

UNIVERSITY OF NEVADA LAS VEGAS

Department of Health Physics and Diagnostic Sciences

RAD 350 PHYSICS OF X-RAY PRODUCTION

Fall 2021

Class Instructor:

Time:

Class Location:

Office Location:

Office Hours:

Phone:

WebCampus:

Email:

Note: The instructor reserves the right to make changes to syllabus as she deems necessary, to include reading assignments.

Course Description:

Discussion of x-ray machines, transformers, rectifiers, circuits and their operation. Theory of x-ray production.

Course Prerequisite(s):

This course must be taken concurrently with RAD351

Course Objectives:

1. Explain how an electromagnetic force is produced.
2. Properly employ Ohm's law.
3. Draw and interpret a diagram of a simple electrical circuit.
4. Determine the effect of voltage, resistance and current in series and parallel circuits.
5. Identify the various types of transformers in an x-ray circuit and explain their function.
6. Explain the various types of rectification and its function in the x-ray circuit.
7. Explain the various types of exposure timers and their relationship in the production of x-rays.
8. Describe how x-rays are produced.
9. Identify the safety practices that should be adhered to when operating an x-ray unit.

10. Given a simple diagram of an x-ray unit, identify the components, explain their function and discuss how they perform their function.
11. Identify accessory equipment that may be added to an x-ray circuit/unit.
12. Summarize computer applications in medical imaging.
13. Discuss and explain digital imaging and its applications.

Required Material:

Essential of Radiographic Physics and Imaging 3rd ed. (Johnston, Fauber)

Digital Radiography in Practice 1st ed. (Carroll)

Evaluation Methods:

- Each student will accumulate several hundred points in this course predicated on:
- Assignments (45% of total grade)
- Tests (50% of total grade)
- Participation and attendance (5% of total grade)

Grading Scale:

The student's final grade will be based on their percentage of total points given. Grade determination is based on the following percentage:

A	93.4 – 100%
A-	90.1 – 93.3%
B+	86.7 – 90%
B	83.4 – 86.6%
B-	80.1 – 83.3%
C+	76.7 – 80%
C	73.4 – 76.6%
C-	70.1 – 73.3%
D+	66.7 – 70%
D	63.4 – 66.6%
D-	60.1 – 63.3%
F	60% and below

Attendance Policy

Students are expected to attend class and be on time. Class will start at the designated time offered. A student may accrue two excused absences throughout the semester. Additional absences or excessive tardiness will result in a deduction in their overall grade.

Cell Phone Policy:

All cell phones will be kept off while in class. Cell phones, while an important part of our culture, are very distracting if heard or used in class. If the instructor finds a student talking or texting during class they will be asked to leave and receive an absence for the day. Any use of a cell phone or electronic device during a quiz or test will be considered cheating and the student will receive a “0” for the quiz or test.

UNLV POLICIES:

Public Health Directives

Face coverings are mandatory for all faculty and students who are not fully vaccinated. Students must follow all active UNLV public health directives while enrolled in this class.

UNLV public health directives can be found [here](#). Students who do not comply with these directives WILL be asked to leave the classroom. Refusal to follow the guidelines may result in further disciplinary action according to the [UNLV Code of Student Conduct](#), including being administratively withdrawn from the course. It is also recommended that students download the RebelSafe app and perform a self-check, using the COVID-19 assessment tool, before arriving on campus.

Academic Misconduct

Academic integrity is a legitimate concern for every member of the Campus community; we all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility, and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy, and are encouraged to always take the ethical path whenever faced with choices. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLV’s educational mission. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another person, from the Internet or any other source without proper citation of the sources. See the [Student Code of Conduct](#).

Auditing Classes

Auditing a course allows a student to continue attending the lectures and/or laboratories and discussion sessions associated with the course, but the student will not earn a grade for any component of the course. Students who audit a course receive the same educational experience as students taking the course for a grade, but will be excused from exams, assessments, and other evaluative measures that serve the primary purpose of assigning a grade.

Classroom Conduct

Students have a responsibility to conduct themselves in class and in the libraries in ways that do not interfere with the rights of other students to learn or of instructors to teach. Use of electronic devices such as pagers, cellular phones, or recording devices, or potentially disruptive devices or activities, are only permitted with the prior explicit consent of the instructor. The instructor may rescind permission at any time during the class. If a student does not comply with established requirements or obstructs the functioning of the class, the instructor may initiate an administrative drop of the student from the course.

Copyright

The University requires all members of the University Community to familiarize themselves with, and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The University will neither protect nor defend you, nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional copyright policy information is available at the [UNLV Provost Office](#)

Disability Resource Center (DRC)

The [UNLV Disability Resource Center](#) (SSC-A, Room 143, 702-895-0866) provides resources for students with disabilities. Students who believe that they may need academic accommodations due to injury, disability, or due to pregnancy should contact the DRC as early as possible in the academic term. A Disabilities Specialist will discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours, so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

Final Examinations

The University requires that final exams given at the end of a course occur on the date and at the time specified in the Final Exam schedule. The general schedule is typically available at the start of the semester, and the classroom locations are available approximately one month before the end of the semester. See the Final Exam Schedule, [here](#).

Identity Verification in Online Courses

All UNLV students must use their Campus-issued ACE ID and password to log in to WebCampus.

UNLV students enrolled in online or hybrid courses are expected to read and adhere to the [Student Academic Misconduct Policy](#), which defines, “acting or attempting to act as a substitute for another, or using or attempting to use a substitute, in any academic evaluation or assignment” as a form of academic misconduct. Intentionally sharing ACE login credentials with another person may be considered an attempt to use a substitute and could result in investigation and sanctions, as outlined in the Student Academic Misconduct Policy.

UNLV students enrolled in online courses are also expected to read and adhere to the [Acceptable Use of Computing and Information Technology Resources Policy](#), which prohibits sharing university accounts with other persons without authorization.

To the greatest extent possible, all graded assignments and assessments in UNLV online courses should be hosted in WebCampus or another UNLV-managed platform that requires ACE login credentials for access.

Incomplete Grades

The grade of "I" (Incomplete) may be granted when a student has satisfactorily completed three-fourths of course work for that semester/session, but cannot complete the last part of the course for reason(s) beyond the student's control and acceptable to the instructor, and the instructor believes that the student can finish the course without repeating it. For undergraduate courses, the incomplete work must be made up before the end of the following regular semester. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the period indicated, a grade of "F" will be recorded, and the student's GPA will be adjusted accordingly. Students who are fulfilling an Incomplete grade do not register for the course, but make individual arrangements with the instructor who assigned the "I" grade.

Library Resources

Librarians are available to consult with students on research needs, including developing research topics, finding information, and evaluating sources. To make an appointment with a subject expert for this class, please visit the Libraries' Research Consultation website:

<http://guides.library.unlv.edu/appointments/librarian>. You can also ask the library staff questions via chat and text message at: <http://ask.library.unlv.edu/>.

Missed Classwork

Any student missing class, quizzes, examinations, or any other class or laboratory work because of observance of religious holidays will be given an opportunity during that semester to make up the missed work. The make-up opportunity will apply to the religious holiday absence only. It is the responsibility of the student to notify the instructor within the first 14 calendar days of the course for Fall and Spring courses (except for modular courses), or within the first 7 calendar days of the course for Summer and modular courses, of their intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit the Policy for Missed Work, under Registration Policies, on the Academic Policies webpage, <https://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

In accordance with the policy approved by the Faculty Senate regarding missed class time and assignments, students who represent UNLV in any official extracurricular activity will also have the opportunity to make up assignments, provided that the student provides official written notification to the instructor no less than one week prior to the missed class(es).

The spirit and intent of the policy for missed classwork is to offer fair and equitable assessment opportunities to all students, including those representing the University in extracurricular activities. Instructors should consider, for example, that in courses which offer a "Drop one" option for the lowest assignment, quiz, or exam, assigning the student a grade of zero for an excused absence for extracurricular activity is both contrary to the intent of the Faculty Senate's policy, and an infringement on the student's right to complete all work for the course.

This policy will not apply in the event that completing the assignment or administering the examination at an alternate time would impose an undue hardship on the instructor or the University that could reasonably have been avoided. There should be a good faith effort by both the instructor and the student to agree to a reasonable resolution. When disagreements regarding this policy arise, decisions can be appealed to the Department Chair/Unit Director, College/School Dean, and/or the Faculty Senate Academic Standards Committee.

For purposes of definition, extracurricular activities may include, but are not limited to: fine arts activities, competitive intercollegiate athletics, science and engineering competitions, liberal arts competitions, academic recruitment activities, and any other event or activity sanctioned by a College/School Dean, and/or by the Executive Vice President and Provost.

Rebelmail

Rebelmail is UNLV's official email system for students, and by University policy, instructors and staff should only send emails to students' Rebelmail accounts. Rebelmail is one of the primary ways students receive official University communications, information about deadlines, major Campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the University. Emailing within WebCampus is also acceptable.

Tutoring and Coaching

The Academic Success Center (ASC) provides tutoring, academic success coaching, and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, please visit the [ASC website](#), or call 702-895-3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of SSC A, Room 254. Drop-in tutoring is located on the second floor of the Lied Library, and on the second floor of the College of Engineering building (TBE A 207).

UNLV Writing Center

One-on-one or small group assistance with writing is available free of charge to UNLV students at the [Writing Center](#), located in the Central Desert Complex, Building 3, Room 301 (CDC 3-301). Walk-in consultations are sometimes available, but students with appointments receive priority assistance. Students may make appointments in person or by calling the Center, 702-895-3908. Students are requested to bring to their appointments their Rebel ID Card, a copy of the instructions for their assignment, and two copies of any writing they have completed on their assignment.

Diversity Statement

As an institution of higher learning, UNLV represents a rich diversity of human beings among its faculty, staff, and students, and is committed to aspiring to maintain a Campus environment that values that diversity. Accordingly, the University supports understanding and appreciation of all members of its

community, regardless of race, sex, age, color, national origin, ethnicity, creed, religion, disability, sexual orientation, gender, gender identity, marital status, pregnancy, genetic information, veteran status, or political affiliation. Please see [University Statements and Compliance](#).

A successful learning experience requires mutual respect and trust between the students and the instructor. Accordingly, the instructor asks that students be willing to listen to one another's points of view, acknowledging that there may be disagreements, keep discussion and comments on topic, and use first person, positive language when expressing their perspectives.

Course Schedule:

DATE	LECTURE	CHAPTER READINGS	ASSIGNMENTS
Monday August 23, 2021	RADIATION CONCEPTS PART I: matter and energy, structure of matter	Chapter 1 and 2 (RPI)	Radiation Concepts part I Worksheet due 08/24 @ 11:59pm
Wednesday August 25, 2021	RADIATION CONCEPTS PART II: Atomic Theory, Electromagnetic spectrum	Chapter 2 and 3 (RPI)	Radiation Concepts part II worksheet due 08/29 @ 11:59pm 10 test questions due 08/29 @ 11:59pm
Monday August 30, 2021	RADIOACTIVITY AND DECAY	Chapter 2 and 3 (RPI)	Radioactivity and decay worksheet due 09/31 @ 11:59pm
Wednesday Sept. 1, 2021	ELECTRICITY PART I: Electrostatics Electrodynamics	Chapter 3 and 4 (RPI)	Electricity Part I worksheet due 09/05 @ 11:59 pm 10 test questions due 09/05 @ 11:59pm
Monday Sept. 6, 2021	NO SCHOOL	NO SCHOOL	NO SCHOOL
Wednesday Sept. 8, 2021	ELECTRICITY PART II: Series and parallel circuits Electromagnetic energy	Chapter 4 (RPI)	Electricity part II worksheet due 09/12@ 11:59pm
Monday Sept. 13, 2021	ELECTROMAGNETISM: Magnetism Electromagnetism Electromagnets Electrical Current Rectification	Chapter 4 (RPI)	Electromagnetism worksheet due 09/14 @ 11:59pm 10 test questions due 09/14 @ 11:59pm
Wednesday Sept. 15, 2021	TEST 1	TEST 1	TEST 1
Monday Sept. 20, 2021	X-RAY IMAGING SYSTEM PART I: The discovery of X-Rays X-Ray properties X-Ray console, HVG Timers	Chapter 1 and 4 (RPI)	X-Ray imaging system part I worksheet due 09/21 @ 11:59pm
Wednesday Sept 22, 2021	X-RAY IMAGING SYSTEM PART II: The X-Ray tube	Chapter 5 (RPI)	X-Ray imaging system part II worksheet due 09/26 @ 11: 59 pm 10 test questions due 09/26 @ 11:59pm

DATE	LECTURE	CHAPTER READINGS	ASSIGNMENTS
Monday Sept. 27, 2021	X-RAY PRODUCTION AND EMISSION PART I: Target interactions Emission spectrum	Chapter 6 (RPI)	X-Ray production and emission part I worksheet due 09/28 @ 11:59pm
Wednesday Sept. 29, 2021	X-RAY PRODUCTION AND EMISSION PART II: X-ray emission Filtration	Chapter 6 (RPI)	X-Ray production and emission part II worksheet due 10/03 @ 11:59pm 10 test questions due 10/03 @ 11:59pm
Monday Oct. 4, 2021	X-RAY INTERACTIONS WITH MATTER PART I	Chapter 7 (RPI)	X-Ray interactions with matter part I worksheet due 10/05 @ 11:59pm
Wednesday Oct. 6, 2021	X-RAY INTERACTIONS WITH MATTER PART II: Estimating Entrance Skin exposure Basic Radiation Protection	Chapter 7 (RPI)	X-Ray interactions with matter part II worksheet due 10/10 @ 11:59pm 10 test questions due 10/10 @ 11:59pm
Monday Oct. 11, 2021	TEST 2	TEST 2	TEST 2
Wednesday Oct. 13, 2021	The PRIME FACTORS: Technical factor selection Image quality factors.	Chapter 11 (RPI) Chapter 4 (DRP)	The Prime Factors worksheet due 10/17 @ 11:59pm 5 test questions due 10/17 @ 11:59pm
Monday Oct. 18, 2021	IMAGE PRODUCTION	Chapter 8 (PRI) Chapter 2 (DRP)	Image production worksheet due 10/19 @ 11:59pm
Wednesday Oct. 20, 2021	BEAM RESTRICTION	Chapter 12 (RPI)	Beam restriction worksheet due 10/24 @ 11:59pm 10 test questions due 10/24 @ 11:59 pm
Monday Oct. 25, 2021	THE GRID AND THE VIRTUAL GRID	Chapter 4 (DRP pg. 36)	The grid worksheet due 10/26 @ 11:59 pm
Wednesday Oct. 27, 2021	THE PATHOLOGY PROBLEM		The Pathology problem due 10/31 @ 11:59 pm 10 test questions due 10/31 @ 11:59pm
Monday Nov. 1, 2021	TEST 3	TEST 3	TEST 3
Wednesday Nov. 3, 2021	DIGITAL IMAGING	Chapter 2 (DRP)	Digital imaging part I worksheet due 11/07 @ 11:59pm

DATE	LECTURE	CHAPTER READINGS	ASSIGNMENTS
Monday Nov. 8, 2021	IMAGE RECEPTORS	Chapter 10 (RPI) Chapter 11 (DRP)	Image receptors worksheet due 11/09 @ 11:59pm 10 questions due 11/09 @ 11:59pm
Wednesday Nov. 10, 2021	DIGITAL IMAGING CHARACTERISTICS	Chapter 9 (RPI) Chapter 3 (DRP)	Imaging characteristic worksheet due 11/14 @ 11:59pm
Monday Nov. 15, 2021	FLUOROSCOPY	Chapter 15 (RPI)	Fluoroscopy worksheet due 11/16 @ 11:59pm 10 questions due 11/16 @ 11:59 pm
Wednesday Nov. 17, 2021	DIGITAL FLUOROSCOPY	Chapter 24 (DRP)	No worksheet
Monday Nov. 22, 2021	MOBILE RADIOGRAPHY AND ADDITIONAL EQUIPMENT	Chapter 16 (RPI)	No worksheet 10 test questions due 11/28@ 11:59pm
Wednesday Nov. 24, 2021	NO CLASS HAPPY THANKSGIVING	NO CLASS HAPPY THANKSGIVING	NO CLASS HAPPY THANKSGIVING
Monday Nov. 29, 2021	AN INTRODUCTION TO CT	Chapter 17 (RPI)	
Wednesday Dec. 1, 2021	Study day	Study day	Study day
Monday Dec. 6, 2021	FINAL EXAM	FINAL EXAM	FINAL EXAM