



BROWARD COLLEGE

COURSE OUTLINE

LAST REVIEW: 2010-2011 **NEXT REVIEW:** 2015-2016 **STATUS:** A

COURSE TITLE: Introduction to Radiologic Technology

COMMON COURSE NUMBER: RTE 1000

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN

CLOCK HOURS:

Lecture: 48 Lab:

Clinic: Other:

PREREQUISITE(S): Program Admission

COREQUISITE(S):

PRE/COREQUISITE(S): RTE 1111, RTE 1503, RTE 1503L, RTE 1804

COURSE DESCRIPTION: The organization and operation of a Radiology Department; radiographic topics to include: x-ray equipment operation, historical aspects of radiography, department organizational structure, safety, radiation protection, imaging media and receptors, image processing techniques, basic exposure factors, and accreditation and professional development.

UNIT TITLES

1. Basic Radiographic Equipment Operation
2. Historical Aspects of Radiography
3. Organizational Structure of a Radiology Department
4. Departmental Safety
5. Radiation Protection
6. Screen-Film Imaging: Film & Intensifying Screens
7. Darkroom & Chemical Film Processing
8. Digital Image Receptors and Image Processing
9. Basic Exposure Factors
10. Professional Development, Professional Organizations, Accreditation and Certification

EVALUATION: Assessment includes assignments, comprehensive/cumulative unit exams, comprehensive/cumulative final exam.

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UNITS

Unit 1 Basic Radiographic Equipment Operation

General Outcome:

- 1.0 The student shall be able to accurately describe the function of all the basic radiographic equipment components involved in the production of a radiographic image.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1** Identify and describe the function of the following radiographic equipment components and accessories:
- X-ray tube assembly, x-ray table, vertical Bucky, and equipment console
 - X-ray tube head movement controls
 - Vertical (SID)
 - Lateral/Horizontal/Transverse
 - Longitudinal
 - Angulation
 - X-ray tube detents
 - Vertical
 - Lateral/Horizontal
 - Table & Vertical Bucky tray movements
 - Vertical Bucky cassette support placement and use
 - Table-top Vs Bucky selector
 - Collimator use
 - Lengthwise adjustment
 - Crosswise adjustment
 - PBL use/override
 - Laser centering light use
 - SID tape measure location and use
 - X-ray tube head column lock and adjustment options
 - IR orientation relative to table-top or vertical Bucky holder

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UNITS

Unit 2 Historical Aspects of Radiography

General Outcome:

2.0 The student shall be able to describe the discovery of x-radiation and discuss the background of radiography.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Describe the discovery of x-ray.
- 2.2 State the date of the discovery of x-ray.
- 2.3 Name the person credited with the discovery of x-ray.
- 2.4 Discuss societal reactions to the discovery of x-radiation.
- 2.5 State "normal" exposure times for early radiography.
- 2.6 Identify the person credited with starting the training for x-ray workers.
- 2.7 Discuss radiation injuries that resulted from early use of x-radiation.
- 2.8 Discuss the kind of equipment used at the time of discovery of x-rays.
- 2.9 Identify prominent individuals involved in the discovery and investigation of radioactive materials.

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Unit 3 Organizational Structure of a Radiology Department

General Outcome:

3.0 The student shall be able to describe the organizational structure of a Radiology Department.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1** List the chain of command in a typical Radiology department.
- 3.2** Discuss the relationship between institutional administrative personnel and radiology services.
- 3.3** Identify other health science professions that participate in the patient's total health care.
- 3.4** List ancillary services (non-technical) in the Radiology department.
- 3.5** List the Departments (specialty areas) in Radiology.
- 3.6** List the common duties/role of a radiographer and a Radiologist.
- 3.7** Discuss the role and value of a mission statement to the operation of an institution.
- 3.8** Discuss the responsibilities and relationships of all personnel in the radiology department.
- 3.9** State the purpose of an organizational/flow chart in a clinic/hospital.
- 3.10** Identify items included in a Procedural Manual in a Radiology Department.

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Unit 4 Departmental Safety

General Outcome:

4.0 The student shall be able to discuss different aspects of safety in the Radiology Department.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1** List three (3) rules for fire prevention.
- 4.2** Describe steps to take to insure patient safety in event of fire.
- 4.3** State to whom a report of accident or incident affecting a patient, visitor or staff member should be made.
- 4.4** Discuss hazards that may occur in the Radiology Department.
- 4.5** Identify practices aimed at prevention of accidents in the Radiology department.
- 4.6** Describe how to recognize and report safety hazards.
- 4.7** Identify Florida State Law Requirements for equipment testing and radiation protection in the Radiology Department; and reasons for necessity of such laws.
- 4.8** Discuss reasons for radiation personnel monitoring in the Radiology Department.
- 4.9** Define/explain the acronyms: OSHA, JCAHO, CDC and FDA and state their function.
- 4.10** Discuss the proper method of waste disposal for infection control.
- 4.11** Explain what is meant by "disaster plan"; and identify reasons for its implementation.
- 4.12** Explain the principle of "risk management."
- 4.13** Explain the fire response acronym RACE, stating what each letter represents.
- 4.14** List the three types of fire extinguishers: state the type used for electrical fires.
- 4.15** List five (5) emergency codes used in hospitals to alert employees of such events, e.g. "Dr. Red", "code blue", etc.

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Unit 5 Radiation Protection

General Outcome:

5.0 The student shall be able to discuss basic radiation protection practices.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1** Define Rad, Rem, Roentgen, Curie, Grey and Sievert.
- 5.2** State the purposes of filtration and list minimum amounts required by law.
- 5.3** Discuss the purpose of beam limiting devices.
- 5.4** Explain the purpose and importance of patient shielding devices.
- 5.5** Identify which radiographic examinations should include gonadal shielding.
- 5.6** Identify who should be shielded during radiographic examination.
- 5.7** List and describe three (3) types of available personnel shielding devices.
- 5.8** Describe the effect that repeat radiographs have on patient absorbed dose.
- 5.9** List five (5) radiation protection measures.
- 5.10** List radiation protection devices available in the Radiology Department for routine and fluoroscopic procedures.
- 5.11** Discuss the purpose of personnel monitoring devices.
- 5.12** Describe annual dose limit and compare it to cumulative dose limit.
- 5.13** Discuss the dose-limiting recommendations for occupational workers, general populations, individuals under 18 years of age, and pregnant technologists.
- 5.14** Compare Skin Entrance Exposure (SEE) and Effective Dose (ED).
- 5.15** State the cardinal principles of radiation protection.

- 5.16** Differentiate between natural background radiation and artificial radiation; give two examples of each.
- 5.17** State the function of the National Council on Radiation Protection and Measurements (NCRP).
- 5.18** State the required minimum amount of lead equivalent in aprons, gloves, primary and secondary barriers.
- 5.19** Determine exposure factors to achieve optimum radiographic techniques with minimal radiation exposure to the patient.
- 5.20** Summarize the rules for specific area shielding.
- 5.21** Define the acronym ALARA and explain its application in Radiography.
- 5.22** Compare fluoroscopy exposure rates with conventional x-ray exposure rates.
- 5.23** Compare conventional screen-film exposure dose with digital imaging exposure dose.

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UNITS

Unit 6 Screen-Film Imaging: Film & Intensifying Screens

General Outcome:

- 6.0 The student shall be able to describe the properties and characteristics of Radiographic film and the properties and characteristics of intensifying screens and cassettes.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1** List the components of film and state the function of each.
- 6.2** Differentiate between screen/non-screen films.
- 6.3** Define the properties of film i.e., speed, latitude, detail, and contrast.
- 6.4** Discuss proper film handling technique.
- 6.5** List the most common sizes of film and be able to identify each.
- 6.6** Explain the principle of latent image formation.
- 6.7** Define entrapment, migration and sensitization speck as they relate to latent image formation.
- 6.8** Describe the test for poor film/screen contact utilizing the wire mesh.
- 6.9** Define sensitometry and state its purpose.
- 6.10** List the parts of a sensitometric (characteristic) curve.
- 6.11** Recognize on a chart, a film with the greatest speed and highest contrast.
- 6.12** Explain how the speed of film can be increased/decreased.
- 6.13** Explain the effect of increasing film speed on recorded detail.
- 6.14** Identify the common different types/speeds of film.

- 6.15 Differentiate between films used with blue or green light-emitting screens.
- 6.16 Explain how film contrast, speed and detail may be changed during manufacture.
- 6.17 Define base fog and base density; state the source of each.
- 6.18 Define/describe the terms grain, speed, and contrast as they relate to film.
- 6.19 Explain how improper film care/handling will affect radiographic quality.
- 6.20 List the purpose of cassettes and screens.
- 6.21 Describe the construction of cassettes & screens and state the purpose of each component.
- 6.22 State the advantages of intensifying screens over non-screen imaging.
- 6.23 Identify/explain the characteristics/properties of screens i.e., quantum mottle, fluorescence, phosphorescence, screen lag, crossover, etc.
- 6.24 Explain what is meant by poor screen contact, how it is produced and detected.
- 6.25 List the various common screen speeds.
- 6.26 Calculate technique when changing from one screen speed to another i.e., par (100) to high (400) speed.
- 6.27 State the proper handling and care of film holders and screens.
- 6.28 Draw and label a cross-section of a loaded cassette.
- 6.29 Explain the factors that determine screen speed.
- 6.30 Differentiate between blue-light and green-light emitting screens.
- 6.31 State the different phosphors used in intensifying screens.
- 6.32 Explain the effect of the screen phosphors on recorded detail.
- 6.33 Explain how speed/detail is altered for different intensifying screens.
- 6.34 Describe the effect of screen speed on radiographic density and recorded detail.
- 6.35 Explain how/why changing phosphor size, concentration, and thickness will affect radiographic quality.
- 6.36 Explain which technical exposure factors will have an effect on intensity (brightness) of

screen fluorescence (speed).

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Unit 7 Darkroom & Chemical Film Processing

General Outcome:

7.0 The student shall be able to describe the general design of darkrooms and identify darkroom/processing technique, including the steps in automatic processing.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1** List and describe three (3) types of darkroom entrances.
- 7.2** Describe a passbox and explain its purpose.
- 7.3** Describe where passboxes should be located.
- 7.4** Explain the purpose of film bins.
- 7.5** Explain the mechanism of using passboxes.
- 7.6** Explain & describe the construction of the walls, floors & ceiling of the processing room.
- 7.7** Describe the general construction of the processing room.
- 7.8** State the rationale for the processing room walls being lead lined.
- 7.9** Give reason for the room's accessibility to plumbing and electricity.
- 7.10** List two (2) types of filters used for safelights and differentiate between them.
- 7.11** Explain the process for testing a safelight for leaks, cracks, etc.
- 7.12** State the purpose of a safelight and explain how it is made "safe."
- 7.13** Explain the importance of maintaining proper humidity in the darkroom.
- 7.14** Identify three artifacts produced by poor darkroom technique.
- 7.15** Identify three types of "static" and explain how it affects the quality of a radiograph.

- 7.16 Discuss how improper handling and storage of film can cause image artifacts.
- 7.17 Describe daylight-processing and identify differences from non-daylight processing.
- 7.18 List the chemicals in the developer and fixer and state the purpose of each.
- 7.19 List the differences between manual and automatic processing.
- 7.20 List the advantages of automatic vs. manual processing.
- 7.21 State two (2) purposes of the developer and fixer.
- 7.22 State when, in the processing cycle, rinsing occurs.
- 7.23 State reasons for the rinsing process.
- 7.24 Define manifest image; latent image.
- 7.25 List and describe the five (5) interdependent systems of automatic processing.
- 7.26 State the correct temperature for development in automatic processors.
- 7.27 State the correct temperature for film drying in automatic processors.
- 7.28 Define replenishment and state its purpose; explain how it is accomplished.
- 7.29 Describe the correct automatic processing film feeding pattern for each film size.
- 7.30 List the steps for turning on an automatic processor.
- 7.31 List three (3) purposes of the transport system in automatic processing.
- 7.32 Identify various processing problems exhibited on radiographs and explain the cause of each.
- 7.33 Describe the function of the various rollers in the transport system, e.g. master, guide shoe, turnaround assembly.
- 7.34 Explain the importance of cleaning the crossover-rollers daily.
- 7.35 State the purpose of the detector micro-switch on the processors film feed tray.
- 7.36 Explain the purpose of the bell/safe light for proper film feed.
- 7.37 Describe the types of artifacts caused by processor problems.

- 7.38** Identify the advantages of daylight processing over conventional darkroom based chemical processing.

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UNITS

Unit 8 Digital Image Receptors & Image Processing

General Outcome:

8.0 The student shall be able to describe the properties and characteristics of Digital Radiographic imaging media and processing techniques.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1** Define terminology associated with digital imaging systems.
- 8.2** Describe the various types of digital receptors.
- 8.3** Discuss the fundamentals of digital radiography, distinguishing between cassette-based systems and cassette-less systems.
- 8.4** Compare the image acquisition and extraction of cassette-based vs. cassette-less systems, including detector mechanism, initial image processing, histogram analysis, and automatic rescaling and exposure index determination.
- 8.5** Compare dynamic range to latitude of a screen/film receptor system to that of a digital radiography system.
- 8.6** Describe image acquisition precautions necessary for CR imaging.
- 8.7** Describe the response of PSP systems to background and scatter radiation.
- 8.8** Identify common limitations and technical problems encountered when using PSP systems.
- 8.9** Describe the various image processing employed for digital images.
- 8.10** Evaluate the effect of a given exposure change on histogram shape, data width and image appearance.
- 8.11** Describe the conditions that cause quantum mottle in a digital image.
- 8.12** Examine the potential impact of digital radiographic systems on patient exposure and methods of practicing the ALARA concept with digital systems.

8.13 Describe Picture Archival and Communications System (PACS) and its function.

- 8.14** Identify components of a PACS system.
- 8.15** Describe patient benefits gained through the use of teleradiology.
- 8.16** Identify modality types that may be incorporated into a PACS.
- 8.17** Define Accession Number.
- 8.18** Describe Worklist and discuss its correct usage.
- 8.19** Discuss digital imaging and communications in medicine (DICOM).

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UNITS

Unit 9 Basic Exposure Factors

General Outcome:

9.0 The student shall be able to describe the primary exposure factors and discuss their use in producing the radiographic image.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1** Define the prime factors: mA, kV Time, and SID.
- 9.2** List average ranges for mA, kV, and Exposure time.
- 9.3** State source image- receptor distance SID used in radiography.
- 9.4** Define the Radiographic Qualities of Contrast, Density, Detail, and Distortion.
- 9.5** List the primary controlling factor affecting each aspect of Radiographic Quality.
- 9.6** List four (4) secondary factors of Radiographic Quality.
- 9.7** Explain what is meant by the Reciprocity Law; calculate problems using this law.

UNITS

Unit 10 Professional Development, Professional Organizations, Accreditation and Certification

General Outcome:

10.0 The student shall be able to identify areas of specialization and discuss continuing education as it relates to the professional development of the radiographer. The student should also be able to identify various professional organizations that offer membership to radiographers and discuss accreditation, certification and licensure as it relates to the radiographer and the radiography program.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 10.1** Describe the various types of Radiology Programs available to students.
- 10.2** Identify areas of specialization for the graduate radiographer.
- 10.3** Discuss the employment outlook and economic return for the graduate radiographer.
- 10.4** Discuss career advancement and opportunities for the radiographer.
- 10.5** Identify the benefits of continuing education as related to improved patient care and professional enhancement.
- 10.6** List the various organizations offering membership to radiographers.
- 10.7** Differentiate between local, state and national radiologic organizations.
- 10.8** Describe purposes, functions and activities of professional organizations.
- 10.9** Define accreditation, credentialing, certification, licensure and registration.
- 10.10** Explain the difference between the accreditation and credentialing processes and identify agencies involved in each process.
- 10.11** Explain the process for Licensure in the State of Florida.
- 10.12** Describe the process for maintaining a current license in the State of Florida.
- 10.13** List methods of obtaining continuing education credits for licensure renew.