COURSE SYLLABUS

Department: Radiologic Technology

Course Title: Radiation Biology and Protection

Section Name: RADR 1313

Start Date: 01/18/2011

End Date: 05/14/2011

Modality: FACE-TO-FACE

Credits: 3

Instructor Information

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Course Description

Radiographic image quality and the effects of exposure variables. An introduction to radiographic image qualities and the effects of exposure variables upon these qualities. The student will define, recognize, and evaluate qualities of the radiographic image; and analyze the effects of exposure variables upon each image quality. Also includes an introduction to computed and digital radiography. Lab fee required.

Prerequisites/Corequisites

Prerequisite: RADR 2309. Corequisites: RADR 1366, RADR 2305 and RADR 2431

SCANS

1, 2, 3, 6, 7, 9, 11

Course Objectives

Define, identify, and evaluate qualities of the radiographic image; and analyze the effects of exposure variables upon each image quality.

COURSE COMPETENCIES

1XRA.18.00 IDENTIFY/DEFINE RADIATION SCIENCE TERMS
1XRA.18.01 Given specific diagnostic imaging terms/procedures, define the terms/procedures.
1XRA.18.02 Given specific diagnostic imaging terms, identify/locate the places where procedures are performed.

1XRA.60.00 COMPETENTLY DISCUSS/MANIPULATE RADIOGRAPHIC DENSITY
1XRA.60.01 Define radiographic density.
1XRA.60.02 Identify the acceptable range of radiographic density.
1XRA.60.03 Analyze relationships of factors affecting radiographic density.

1XRA.61.00 COMPETENTLY DISCUSS MANIPULATE RADIOGRAPHIC CONTRAST
1XRA.61.01 Define radiographic contrast.
1XRA.61.02 Differentiate between subject contrast and film contrast.
1XRA.61.03 Analyze relationships of factors affecting radiographic contrast.

1XRA.62.00 COMPETENTLY DISCUSS/MANIPULATE RECORDED DETAIL
1XRA.62.01 Define recorded detail.
1XRA.62.02 Differentiate between umbra and penumbra.
1XRA.62.03 Analyze relationships of factors affecting recorded detail

1XRA.63.00 CONTROL DISTORTION
1XRA.63.01 Define distortion.
1XRA.63.02 Differentiate between shape distortion and size distortion.
1XRA.63.03 Analyze between relationships of factors affecting exposure latitude.

1XRA.64.00 EXPLAIN/MANIPULATE EXPOSURE LATITUDE
1XRA.64.01 Define exposure latitude.
1XRA.64.02 Analyze relationships of factors affecting exposure latitude.

1XRA.65.00 DISCUSS/USE BEAM LIMITING DEVICES
1XRA.65.01 List the types of beam limiting devices and describe the operation and application for each.
1XRA.65.02 Explain purposes of beam limiting devices in terms of patient dosage, scattered radiation production, radiographic density and contrast.

1XRA.66.00 DISCUSS/EMPLOY BEAM FILTRATION
1XRA.66.01 Define beam filtration
1XRA.66.02 Explain purposes of beam filtration in terms of patient dosage, scattered radiation production, radiographic density, and contrast.

1XRA.67.00 DISCUSS/CONTROL SCATTERED AND SECONDARY RADIATION
1XRA.67.01 Define scattered and secondary radiation.
1XRA.67.02 Describe interactions of x-rays with matter which produce scattered and secondary radiation.
1XRA.67.03 Analyze relationships of factors affecting scattered and secondary radiation.
1XRA.67.04 Discuss effects of scattered and secondary radiation in terms of patient dosage, image quality, and occupational exposure.

1XRA.68.00 DISCUSS/CONTROL EXIT RADIATION
1XRA.68.01 Explain the relationship between kVp and scattered and secondary radiation.
1XRA.68.02 Describe a grid in terms of its purpose, components, and construction.
1XRA.68.03 Differentiate among types of grids.
1XRA.68.04 Analyze grid efficiency in terms of grid ratio and frequency.
1XRA.68.05 Given technical information, select an appropriate grid.
1XRA.68.09 Explain the relationship between beam limitation and scattered/secondary radiation.

1XRA.69.00 EXPLAIN/DEMONSTRATE/USE EXPOSURE SYSTEMS
1XRA.69.01 Explain the purpose of an exposure system in terms of standardization of exposure and image consistency.
1XRA.69.02 Discuss considerations involved in exposure selection.
1XRA.69.03 Distinguish among various types of exposure systems.

1XRA.70.00 CALCULATE EXPOSURES
1XRA.70.01 Analyze relationships of exposure factors and their effects on exposure calculations.
1XRA.70.02 Given exposure factors, calculate the photographic effect.
1XRA.70.03 Given exposure problems, calculate penumbra, magnification factor, and percent magnification.
1XRA.70.04 Apply mAs reciprocity in clinical stimulations.

1XRA.71.00 DISCUSS/EXPLAIN PROCESSING AREA CONSIDERATIONS
1XRA.71.03 Describe the operation and utilization of day light processing.

1XRA.73.00 EXPLAIN CHARACTERISTICS OF FILMS UTILIZED IN RADIOGRAPHIC PROCEDURES
1XRA.73.01 Given cross-sectional diagrams of radiographic film, label the components, and describe the structure and function of each component.
1XRA.73.02 Define properties of radiographic film and analyze the influence of each on the resultant image.
1XRA.73.03 Relate properties of radiographic film to specific procedure applications.
1XRA.73.04 Define latent image formation.
1XRA.73.05 Explain how sensitization specks contribute to latent image formation.

1XRA.74.00 DISCUSS/EMPLOY FILM HOLDERS AND INTENSIFYING SCREENS
1XRA.74.01 Discuss various film holders in terms of purpose, construction, application, patient dosage, loading/unloading and maintenance.
1XRA.74.02 Explain the construction and purpose of intensifying screens.
1XRA.74.03 Describe the principles and function of intensifying screens.
1XRA.74.04 Explain classification of intensifying screens and the applications of each.

1XRA.75.00 EXPLAIN/EMPLOY AN AUTOMATIC PROCESSOR
1XRA.75.01 Discuss the purpose of the automatic processor.
1XRA.75.02 Given cross-sectional diagrams of automatic processors, label the components and explain the function of each.
1XRA.75.03 Describe systems of the automatic processor and functions of each.
1XRA.75.04 Given various types and sizes of film, demonstrate how each is fed into the processor.
1XRA.75.05 Explain the components of the processing cycle providing the specific action and duration of time for each component.

2XRA.05.00 DISCUSS/IMPLEMENT IMAGING STANDARDS
2XRA.05.01 *List the elements of a diagnostic image that are necessary for film critique.
2XRA.05.02 *Identify the steps in the decision making process.

2XRA.05.03 *Describe an effective film critique method.
2XRA.05.04 *Describe the role of the radiographer in film critiquing.

2XRA.06.00 EXPLAIN/DEMONSTRATE MANIPULATION OF TECHNICAL FACTORS
2XRA.06.01 *Explain the process for evaluating radiographs for adequate density, contrast and scale of contrast.
2XRA.06.02 *Explain how the radiographer determines if adequate penetration is present along with subject contrast.
2XRA.06.03 *List the parameters for evaluating visibility of detail on radiographs.
2XRA.06.04 *Describe how the degree of image distortion may be evaluated.
2XRA.06.05 *Explain possible cause for proper distortion.

2XRA.07.00 DISCUSS PROCEDURAL FACTORS
2XRA.07.01 *Describe the importance of proper positioning.
2XRA.07.02 *Describe how properly preparing a patient affects the quality of the image.
2XRA.07.03 *Describe/demonstrate the method for assessing beam restriction.

2XRA.22.00 DISCUSS/IDENTIFY THE NEED FOR RADIATION PROTECTION
2XRA.22.01 *Identify and justify the need to minimize unproductive radiation exposure of humans.

2XRA.26.00 DISCUSS THE NEED FOR/PROMOTE PATIENT PROTECTION
2XRA.26.01 Explain the relationship of beam limiting devices to patient radiation protection.
2XRA.26.02 Discuss added and inherent filtration in terms of the effect on patient dosage.
2XRA.26.06 Explain the relationship of exposure factors to patient dosage.
2XRA.26.07 Given various radiographic procedures, state the desired film/screen combination that will result in an optimum diagnostic image with the minimum radiation exposure.

2XRA.27.00 DESCRIBE/EMPLOY PRACTICAL RADIATION PROTECTION MEASURES
2XRA.27.11 Demonstrate how time, distance and shielding can be manipulated to keep radiation exposures to a minimum.
2XRA.27.12 Perform calculations of exposure with varying time, distance and shielding.
2XRA.27.13 Discuss the relationship between half-value layer and shielding design.
2XRA.27.14 Identify emergency procedures to be followed during failures of x-ray mechanisms.

2XRA.28.00 DESCRIBE/DIAGRAMMATICALLY REPRESENT CELL STRUCTURE, CLASSIFICATION AND FUNCTION AND RADIATION EFFECTS ON CELLS
2XRA.28.07 Distinguish between ionizing and non-ionizing radiations.
2XRA.28.08 Identify sources of electromagnetic and particulate ionizing radiations.
2XRA.28.11 Identify sources of radiation exposure.

Required Readings/Materials

You must purchase the following required readings/materials:

Radiation Protection in Medical Radiography, Sherer/Visconti/Ritenour, 6th Ed.
Radiation Protection in Medical Radiography Workbook, Sherer/Visconti/Ritenour, 6th Ed.

Course Requirements (Lectures, Assignments and Assessments)

A. Regular and punctual attendance at all class lectures.
B. Read and discuss textbook assignments and outside readings when they are assigned.
C. Complete all course assignments to include worksheets, laboratory exercises, written papers, examinations, etc.
D. Demonstrate proficiency of the requirements set forth in this course by attainment of a grade "C" or better.

METHOD OF EVALUATION

Grading Criteria	Weight of Course Requirements
A - 93-100	30% - Chapter Tests/Assignments
B - 84-92	20% - Miscellaneous
C - 75-83	20% Lab Final
	30% - Final Exam

ATTENDANCE POLICY

Student attendance at every class, lab and clinical practicum is expected. Students shall be prompt to class and clinical practicums. Points will be deducted from a student's final course grade for absences. (1-2 abs = 1 pt each; 3-5 abs = 2 pt. each; 6-7 abs = 4 pts. each) A student is considered absent if more than 10 minutes late to lecture or lab or more than 2 hours late for a clinical practicum. Four (4) or more absences will constitute an administrative drop.

ACADEMIC ETHICS:

You are expected to complete your own assignments and take tests without notes or other outside assistance. ALL WORK IS EXPECTED TO BE YOUR OWN. If unethical behavior is detected, ALL parties involved will be denied points for that project or exam. The questioned material and a report of the ethics violation will be submitted to the department chair for further action as deemed necessary by the department chair. Unethical behavior including dishonesty (cheating) on any work can be reason for dismissal from the class and ultimately the Program.

Statement of Academic Dishonesty

Ethics, Cheating and Plagiarism

"Using someone else's ideas or phrasing and representing those ideas of phrasing as our own, either on purpose or through carelessness, is a serious offense known as plagiarism. "Ideas or phrasing" includes written or spoken material, of course, from whole papers and paragraphs to sentences, and indeed, phrases. But it also includes statistics, lab results, art work, etc. "Someone else" can mean a professional source, such as a published writer or critic in a book, magazine, encyclopedia, or journal; an electronic resource such as material we discover on the World Wide Web; another students at our school or anywhere else; a paperwriting "service" (online or otherwise), which offers to sell written papers for a fee." (statement taken from http://webster.commnet.edu/mla/plagiarism.shtml)

STUDENT ASSISTANCE

The following resources are available to assist you in successful completion of this course:

A. In the LRC - Audiovisual materials from LRC presented during course.

B. **Smarthinking** (http://Smarthinking.com)
Smarthinking Provides live, online, on-demand tutoring and writing assistance to Odessa College students in **Mathematics (Basic Skills - Calculus II), Writing, General Chemistry, Organic Chemistry, Physics, Biology, Introduction to Human Anatomy and Physiology, Accounting, Economics, Introductory Finance, Spanish and Statistics.**
Keep in mind that the Success Center still has 7 outstanding tutors for in-house face-to-face tutoring sessions.

C. Instructor Assistance - Instructor office hours are posted on their office doors. Instructors are available during these hours to assist students. Some office hours are at the college while others are at clinical affiliates.

SPECIAL NEEDS STATEMENT

Special Needs: Odessa College complies with Section 504 of the Vocational Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. If you have any special needs or issues pertaining to your access to and participation in this or any other class at Odessa College, please contact Becky Rivera-Weiss in the Office of Disability Services at 432-335-6861 to request assistance and accommodations.

IMPORTANT NOTES

The final examination is a comprehensive examination based on the ARRT format.

MISSED EXAMINATIONS

Students will be allowed to make up tests; however, 10 points will be deducted for each class day a student fails to schedule and complete the examination. It is the student's responsibility to schedule the retake with regards to the instructor's schedule.

COMPUTER PROGRAMS AVAILABLE IN CT 216 (COMPUTER LAB)

Radiologic Physics, Mosby, 1998 MCD
Challenge, Radiographic Physics, Corectec, 2009
Radiographic Imaging, Mosby, 1998 MCD
Radiographic Quality, Radiographic Density, Radiographic Contrast, Radiographic Recorded Detail and Distortion, Challenge, Equipment, Patient Care, Anatomy and Positioning, Radiation Biology and Protection, and Radiographic Imaging, Corectec, 2009 MCD
Simulated X-Ray Machine, MCD, Rems
Simulated CR Machine, MCD, Rems
Simulated PACS, MCD, Rems

Summary of Assignments & Activities

Item (Name)	Type	Description
Chapter 6: The X-ray Imaging System The imaging system for a diagnostic radiographic machine is covered in detail. Each component is identifed by location and function. Various types of equipment are compared in regards to efficiency of x-ray production.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapter 7: The X-Ray Tube The protective housing and the cables of the x-ray machine are identified as to location, composition and function. Each part and function of the x-ray tube is discussed in depth. A differentiation is made between focal spot and focal tract and actual and effective focal spot size. Anode heel effect is also discussed.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapters 6 and 7		Quiz
Chapter 8: X-Ray Production Explains the interactions of the projectile electrons that are accelerated from the cathode to the anode of the x-ray tube. Those interactions produce two types of x-rays - characteristic and Bremsstrahlung; these are described by the x-ray emission spectrums, continuous and discrete. Various conditions that affect the x-ray emission spectrum are discussed.		
Chapter 9: X-Ray Emission Discusses the numerous factors that affect x-ray beam quantity and quality.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapters 8 and 9		Quiz
Chapter 10 X-Ray Interaction With Matter The five ways x-rays interact with matter are explained. Coherent and Compton scatter, photoelectric effect, pair production and photo-disintegration are discussed step by step. Only the Compton and photoelectric effects are important in diagnostic radiology; the conditions that govern these two interactions control differential absorption, which determines the degree of contrast of an x-ray image made using film-screen image receptors. The factors governing these two interactions are presented with explanations.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapter 10		Quiz
Chapter 11 Radiographic Film Discusses the construction and various types of radiographic film, the use of x-rays to form a latent image, and tips for handling and storing radiographic film.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapter 12: Processing the Latent Image Discusses automatic film processor design and use, as well as alternative processing methods.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapters 11 and 12		Quiz

Chapter 13: Radiographic Intensifying Screens Discusses the components a radiographic intensifying screen, how these components contribute to a screen's performance characteristics, the properties of rare Earth screens, and the importance of spectral matching.		
Chapter 14: Control of Scatter Radiation Discusses two devices employed to control scatter radiation. Also covers contrast and contrast resolution, factors that contribute to increased scatter, and spatial resolution.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapters 13 and 14		Quiz
Chapter 15: Radiographic Technique Four primary exposure factors and properties of the x-ray imaging system that influence the selection of those exposure factors are reviewed to include focal-spot size, total filtration, and the source of high voltage generation. Includes discussion of conventional tomography and magnification radiography.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapter 16: Image Quality The selection of radiographic technique factors is discussed.	Lecture/Discussion of Key Points	Complete Worksheets & Review Questions
Chapters 15 and 16		Quiz
Chapter 21: Fluoroscopy Presents basic principles of fluoroscopic imaging with special emphasis on the image intensifier tube.		
Chapter 21		Quiz
Final Examination		Comprehensive