell phones should be kept on vibrate mode and students who must speak on a cell phone, must do so outside of the classroom to prevent disruption to the rest of the class.

Testing policy

To assure testing integrity the following policy is mandated:

- 1) Number 2 pencils will be provided. Student are not to use their pencils or mechanical pencils
- 2) Ear buds, ear phones and any other type of personal audio equipment may not be used
- 3) The instructor reserves the right to assign seating
- 4) Students must raise their hand if there is a question about the test during the test period. Students are not to come to the instructor.
- 5) All personal items must be placed on the ground where the student is seated for the exam. Lockers are available for those who wish to use them.
- 6) Cell phones and lap tops must be placed beside the student on the ground during the test.
 - a. Cell phones should be turned off. Lap tops should be turned off. Books must be closed. Notebooks must be closed
- 7) The instructor reserves the right to remove the exam from the student if the student is exhibiting behavior not conducive to maintaining testing integrity (examples and not limited to: talking to other students during the test, looking at other student's answer key etc.)
- 8) Program will follow the college's policy on Academic dishonesty.

Source: **Academic Dishonesty** and How It Is Handled" from Montgomery College's Student Code of Conduct. VIII.

Student e-mail

For this class, e-mail will be sent via Blackboard. Assignments not already indicated in this syllabus and other than homework assignments which will be attached to BB. Students will be informed either in class or via BLACK BOARD e-mail for any additional assignments.

Radiologic Technology Program Social Media Policy

Students are advised that no information about the clinical site, staff and clinical patients are ever to be posted on personal and other social media accounts. The posts that ARE NEVER TO BE PUBLISHED ON SOCIAL MEDIA ACCOUNTS include but are not limited to are selfies, photos, descriptions of patients, descriptions of patients’ other medical staff are attending to, tagging yourself, classmates, technologists or patients (even with assumed patient permission), or “checking in” during clinical hours as a student. *In addition, no images of other students or faculty taken during class hours or lab hours should be posted on private or public social medial account or pages.* Any students found in non-compliance to these policies are considered to be in violation of HIPAA as well as program policy and may be dismissed from the program. Students are cautioned about “liking” a public clinical site social media page and posting any comments that are in non-compliance to the policy noted above. Students are cautioned about friending technologists from their clinical sites. Students may never ask to “friend” or follow a patient’s social media account. Montgomery College’s Radiologic Technology program has a public Facebook page but the program coordinator is the administrator of this page and is the only person authorized to post on this page. If you feel you have an appropriate post for this page you can place this post on the Facebook page and the program coordinator will review it before allowing it to post. Academic support, images and job opportunities as well as shared posts from other approved sites are regularly posted on this page.

Delayed Opening or Closing of the College

Because of inclement weather or utility failure or for other reasons, it may be necessary to delay opening or suspend all operations of the College or an individual campus. Please refer to the general syllabus link on page 5 of this syllabus.

All inquiries from the news media regarding an emergency event should be directed to the College’s Office of Communications.

How Closing and Delays Impact Classes

If a class can meet for 50% or more of its regularly scheduled meeting time OR if the class can meet for 50 minutes or more, it will meet. Montgomery College will always operate on its regular schedule unless otherwise announced. Depending on the nature of the incident, notifications of emergencies and changes to the College’s operational status will be communicated through one or more communication methods including the College’s website www.montgomerycollege.edu. For the most up-to-date information regarding College openings, closings, or emergencies, all students, faculty, and staff are encouraged to sign up for email and text alerts via Montgomery College ALERT. Registration information is available at www.montgomerycollege.edu/emergency.

PRINTING AT MONTGOMERY COLLEGE

Students will now be charged for printing any document at Montgomery College Please refer to this link for more information:

<http://cms.montgomerycollege.edu/edu/department.aspx?id=27707>

Grading:

93-100	A	Any student receiving a grade below “C” in this course must repeat it satisfactorily before taking successive courses.
86-92	B	
78-85	C	
77 and below	F	
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Grades will be determined by:

Attendance	5%
Assignments (Blackboard Quizzes /Critical Thinking Assignments)	15%
Exams (3)	45%
Cumulative Final Exam	<u>35%</u>
	100%

Grades will be posted on Blackboard so students can track their progress

Attendance: (5%)

Students are expected to attend all class sessions. In cases involving excessive absences from class, the instructor may drop the student from the class. An excessive absence is defined as one more absence than the number of classes per week during a fall or spring semester; the number of absences is prorated for accelerated sessions.

Students are also expected to be on time for class. Excessive lateness will result in a counseling session with the instructor and persistent lateness may result in unsuccessful completion of the course.

- ❖ The attendance policy for this course is the same as that stated above and in the Montgomery College Catalog. Unexcused and excessive absences may result in an administrative drop from the course.
- ❖ Students must email the instructor or leave a message on the instructor's office phone prior to absence or if they will be late for class
- ❖ Every absence, lateness to class or lab, leaving early or lack of participation in class will result in a 10 point deduction per infraction.
- ❖ A student may NOT attend a lab that are not enrolled in.
- ❖ Excessive infractions will result in a coaching/counseling process which result in grade deductions or unsuccessful completion of course.

The student is urged to review the last sentence concerning unexcused absences and administrative drop from the course. **If a student cannot make class, it is their responsibility to call the College and relay that message to the faculty.**

Assignments (15%)

BB Quizzes

Quizzes will be posted on Blackboard and will be due by 12:00 pm the day of the examination that covers the objectives on the respective quizzes (the due date will be posted on BB as well as the course outline of the syllabus) Quizzes not completed by the time and date due will be recorded as a zero. There will be no exceptions. Quizzes will

be posted in adequate time for students to take and students must make a 90% on the quiz. Students may take the quiz multiple time until a 90% or higher score is reached. Those students who receive less than a 90% and choose not to retake the quiz will receive a zero as the grade for the quiz. Students must meet with the faculty if they are having challenges meeting the 90% grade. A 90% or higher score will be overridden by faculty and students will be given a 100% for the grade. If students have questions about this process, they need to speak to the faculty. This will be reviewed on the first day of class and recorded on collaborate.

Other Assignments for RADT 101

1. These assignments will be posted on Blackboard.
2. Assignments are due on examination days. Assignments covering the objectives for each examination should be completed
3. The instructor does not check for accuracy of answers as an answer key is provided and it is the student's responsibility to check the answers.
4. There is no make-up time or partial credit given for missing assignments

Grading for Quizzes/Assignments:

If the assignment and quizzes are not completed by the start of a scheduled exam day, the assignment grade will be calculated based on the number of assignments completed divided by the number of assignments required. For example if a total of three quizzes and three assignments were required to be completed by an examination date and only 4 were completed, the student's grade for quizzes and assignments would be a 66%.

Critical Thinking Assignment-Journal articles

The ability to critically think is essential for the successful completion of the Radiologic Technology program. Critical thinking concepts such as self assessment, evaluation, problem solving, deductive reasoning are but a few strategies employed in the diagnostic imaging environment. Use of these and other critical thinking strategies assist in the application of the book knowledge to the clinical setting. To this end throughout the two years in the program students will be required to complete specific didactic and clinical assignments used to assess critical thinking in the classroom and in the clinical rotations. In addition to critical thinking questions imbedded into each didactic exam, a percentage of the final grade for each class (including the clinical courses) will include the grade(s) from each critical thinking assignment.

RADT 101 Critical thinking assignment

Journal article Assignment

Three journal article assignments related to the field radiology from the current Radiology periodicals found in the classroom, media center or other sources or from the Internet will be due this semester. **Journal assignments may be on any topic as it**

relates to radiology. Date for submission of these assignments are noted in the course outline. **Printed copies of article from periodicals and from the Internet must accompany the assignment. If a copy of the article does not accompany the review, the assignment will be given a grade of a zero.** Students are reminded that this is an individual project. Review of the plagiarism policy signed by the student is suggested. *To receive credit for this assignment the assignment must be turned in at the start of class. Late assignments (after the start of class) will not be accepted and a grade of zero will be recorded.*

Guidelines for the assignment are as follows:

- Assignment must be typed with a 12 font only and double spaced
- Assignments should be a minimum of 3 pages long
- A copy of the article must be attached. If the publication date is not printed on the article, this should be submitted in bibliography style.
- *Assignments should briefly review and summarize the main points of the article submitted*
- *As part of this assignment students are required to note their opinions, perspectives and other critical thinking processes that demonstrate evaluation and analysis of the article*

(See page 14 of this syllabus for the grading rubric for further guidance)

Examinations (45%)

A minimum of three examinations will be given to assess student comprehension of presented materials. The dates and objectives covered in examination form are noted in the class schedule in this syllabus. Examinations will include multiple choice questions and may include matching, sequencing, true or false, fill in the blank and/or short essay questions. The point value is indicated on the examination. Multiple choice, true or false, matching questions are worth one point. Grades are calculated based on the number of points earned divided by greatest possible points. For example if the test has a total of 89 points and a student earns 79 possible points (79/89) the student's score would be 88.7% which will be rounded up to an 89%. ***Examinations whose questions are to be answered on a scantron will be graded based on the answers recorded on the scantron only.*** All examinations are reviewed in class after graded and open for discussion of content only. Concerns about calculation of grade or possible misgrading may be addressed individually with the instructor after class. Tests are kept in the student file. Students are not given them to keep.

Comprehensive Final Examination (35%)

The final examination is given on the date as dictated by the collegewide final schedule found in each semester's Montgomery College Credit Course Schedule and noted in the class schedule. The examination covers all material reviewed in the semester. Questions are primarily designed in multiple choice fashion although some other forms of questions may be designed.

Chapters marked with an asterisk indicate only portions of the chapter will be discussed. Students are encouraged to download the PowerPoints for each class to use as a guideline of objectives covered for each class

Tentative Course Outline

<u>Week</u>	<u>Lecture/Assignment</u>	<u>Lab</u>
-Week 1 COMPONENTS OF X-RAY ROOM OVERVIEW/INTRO TO RADIOGRAPHIC PHYSICS		
Mon . 8/27	Review of 119 Introductions, Syllabus Bushong Chptrs. 5/6/ *	“A zombie ate all the techs”
Wed 8/29	Bushong Chptrs. 5/6/13 * Carter Pages -refer to specific pages as noted in powerpoint BB quiz due by 12:00 pm due Sept 26	“A zombie ate all the techs”
-Week 2 RADIOGRAPHIC PHYSICS		
Mon 9/3	Holiday No classes	NO LAB
Wed 9/5	Ch. 1 Bushong	NO LAB
BB quiz due by 12:00 pm due Sept 26		
-Week 3 RADIOGRAPHIC PHYSICS		
Mon 9/10	Ch 2 Bushong	Lab stations Discussion of Textbook/testing strategies
Wed 9/12	Ch 3 Bushong	Lab stations Discussion of Textbook/testing strategies
JOURNAL ARTICLE #1 DUE		
BB quiz due by 12:00 pm due Sept 26		
-Week 4 BASIC RADIOGRAPHIC PHYSICS/X-RAY IMAGING SYSTEM		
Mon 9/17	Ch 3 Bushong/	Exposure Practice/Educate the eyes
Wed 9/19	Ch 5* Bushong/13* Ch 6 Bushong BB quiz due by 12:00 pm due Sept 26	Exposure Practice/Educate the eyes

Week	Lecture/Assignment	Lab
-Week 5	X-RAY PRODUCTION/EXAM 1	
Mon 9/24	CH 5/6 (Bushong)/Exam Review	NO LAB
Wed 9/26	Exam (Chapters 1,2,3, 5*,6*) * portions of this chapter as directed by powerpoint BB quizzes due assignments due by 12:00 pm this date	NO LAB
-Week 6	X-RAY PRODUCTION/INTERACTION WITH MATTER	
Mon 10/1	CH 6 (Bushong)	Missing Factors
Wed 10/3	Ch 7 Bushong Worksheet/ BB quiz due by 12:00 pm due October 22	Missing Factors
-Week 7	INTERACTION WITH MATTER/EMISSION CONCEPTS	
Mon 10/8	Ch 8-intro to chpt 9 Bushong	Student comps
Wed 10/10	Chapter 8 intro to chpt 9 Bushong BB quiz due by 12:00 pm due October 22 JOURNAL ARTICLE #2 DUE	Student Comps
-Week 8	SCATTER/GRIDS/IMAGE CAPTURE-	
Mon 10/15	Chpt 9 Bushong	Fix it/ missing factor
Wed 10/18	Review	fix it/ missing factor
-Week 9	EXAM 2/INTRO TO DIGITAL REVIEW	
Mon 10/22	Exam (Chpts 6, 7,8,9, -Bushong) (missing factors) BB quizzes/	NO Lab
Wed 10/24	Chpt 11 Bushong	NO LAB
-Week 10	IMAGE CAPTURE CR/DR CONCEPTS	
Mon 10/30	Chapter 1,4,5 Carter/ Bushong 14-18* BB Quiz due November 14	TBA
Wed 11/1	Chapters 1, 4,5 Chapters 2-3 Carter/Chapter 17 Bushong	TBA

Week	Lecture/Assignment	Lab
-Week 11	Digital imaging	
Mon 11/6	Chapters 1,4, 5 Carter	Chapter 2
Wed 11/8	Chapters 1,4,5 Carter cont. Chapter 3	Chapter 2
	JOURNAL ARTICLE #3 DUE	
-Week 12	CELEBRATING NATIONAL RAD TECH WEEK/EXAM /	
Mon 11/12	12:00-1:15 START TIME: PIZZA PARTY WITH 2 ND YEARS CELEBRATING NATIONAL RAD TECH WEEK-MANDATORY ATTENDANCE. OPTIONAL 1;15-2:15 REVIEW FOR EXAM 3	
Wed 11/14	Exam #3 (Chapters 1-5 Carter)	NO LAB
-Week 13	TBA/THANKSGIVING HOLIDAY	
Mon 11/19	TBA	NO LAB
Wed 11/21	No Classes	
-Week 14	TBA	
Mon Nov 26	TBA	TBA
Wed Nov 28	TBA	TBA
-Week 15	Final Review	
Dec 3	Review for Final	No Lab
Dec 5	Review for Final	RADT 111 review (tentative)

FINAL EXAM

FINAL: Wednesday, December 12th 12:30-2:30

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Faculty reserves the right to modify course content and evaluation procedures as deemed necessary.

RADT 101 Critical Thinking Assignment-Journal Article Grading Rubric

Please note that if the assignment is handed in without the a copy of the article attached an automatic grade of zero will be assigned and the rubric below will not be considered for the review.)

	Met		Not met -20	Comments
Used correct size of font				
Three pages in length				
Spelling/ neatness				
	<i>Met</i>	<i>Partially Met -1 to 10</i>	<i>Not met -10 to -20</i>	
Reviewed all main points of the article				
Main points reviewed were written in the student's own words				
If quoting from article, appropriate usage of quotations and notation of author was used				
Student evaluated and analyzed the article by drawing conclusions, theorizing and/or assessing content to their current level of education in the field of radiography				