

South Plains College-Reese Campus
Course Syllabus

COURSE: **RADR 2309.200 (3:3:0), Radiographic Imaging Equipment**

SEMESTER: **Fall 2014**

CLASS TIMES: **TR, 9:30 – 10:45**

INSTRUCTOR: **Stacy Randel, MSRS**

OFFICE: **RC 512B**

OFFICE HOURS: **M-R, 01:00 – 03:00; By appointment**

OFFICE PHONE: **806-716-4928**

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Facebook: The radiologic technology program has a Facebook page at www.facebook.com/spcradiologictechnologyprogram. In addition to the South Plains college websites, this Facebook page will be used to keep students up-to-date on program activities, weather delays, South Plains college announcements and will help with program recruitment. "Liking" the radiologic technology program's Facebook page is not mandatory, nor are personal Facebook accounts in order to access this page.

BlackBoard: Blackboard is an e-education platform designed to enable educational innovations everywhere by connecting people and technology. This education tool will be used in this course throughout the semester.

"South Plains College improves each student's life."

GENERAL COURSE INFORMATION

COURSE DESCRIPTION

This course is a study of the equipment and physics of x-ray production, basic x-ray circuits and the relationship of equipment components to the imaging process.

STUDENT LEARNING OUTCOMES

The student will:

1. Identify the components of a basic x-ray circuit and explain their role in x-ray production.
2. Identify the components of a fluoroscopic unit and explain their function.
3. Identify the components of various digital radiography systems and explain their function.
4. Differentiate between conventional and digital radiography systems.
5. Identify the essential quality control tests for radiographic, fluorographic and tomographic systems.

COURSE OBJECTIVES

The student will:

1. Differentiate between electrostatics and electrodynamics.
2. List the laws of electrostatics.
3. Identify and differentiate between series, parallel and compound electric circuits.
4. Apply Ohm's Law and the rules for series and parallel electric circuits.
5. Define direct current and alternating current.
6. Define the terms associated with magnetism and electromagnetism.

7. List the laws of magnetism.
8. Identify the laws of electromagnetic induction.
9. Identify the components of an electric generator, electric motor and transformer and describe their function.
10. Identify the components of the x-ray circuit and describe their function
11. Identify the components of a beam restricting devices and radiographic grids.
12. Identify the characteristics of a diagnostic radiographic image.
13. Adjust the appropriate technical factor to produce a diagnostic radiographic image.
14. Identify the Quality Assurance procedures and acceptable parameters for specific parts of the x-ray imaging system, fluoroscopic imaging system and automatic film processor.

EVALUATION METHODS

The course grade will be determined by a combination major exams and a comprehensive final exam. The following guidelines will be followed regarding exams:

- The student is expected to complete a major exam at the scheduled time. **Make-up major exams will not be given.**
- If one major exam is missed for any reason, the percentage value of that exam is added to the weight of the final exam grade. Any additional missed major exam will result in a zero being recorded for the missed exam.
- A student arriving late for a major exam will not be allowed to take the exam if any student has completed the exam and left the classroom.
- All major exams must be completed within the designated class time.
- Major exams will be returned to the student to be corrected in class. One-fourth credit will be awarded for each successful correction and added to the original grade.
- A comprehensive final exam will be given during the time designated by South Plains College. This exam will not be corrected for additional points.
- **Cell phones cannot be used as calculators during class.** No exceptions.
- It is the responsibility of the student to bring an appropriate calculator to class. **Students will not be allowed to share calculators during any exam.**

ACADEMIC INTEGRITY

It is the aim of the faculty of South Plains College to foster a spirit of complete honesty and a high standard of integrity. The attempt of any student to present as his or her own any work which he or she has not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offender liable to serious consequences, possibly suspension.

Cheating - Dishonesty of any kind on examinations or on written assignments, illegal possession of examinations, the use of unauthorized notes during an examination, obtaining information during an examination from the textbook or from the examination paper of another student, assisting others to cheat, alteration of grade records, illegal entry or unauthorized presence in the office are examples of cheating. Complete honesty is required of the student in the presentation of any and all phases of coursework. This applies to quizzes of whatever length, as well as final examinations, to daily reports and to term papers.

Plagiarism - Offering the work of another as one's own, without proper acknowledgment, is plagiarism; therefore, any student who fails to give credit for quotations or essentially identical expression of material taken from books, encyclopedias, magazines and other reference works, or from themes, reports or other writings of a fellow student, is guilty of plagiarism.

SCANS and FOUNDATION SKILLS

Scans and foundation skills are identified for specific course objectives. A complete list explaining these skills is attached to the back of the syllabus for your information.

SPECIFIC COURSE INFORMATION

TEXT AND MATERIALS

Bushong, Stewart C. Radiologic Science for Technologists. 9th Edition. 2008. Elsevier/Mosby.

ATTENDANCE POLICY

Class attendance is mandatory. Policies regarding absences coincide with those established for South Plains College as outlined in the SPC General Catalog.

It is important that the student take class attendance very serious, in order to make it possible to complete the course objectives. It is extremely important that students arrive for class on time. Tardiness disrupts the instructor and the other students. **Students with perfect attendance will be awarded 2 points to their final grade at the end of the semester.**

CLASSROOM PARTICIPATION

Attending class regularly will provide the student opportunity to supplement their reading assignments and acquire a better understanding of the course material. Class time missed will result in information gaps and will increase course difficulty. It is the student's responsibility to attend class which will enable him or her to take notes, ask questions, and participate in class discussions. Copies of PowerPoint presentations will not be given out. Information handouts may be given in certain instances, but the student should not rely on them. The student is encouraged to take adequate notes during class. Recording class is permitted.

ASSIGNMENT POLICY

The student is responsible for being prepared for class, which means reading the assigned chapters and/or pages from the textbook prior to class. In some instances, information from the reading assignments not covered during class may be included on an exam.

REVIEW

Time is limited and the amount of information that must be covered during class is significantly large. Therefore, classroom time will not be used for extensive review. If a student needs assistance with reviewing information for a test, the student is encouraged to make an appointment with the instructor.

COMMUNICATION POLICY

Electronic communication between instructor and students in this course will utilize the South Plains College email system. Instructor will not initiate communication using private email accounts. Students are encouraged to check SPC email on a regular basis.

GRADING RUBRIC - Grades in this course will be determined using the following criteria:

Assessment Tool	Assessment Criteria	Percentage Score	Grade
MAJOR EXAMS 50%	✓ Exceptional unit content knowledge & understanding	91 – 100	A
	✓ Good unit content knowledge & understanding	83 – 90	B
	✓ Average unit content knowledge & understanding	75 – 82	C
	✓ Unacceptable unit content knowledge & understanding	0 – 74	F
FINAL EXAM 50%	✓ Exceptional course content knowledge & understanding	91 – 100	A
	✓ Good course content knowledge & understanding	83 – 90	B
	✓ Average course content knowledge & understanding	75 – 82	C
	✓ Unacceptable unit content knowledge & understanding	0 – 74	F

Course Grade: A 91 – 100
 B 83 – 90
 C 75 – 82
 F 0 – 74

A grade average of C (75) must be maintained in all RAD TECH classes. Failure to do so will result in the student being dropped from the Program.

STUDENT CONDUCT

Students in this class are expected to abide by the standards of student conduct as defined in the SPC Student Guide pages 11-14.

CELL PHONES

Cell phone use, including text messaging, is not allowed during class. Cell phones are to be turned **OFF** during scheduled class periods, unless prior approval has been given from the instructor. Cell phones are to be used **OUTSIDE** the classroom only. **STUDENTS THAT FLAGRANTLY IGNORE THIS POLICY WILL BE DROPPED FROM CLASS.**

ACCOMMODATIONS

DIVERSITY STATEMENT

In this class, the teacher will establish and support an environment that values and nurtures individual and group differences and encourages engagement and interaction. Understanding and respecting multiple experiences and perspectives will serve to challenge and stimulate all of us to learn about others, about the larger world and about ourselves. By promoting diversity and intellectual exchange, we will not only mirror society as it is, but also model society as it should and can be.

DISABILITIES STATEMENT

ADA Statement

Students with disabilities, including but not limited to physical, psychiatric, or learning disabilities, who wish to request accommodations in this class should notify the Disability Services Office early in the semester so that the appropriate arrangements may be made. In accordance with federal law, a student requesting accommodations must provide acceptable documentation of his/her disability to the Disability Services Office. For more information, call or visit the Disability Services Office through the Guidance and Counseling Centers at Reese Center (Building 8) [716-4606](tel:716-4606), or Levelland (Student Services Building) [716-2577](tel:716-2577).

COURSE OUTLINE

FUNDAMENTALS OF RADIOLOGIC PHYSICS

The student will:

1. Identify the base quantities and their units of measure.
2. Differentiate between the MKS and International systems of units.
3. Identify the derived quantities and special quantities of radiologic science.
4. Identify the nine categories of mechanics and their units of measure.

Text Assignment: Bushong, Ch. 2

THE STRUCTURE OF MATTER

The student will:

1. Identify the three principle particles of an atom and their properties.
2. Identify the nucleons of an atom.
3. Describe the arrangement of atomic particles within the atom.
4. Identify the atomic number of an element when given the number of protons of that atom. (C7)
5. Calculate the atomic mass number of an element when given the number of protons and neutrons within the nucleus. (C7;F3,10,12)
6. Calculate the number of neutrons within a nucleus when given the atomic number and atomic mass number of an element. (F3,10,12)
7. Differentiate between centrifugal and centripetal force.
8. Use scientific element notation to communicate the atomic symbol, atomic number, atomic mass number and valence of a given element. (C5)
9. Define isotope, isobar, isotone and isomer.
10. Identify groups of isotopes, isobars and isotones when given a selection of different elements. (C5,6)

ELECTRICITY, MAGNETISM & ELECTROMAGNETISM

The student will:

1. Define *electrostatics*.
2. Identify the methods of electrification.
3. Identify the unit of measure for *electric charge*.
4. Identify the laws of electrostatics.
5. Identify Coulomb's Law.
6. Identify the unit of measure for *electric potential*.
7. Define *electrodynamics*.
8. Identify the unit of measure for *electric current*.
9. Define and differentiate between superconductor, conductor, semiconductor and insulator.
10. Identify typical materials used as a superconductor, conductor, semiconductor and insulator.
11. Identify and describe the elements of a basic electric circuit.
12. Differentiate between electron flow and conventional electric current. (F10)
13. Identify the unit of measure for *electrical resistance*.
14. Identify the factors and explain how they affect electrical resistance.
15. State *Ohm's Law*.
16. Differentiate between a series, parallel and compound electric circuit. (F10)
17. Calculate the resistance, current and/or electric potential of an electric circuit using Ohm's law and the rules for parallel and series circuits. (F3,10,12)
18. Identify the unit of measure for *power*.
19. Calculate the power of an electric circuit. (F3,10,12)
20. Compare the sine curves of direct and alternating electric currents. (F10)
21. Explain the atomic nature of magnetism. (F10)
22. State the laws of magnetism.
23. Describe a magnetic field.
24. Identify the characteristics of magnetic lines of force (magnetic flux).
25. Differentiate between magnetic permeability and retentivity. (F10)
26. Classify materials according to their magnetic properties.
27. Define magnetic force.
28. Identify the units of measure for the total number of magnetic flux lines and magnetic field strength (intensity).
29. Define *electromagnetism*.
30. Differentiate between a helix, solenoid and an electromagnet. (F10)
31. Describe *electromagnetic induction*.
32. State *Faraday's Law* and *Lenz's Law*.
33. Identify the factors that affect the magnitude of an induced current.
34. Differentiate between mutual induction and self-induction.
35. Define *inductive reactance* and identify its unit of measure.
36. Define *impedance*.
37. Apply *Fleming's Hand Rules of Electromagnetics* in identifying the electron flow and magnetic field of a current carrying wire.
38. Identify the components and function of an electric generator.
39. Identify the components and function of an electric motor.
40. Differentiate between an alternating current and direct current generator and motor. (F10,12)
41. Identify the use of an induction motor in the x-ray machine.
42. Identify the components and function of an electromagnetic transformer.
43. Differentiate between the different types of transformer construction. (F10,12)
44. Identify and explain the various types of power loss in a transformer.
45. Differentiate between a step-up transformer, step-down transformer and an autotransformer. (F10,12)
46. Calculate problems using the Transformer Law formula. (F3)

47. Describe and explain the function of a *capacitor*.
48. Identify the unit of measure for *capacitance*.
49. Calculate capacitance.
50. Define *time constant* of a capacitor.
51. Calculate the *time constant* of a capacitor.
52. Define *capacitive reactance* and its unit of measure.

Text Assignment: Bushong, Ch. 5

THE X-RAY IMAGING SYSTEM

The student will:

1. Identify the controls and meters of the operating console positioned outside the x-ray examination room.
2. Define *line voltage*.
3. Describe the purpose of *line voltage compensation*.
4. Explain the function of the *autotransformer* in the x-ray circuit.
5. Identify the various exposure timers used in x-ray circuits and their methods of operation.
6. Identify the components of the high-voltage generator.
7. Explain the function of the high voltage transformer in the x-ray circuit.
8. Define rectification.
9. Identify the two types of rectifiers available for x-ray circuits.
10. Identify the construction of a solid-state rectifier.
11. Predict the results of various combinations of defective rectifiers in an x-ray circuit (F9-12;C15,16)
12. Trace the path of electron flow during the positive and negative half-cycles using a schematic of a full-wave, single-phase rectification x-ray circuit. (F10)
13. Identify and describe the components of the filament circuit and the role each plays in x-ray production. (F10)
14. Differentiate between single-phase, three-phase, high-frequency and capacitor discharge generators. (F10,12)
15. Define voltage ripple.
16. Identify and differentiate between the voltage ripples of single-phase, three-phase, high-frequency and capacitor discharge generators. (F10,12)
17. Identify and explain the function of all components of a typical x-ray circuit.
18. Identify the characteristics, advantages and disadvantages of these mobile x-ray units: battery-operated, capacitor-discharge and falling-load. (F10,12)

Text Assignment: Bushong, Ch. 6

THE X-RAY TUBE

The student will:

1. Identify the components of an x-ray tube and describe the function of each in the production of x-rays. (F10,12)
2. Explain how the energy of the resulting x-rays is related to the voltage applied across the x-ray tube electrodes.
3. Differentiate between filament current and tube current. (F10)
4. Explain the relationship between filament current and tube current. (F10,12)
5. Describe the design of stationary and rotating anodes, identifying the advantages and disadvantages of each. (F10,12)
6. Explain the line focus principle.
7. Explain the relationship between the size of the filament and the size of the focal spot. (F12)
8. Explain the effects of the line focus principle on heat capacity and radiographic detail. (F10,12)

9. Describe the cause of anode heel effect and its impact on x-ray beam intensity and optical density. (F12)
10. Identify the purpose of the protective housing of an x-ray tube. (F10)
11. Determine safe technical factors using radiographic rating charts and anode cooling charts. (F1,8-10,12;C5-7, 15,16,18-20)

Text Assignment: Bushong, Ch. 7

RADIOGRAPHIC IMAGING EQUIPMENT REVIEW

The student will:

1. Identify the components of radiographic film/screen systems and explain their function in radiography.
2. Identify the components of cones, cylinders, collimators and grids and explain their function in radiography.
3. Explain the function of mAs. (C16)
4. Identify and explain the effect of optical density on visibility of detail. (F10, F12)
5. Identify and explain the controlling factor for optical density. (F10, F12)
6. Identify and explain the technical factors that affect optical density. (F10, F12)
7. Explain the function of kVp. (F10, F12)
8. Identify and explain the effect of contrast on visibility of detail. (F10, F12)
9. Identify and explain the controlling factor for radiographic contrast. (F10, F12)
10. Identify and explain the technical factors that affect radiographic contrast. (F10, F12)
11. Identify and explain the effect of differential absorption on visibility of detail. (F10, F12)
12. Explain the relationship between SID and radiation intensity (exposure). (C15)
13. Explain the relationship between the alignment of the beam, radiographic object and IR in producing an accurate image. (F10, F12)
14. Evaluate a radiographic image for diagnostic optical densities. (C16)
15. Identify the appropriate change in exposure factors to correct for insufficient or excessive optical density. (F9, C16, C18, C19)
16. Evaluate a radiographic image for diagnostic levels of contrast. (C16)
17. Identify the appropriate change in exposure factors to correct for insufficient or excessive contrast. (F9, C16, C18, C19)
18. Evaluate a radiographic image for diagnostic spatial resolution. (C16)
19. Identify the appropriate change in exposure factors to correct for insufficient spatial resolution. (F9, C16, C18, C19)
20. Evaluate a radiographic image for evidence of distortion. (C16)
21. Identify the appropriate change in exposure factors to correct for image distortion. (F9, C16, C18, C19)

Text Assignment: None

COMPUTED RADIOGRAPHY

The student will:

1. Describe the process of computed radiography (CR).
2. Identify and describe the components of a CR image receptor.
3. Describe photostimulable luminescence (PSL).
4. Identify and describe the process of producing a CR image: exposure, stimulation, reading and erasing.
5. Describe spatial resolution, contrast resolution and radiographic noise related to computed radiography.
6. Identify the sources of image noise in computed radiography.

7. Identify opportunities for patient radiation dose reduction using computed radiography.
8. Identify the recommended radiation exposure for CR.
9. Identify the advantages and disadvantages of CR.

Text Assignment: Bushong, Ch. 25

DIGITAL RADIOGRAPHY

The student will:

1. Identify the advantages of digital radiography over screen-film radiography.
2. Identify the digital radiographic modes.
3. Differentiate between direct digital radiography and indirect digital radiography.
4. Describe the capture, coupling and collection stages of each type of digital radiographic imaging system.
5. Identify the characteristics of a charge-coupled device (CCD).
6. Describe the function, sensitivity and dynamic range of a CCD.
7. Identify the characteristics of scanned projection radiography (SPR).
8. Differentiate between direct and indirect exposure DR imaging systems.
9. Describe the process of image formation using a direct selenium flat panel imaging plate.
10. Describe the process of image formation using an indirect silicon flat panel imaging plate.
11. Describe the construction of direct and indirect cassette-less digital radiography systems.
12. Discuss the use of silicon, selenium, cesium iodide and gadolinium oxysulfide in digital radiography.

Text Assignment: Bushong, Ch. 26

RADIOGRAPHIC EQUIPMENT QUALITY CONTROL

The student will:

1. Identify the essential quality control tests for a radiographic system.
2. Identify the purpose, recommended frequency of test and tolerance limits for the essential quality control tests for radiographic systems.
3. Identify the essential quality control tests for a fluoroscopic system.
4. Identify the purpose, recommended frequency of test and tolerance limits for the essential quality control tests for fluoroscopic systems.
5. Identify the purpose, recommended frequency of test and tolerance limits for the essential quality control tests for tomographic systems.
6. Identify the essential quality control tests for a automatic processing system.
7. Identify the purpose, recommended frequency of test and tolerance limits for the essential quality control tests for automatic processing systems.
8. Identify and describe the QC tests used to evaluate the characteristics of the digital display device.
9. Identify the components of a quality control program for digital display devices.

Text Assignment: Bushong, Ch. 18 & 30

FOUNDATION SKILLS

BASIC SKILLS—Reads, Writes, Performs Arithmetic and Mathematical Operations, Listens and Speaks

- F-1 Reading—locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.
- F-2 Writing—communicates thoughts, ideas, information and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.
- F-3 Arithmetic—performs basic computations; uses basic numerical concepts such as whole numbers, etc.
- F-4 Mathematics—approaches practical problems by choosing appropriately from a variety of mathematical techniques.
- F-5 Listening—receives, attends to, interprets, and responds to verbal messages and other cues.
- F-6 Speaking—organizes ideas and communicates orally.

THINKING SKILLS—Thinks Creatively, Makes Decisions, Solves Problems, Visualizes and Knows How to Learn and Reason

- F-7 Creative Thinking—generates new ideas.
- F-8 Decision-Making—specifies goals and constraints, generates alternatives, considers risks, evaluates and chooses best alternative.
- F-9 Problem Solving—recognizes problems, devises and implements plan of action.
- F-10 Seeing Things in the Mind’s Eye—organizes and processes symbols, pictures, graphs, objects, and other information.
- F-11 Knowing How to Learn—uses efficient learning techniques to acquire and apply new knowledge and skills.
- F-12 Reasoning—discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.

PERSONAL QUALITIES—Displays Responsibility, Self-Esteem, Sociability, Self-Management, Integrity and Honesty

- F-13 Responsibility—exerts a high level of effort and perseveres towards goal attainment.
- F-14 Self-Esteem—believes in own self-worth and maintains a positive view of self.
- F-15 Sociability—demonstrates understanding, friendliness, adaptability, empathy and politeness in group settings.
- F-16 Self-Management—assesses self accurately, sets personal goals, monitors progress and exhibits self-control.
- F-17 Integrity/Honesty—chooses ethical courses of action.

SCANS COMPETENCIES

- C-1 **TIME** - Selects goal - relevant activities, ranks them, allocates time, prepares and follows schedules.
- C-2 **MONEY** - Uses or prepares budgets, makes forecasts, keeps records and makes adjustments to meet objectives.
- C-3 **MATERIALS AND FACILITIES** - Acquires, stores, allocates, and uses materials or space efficiently.
- C-4 **HUMAN RESOURCES** - Assesses skills and distributes work accordingly, evaluates performances and provides feedback.

INFORMATION - Acquires and Uses Information

- C-5 Acquires and evaluates information.
- C-6 Organizes and maintains information.
- C-7 Interprets and communicates information.
- C-8 Uses computers to process information.

INTERPERSONAL—Works With Others

- C-9 Participates as a member of a team and contributes to group effort.
- C-10 Teaches others new skills.
- C-11 Serves Clients/Customers—works to satisfy customer’s expectations.
- C-12 Exercises Leadership—communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.
- C-13 Negotiates—works toward agreements involving exchanges of resources; resolves divergent interests.
- C-14 Works With Diversity—works well with men and women from diverse backgrounds.

SYSTEMS—Understands Complex Interrelationships

C-15 Understands Systems—knows how social, organizational, and technological systems work and operates effectively with them.

C-16 Monitors and Corrects Performance—distinguishes trends, predicts impacts on system operations, diagnoses systems performance and corrects malfunctions.

C-17 Improves or Designs Systems—suggests modifications to existing systems and develops new or alternative systems to improve performance.

TECHNOLOGY—Works with a Variety of Technologies

C-18 Selects Technology—chooses procedures, tools, or equipment, including computers and related technologies.

C-19 Applies Technology to Task—understands overall intent and proper procedures for setup and operation of equipment.

C-20 Maintains and Troubleshoots Equipment—prevents, identifies, or solves problems with equipment, including computers and other technologies.
