

DI 120 Exposure I
LBCC Diagnostic Imaging Program
Summer 2021

Instructor: Jennifer Clayton, R.T. MBA (R)(CT)(ARRT)
Email: claytoj@linnbenton.edu (best way to contact me)
Lebanon Office Phone: 541-917-4402
Lecture Location: [Virtual Classroom](#)
Lecture Times: Mondays and Wednesdays 9-10:30 a.m.
Office Hours: By appointment only

COURSE DESCRIPTION:

This course is designed to establish basic knowledge of atomic structure, radioactivity, and terminology. We will also cover the nature and characteristics of different radiation types, x-ray production, and the fundamentals of photon interactions with matter. The content is designed to establish a knowledge base in radiography equipment and design. Content is designed to impart an understanding of the factors that govern and influence the production and recording of radiologic images. This course is the first in a three-part series.

SCHEDULE:

- **Class** is held in **real time** in the LIVE [Virtual Classroom](#) **Mondays and Wednesdays** 9-10:30 a.m. It is expected students will attend all lectures.
- **Assignments** will occur in each module during the term. There are also project assignments that will be assigned and which will require work in the lab or health care facility. Assignments are expected to be submitted for grading by **Fridays** at 11:59 p.m.
- **Quizzes** will be given **at least** weekly within the module. Quizzes will be a review of content including lecture, homework, assignments and reading. Quiz questions can be pulled from any learning resources within the modules.
- The **final exam** will be scheduled for the week of **August 30th on site at the HOC in Lebanon.**

REQUIRED TEXTS (provided):

- *Principles of Radiographic Imaging: An Art and a Science, 6th edition*, by Richard R. Carlton
- *Radiologic Science for Technologists, 12th edition*, by Stewart C. Bushong

ASRT COURSE OBJECTIVES:

- Describe the electromagnetic spectrum.
- Identify the properties of x-rays.
- Identify sources of electromagnetic and particulate ionizing radiations.
- Differentiate between ionizing and nonionizing radiation.
- Describe wavelength and frequency and how they are related to velocity.
- Explain the relationship of energy, wavelength and frequency.
- Explain the wave-particle duality phenomenon.
- Describe fundamental atomic structure.
- Explain the processes of ionization and excitation.
- Differentiate between ionic and covalent molecular bonds.
- Describe charged and uncharged forms of particulate radiation.
- Describe radioactivity in terms of alpha, beta and gamma emission.
- Compare the production of bremsstrahlung and characteristic radiations.
- Describe the conditions necessary to produce x-radiation.
- Discuss the clinical significance of the photoelectric and modified scattering interactions in diagnostic imaging.
- Discuss various photon interactions with matter by describing the interaction, relation to atomic number, photon energy and part density and their applications in diagnostic radiology.
- Describe radiation induced chemical reactions and potential biologic damage.
- Identify and justify the need to minimize unnecessary radiation exposure of humans.
- Discuss relationships of wavelength and frequency to beam characteristics.
- Describe the x-ray emission spectra.
- Identify the factors that affect the x-ray emission spectra.
- Identify the components of diagnostic x-ray tubes.
- Explain protocols used to extend x-ray tube life.
- Discuss permanent installation of radiographic equipment in terms of purpose, components, types and applications.
- Discuss mobile units in terms of purpose, components, types and applications.
- Identify the general components and functions of the tube and filaments circuit.
- Define potential difference, current and resistance.
- Compare generators in terms of radiation produced and efficiency.
- Discuss the proper test equipment/procedures for evaluating the operation of an x-ray generator.
- Describe the operation and applications for different types of beam-limiting devices.
- Explain the rationale for using beam-limiting devices.
- Explain how beam filtration affects x-ray beam intensity, beam quality, and resultant patient exposure.
- Discuss added and inherent filtration in terms of the effect on patient dosage.
- Identify performance standards for beam-limiting devices.
- Explain the relationship of exposure factors to patient dosage.

- Relate the receptor exposure indicator values to technical factors, system calibration, part/beam/plate alignment and patient exposure.
- Explain exposure factor considerations involved in selecting techniques.
- Analyze the relationships of factors that control and affect image exposure.
- Demonstrate how time, distance and shielding can be manipulated to keep radiation exposures to a minimum.
- Perform calculations of exposure with varying time, distance and shielding.
- Apply the reciprocity laws to clinical situations.
- Apply conversion factors for changes in the following areas: distance, grid, image receptors, reciprocity law and 15 percent rule.

LBCC Course Outcomes:

- Explain and review the components, principles and operation of imaging systems found in diagnostic radiology.
- Identify and recall the nature and characteristics of radiation and x-ray production.
- Explain the process of radiographic image production.

STUDENT EXPECTATIONS

- **YOU are RESPONSIBLE for your own LEARNING.**
- **We provide the structure for that learning, but it is up to you to decide how much or little you get out of the class. It is imperative that you understand “PRACTICE MAKES PERFECT”.**
- **LBCC faculty provides the classroom lecture portion of the course.**
- **Each student is expected to spend extra time studying on his/her own utilizing various resources.**
- **There are specific deadlines, so this course is not self-paced. It is up to the student to keep up with his/her assignments and deadlines.**
- **Issues with technology are not valid reasons for turning in late work.**
- **No late work is ever accepted.**

VIRTUAL CLASSROOM EXPECTATIONS

1. Students must have a headset with an attached microphone on at all times. Do not talk into the computer's built-in microphone or use your computer's speakers to hear class! Feedback is a major issue and can be avoided by wearing a headset with an attached microphone.
2. Arrange yourself in your work space in such a way that you are well lit and easy to see at all times. Your back should not be to a window or other bright light source.
3. You must be on webcam at all times. We need to see your entire face. The top of your head or just your eyes does not suffice!
4. You will be required to show your workspace prior to each quiz. Your workspace should be clean with no books/papers/etc. open or around. Your cell phone should be put away.
5. Your webcam must be able to show your workspace. For some students, this may mean you have to purchase a separate web cam that attaches to your computer.
6. When asked to show your workspace, do so in a slow and deliberate sweeping motion so we can see the whole area. This should take about 5-7 seconds. Doing it too quickly negates the purpose and you may be asked to do it again if you go faster than this.
7. If you have a question or a comment, please raise your hand.
8. Please mute your microphone unless it is your turn to talk.
9. Students are expected to treat the virtual classroom like a traditional classroom. It is essential that students make arrangements to attend class in a distraction-free space. Household chores, babysitting, maintenance appointments, watching TV (or having a TV on in the background), etc. should *not* be performed or scheduled during class time.
 - a. Ask yourself: Would I _____ in a traditional classroom?
 - b. If the answer is no, then it should not be done in the virtual classroom either.
10. Participation in the virtual classroom is required. Students are expected to be engaged and prepared to respond to instructor questions in a timely manner as not to disrupt the virtual classroom environment.

CONTACTING THE INSTRUCTOR

Email is the best way to contact the instructor for this class. Emails received between Monday at 8am and Friday at 5pm are generally returned within 24 hours. **Emails received on Saturdays, Sundays, or holidays will be returned on the next business day.** I typically do not respond to emails on Saturdays and Sundays.

Students who call and leave a message on the instructor’s office phone should be aware that the instructor is only in Lebanon approximately two (2) days each week. Phone messages are generally checked on Tuesdays and Thursdays. Students wishing for a response sooner should email the instructor. You are encouraged to utilize email as a contact tool instead of leaving a voicemail.

ONLINE RESOURCES/LINKS

This hybrid online course contains many links. A concerted effort is made to ensure all materials are accessible. However, if you discover a link to be broken or missing, *first* check it in another browser. Sometimes things work in Mozilla(Firefox) but not Chrome or IE, or vice versa. It is a fluke of the software and is just something that we have to deal with. If you have checked it in at least two browsers and discover that it is still not functional, please email the instructor to let her know which link is broken/non-functional, which browsers you have checked and where the specific link is located so the problem may be remedied.

CLASS ATTENDANCE

Students are expected to attend scheduled virtual classroom sessions provided by LBCC faculty for this course at the scheduled time. Students will be called upon during class. Distance Education Students and/or students enrolled in “virtual classrooms” sections of the course are required to participate utilizing a webcam.

- Lectures will NOT be recorded. Interaction during lecture is an integral part of the lecture and cannot be substituted. Your participation in the lecture will be captured on your student evaluations.
- Students are expected to complete weekly required text readings prior to "virtual classroom" lectures with the LBCC faculty.
- Students may access the Virtual Classroom for this course at <https://zoom.us/j/9519289278>. The **password is xray20**.

Students should bookmark this link in several browsers (Chrome, Mozilla, Internet Explorer, etc.) so that it is available should access to the classroom via Moodle be unavailable for any reason.

COURSE OUTLINE:

Week/ Module	Date	Topic	Required Reading	Homework	Assignment	Assessment
0	M 6/21 No live lecture this week.	Math Review	Syllabus Math Review Links Bushong: 3-34	None	Assignment 0 Due Date: Friday 6/25	None
1	M 6/28	Intro to X-Ray & Physics Refresh	Bushong: 3-34	HW 1-1	Assignment 1-1 Due Date: Friday 7/2	Orientation Quiz Mon 6/28

1	W 6/30	Wavelength & Frequency	Bushong: 55-69	HW 1-2	Assignment 1-2 Due Date: Friday 7/2	W 6/30 Quiz 1
2	M 7/5 No live lecture-4th of July	Atomic Structure & Ionization	Carlton: 19-34 Bushong: 35-53	HW 2-1	Assignment 2-1 Due Date: Friday 7/9	Quiz 2-1 No Quiz-4th of July
2	W 7/7	Radioactivity	Bushong: 35-53	HW 2-2	Assignment 2-2 Due Date: Friday 7/9	Quiz 2-2 W 7/7
3	M 7/12	X-Ray Production	Carlton: 117-124 Bushong: 131-143	HW 3-1	Assignment 3-1 Due Date: Friday 7/16	Quiz 3-1 M 7/12
3	W 7/14	X-Ray Interactions	Carlton: 158-179 Bushong: 145-154 155-168	HW 3-2	Assignment 3-2 Due Date: Friday 7/16	Quiz 3-2 W 7/14
4	M 7/19	X-Ray Emission Spectrum	Carlton: 30-33 121-124, 194-199 Bushong: 131-143 Review 145-154	HW 4-1	Assignment 4-1 Due Date: Friday 7/23	Quiz 4-1 M 7/19
4	W 7/21	X-Ray Tubes	Carlton: 79-97 Bushong: 113-130	HW 4-2	Assignment 4-2 Due Date: Friday 7/23 Assignment: Create an X-ray Tube Due Date 7/23	Quiz 4-2 W 7/21
5	M 7/26	Circuits	Carlton: 35-51, 67-77, 96-109	HW 5-1	Assignment 5-1 Due Date: Friday 7/30	Quiz 5-1 M 7/26

			Bushong: 95-112			
5	W 7/28	Generators	Bushong: 95-112-Review	HW 5-2	Assignment 5-2 Due Date: Friday 7/30 Assignment: Create a X-ray Circuit	Quiz 5-2 W 7/28
6	M 8/2	Filtration/Beam-Limiting Devices	Carlton: 151-168, 194-199	HW 6-1	Assignment 6-1 Due Date: Friday 8/6	Quiz 6-1 M 8/2
6	W 8/4	Exposure Factors	Bushong: 221-238	HW 6-2	Assignment 6-2 Due Date: Friday 8/6	Quiz 6-2 W 8/4
7	M 8/9 & W 8/11	ALARA	Bushong: 481-506 540-555 Carlton: 139-149 437-443	HW 7	Assignment 7 Due Date: Friday 8/13	Quiz 7-1 M 8/9 Quiz 7-2 W 8/11
8	M 8/16 & W 8/18	Conversions	Bushong: 221-231 Review Carlton: 226-241, review 158-167	HW 8	Assignment 8 Due Date: Friday 8/20	Quiz 8-1 M 8/16
9	M 8/23 and W 8/25	Review	All reading assigned to date	HW 9	None	
10	M to R 8/30-9/2	Finals week	All reading assigned to date	None	None	FINAL EXAM

QUIZZES (QUIZZES @ 5- 15 points each)

There will be scheduled Quizzes. These will cover the material from the lectures, homework and/or assignments. Quiz question content can be pulled from any resource within the course including videos and online modules. (Studies show that frequent small assessments help students retain the information better.) Quizzes are closed note/book and are taken on the designated assessment day and time. All students are expected to take Quizzes with integrity, jeopardizing neither their own work, nor that of others. **Pop Quizzes could be given at any time over any material.**

Time allotted for quizzes:

The guideline we use for determining the amount of time to be used for an assessment is based on the following:

1 minute (60 seconds) for each multiple-choice, true/false, or fill-in-the blank question

2 minutes (120 seconds) for each matching or short answer question

3 minutes (180 seconds) for each essay question

We have developed this guideline to help students be successful when taking the national licensing exam given by the ARRT. The ARRT exam allows *less than one minute per multiple choice question*. To help students best prepare for this capstone exam and entry into the profession, we have found it important to help students prepare by getting used to one minute per multiple choice question during the duration of the program.

ASSIGNMENTS (20-50 points)

Various assignments will occur during the term. There are also project assignments that will be assigned that will require work in the lab or health care facility. Each assignment is worth points that vary depending upon the task.

HOMEWORK: (0 points)

The homework assignments are NOT graded. Consider them an additional resource. The homework assignments allow the student to determine how well they understand the material and give students practice before an assessment. Students who dutifully complete ungraded HW perform better in the course. Students are not required to complete the HW's, but they are encouraged to do so.

WRITTEN FINAL EXAM (200 POINTS)

The final exam will be comprehensive and will consist of 100 ARRT type multiple choice questions. The homework questions definitely help you study for the final. The exam will take place during finals week at a designated time.

GRADING SCALE

This is a three (3) credit, letter grade course. When these points are combined, the final grading scale is:

A = 91.5 – 100%

B = 82.5 – 91.4%

C = 74.5 - 82.4%

FAIL = ≤ 74.4% **This will result in the student being withdrawn from the program and receiving a letter grade of F on their transcripts. The Diagnostic Imaging Program does not utilize the grade of "D."**

SYLLABUS CHANGE POLICY

Syllabus is subject to change as the instructor evaluates the progress of students and their understanding of concepts.

MOODLE

We'll be using Moodle for this class. Before logging in for the first time, you will have to claim your account at <https://identity.linnbenton.edu/>. If you have any problems logging into Moodle, please contact the Student Help Desk at 541-917-4630 or email student.helpdesk@linnbenton.edu.

COURSE FAILURE POLICY

If a student fails this course, he or she must withdraw from the program. No refund for the program will be issued.

DISCRIMINATION POLICY

LBCC prohibits unlawful discrimination based on race, color, religion, ethnicity, use of native language, national origin, sex, sexual orientation, marital status, disability, veteran status, age, or any other status protected under applicable federal, state, or local laws. For further information visit <http://po.linnbenton.edu/BPsandARs/>.

DISABILITY SERVICES POLICY

You should meet with your instructor during the first week of class if:

- You have a documented disability and need accommodations,
- Your instructor needs to know medical information about you, or
- You need special arrangements in the event of an emergency.

If you have not accessed services and think you may need them, please contact Disability Services, 541-917-4789.

STATEMENT OF INCLUSION

The LBCC community is enriched by diversity. Everyone has the right to think, learn, and work together in an environment of respect, tolerance, and goodwill. I actively support this right regardless of race, creed, color, personal opinion, gender, sexual orientation, or any of the countless other ways in which we are diverse. (Related to Board Policy #1015)

Basic Needs Statement:

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Roadrunner Resource Center for support (resources@linnbenton.edu), or visit us on the web www.linnbenton.edu/RRC under Student Support for Current Students). Our office can help students get connected to resources to help. Furthermore, please notify the professor if you are comfortable in doing so. This will enable them to provide any resources that they may possess.