2008 Mississippi Curriculum Framework

Postsecondary Radiologic Technology

(Program CIP: 51.0911 – Radiologic Technology/Science - Radiographer)

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The Research and Curriculum Unit (RCU), located in Starkville, Mississippi, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators, while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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Mississippi Gulf Coast Community College Radiologic Technology Advisory Committee
Northeast Mississippi Community College Radiologic Technology Advisory Committee
Pearl River Community College Radiologic Technology Advisory Committee

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Preface

Radiologic Technology Research Synopsis

Articles, books, Web sites, and other materials listed at the end of each course were considered during the revision process. The American Society of Radiologic Technologists (ASRT) Radiography Curriculum was especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from colleges throughout the state were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills needed in this program included punctuality, ability to work independently, positive attitude, initiative, flexibility of schedule, and ethical responsibilities. Occupational-specific skills stated included critical-thinking and problem-solving skills, ethical responsibilities, patient-care skills, positioning skills, and radiation protection for self and others. Safety practices emphasized included adhering to standard precautions, following OSHA and HIPPA guidelines, and radiation protection.

Instructors from colleges throughout the state were also asked to give input on changes to be made to the curriculum framework. Specific comments related to this program included statements from Advisory Committee members adding CT in the curriculum and limiting the number of students in the program. Changes suggested for the curriculum included the addition of CT in the curriculum but not as a separate course; adding CR equipment; and the need for major revisions in Radiation Exposure I and II.

Curriculum
The following national standards were referenced in each course of the curriculum:

- CTB/McGraw-Hill LLC *Tests of Adult Basic Education, Forms 7 and 8* Academic Standards
- *21st Century Skills*
- *ARRT Content Specifications for the Examination in Radiography*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process, and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the May 20, 2008, curriculum revision meeting included the following:

- Competencies and objectives were reviewed to ensure accuracy and appropriateness.
- Competencies and objectives related to the revised standards for an accredited educational program were added or changed.
- Competencies and objectives related to the revised American Society of Radiologic Technologists (ARST) Radiography Curriculum were added or changed.
- The name Radiation Exposure I (RGT 1413) was changed to Imaging Principles (RGT 1413) and the competency (Competency 1) related to X-ray production and properties of X-rays as related to exposure and measurement of radiation was moved to Physics of Imaging Equipment (RGT 1613).

- The name Radiation Exposure II (RGT 1423) was changed to Digital Imaging (RGT 1423), and all of the concepts taught in this course were moved to Imaging Principles (RGT 1413); new concepts added to RGT 1423 relate to revisions in the ASRT Radiography Curriculum.
- The name Social and Legal Responsibilities (RGT 2132) was changed to Ethical and Legal Responsibilities (RGT 2132).
- In Physics of Imaging Equipment (RGT 1613), the competency (Competency 2) related to utilizing computers in imaging, archiving, and radiology information systems was deleted.
- In Radiographic Procedures III, the concept related to procedural consideration for the reproductive system was moved to Radiographic Procedures IV. The number of semester hours in the course Radiographic Procedures III was increased by one hour.
- The reference list was updated.
- The Recommended Tools and Equipment list was updated.

Assessment
Students will be assessed using the *American Registry of Radiologic Technologists (ARRT) Examination.*

Professional Learning
It is suggested that instructors participate in professional learning related to the following concepts:

- How to use the program Blackboard site
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html, and click on Differentiated Instruction. Work through this online course, and review the additional resources.

Articulation
No articulated credit will be offered upon implementation of this curriculum by the college.

Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Vocational–technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact local vocational–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. Each vocational–technical course in this sequence has been written using a common format that includes the following components:

- Course Name – A common name that will be used by all community/junior colleges in reporting students

- Course Abbreviation – A common abbreviation that will be used by all community/junior colleges in reporting students

- Classification – Courses may be classified as the following:
    - Vocational–technical core – A required vocational–technical course for all students
    - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
    - Vocational–technical elective – An elective vocational–technical course
    - Related academic course – An academic course that provides academic skills and knowledge directly related to the program area.
    - Academic core – An academic course that is required as part of the requirements for an associate's degree

- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester

- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course

- Corequisites – A listing of courses that may be taken while enrolled in the course

- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level.

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
    - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
    - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
    - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised
    - Activities that implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational–technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational–technical programs
    - Individualized learning activities, including worksite learning activities, to better prepare individuals in the courses for their chosen occupational areas

- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
    - 3 semester credit hours — Math/Science Elective
    - 3 semester credit hours — Written Communications Elective
    - 3 semester credit hours — Oral Communications Elective
    - 3 semester credit hours — Humanities/Fine Arts Elective
    - 3 semester credit hours — Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program so that students complete some academic and vocational–technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- In instances where secondary programs are directly related to community and junior college programs, competencies and suggested objectives from the high school programs are listed as Baseline Competencies. These competencies and objectives reflect skills and knowledge that are directly related to the community and junior college vocational–technical program. In adopting the curriculum framework, each community and junior college is asked to give assurances that:
    - Students who can demonstrate mastery of the Baseline Competencies do not receive duplicate instruction and
    - Students who cannot demonstrate mastery of this content will be given the opportunity to do so.

- The roles of the Baseline Competencies are to:
    - Assist community/junior college personnel in developing articulation agreements with high schools and
    - Ensure that all community and junior college courses provide a higher level of instruction than their secondary counterparts.

- The Baseline Competencies may be taught as special "Introduction" courses for 3–6 semester hours of institutional credit that will not count toward associate degree requirements. Community and junior colleges may choose to integrate the Baseline Competencies into ongoing courses in lieu of offering the "Introduction" courses or may offer the competencies through special projects or individualized instruction methods.

- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their areas.

In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new competencies and suggested objectives
- Revising or extending the suggested objectives for individual competencies
- Integrating baseline competencies from associated high school programs
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the State Board for Community and Junior Colleges [SBCJC] of the change)

In addition, the curriculum framework as a whole may be customized by doing the following:

- Re-sequencing courses within the suggested course sequence
- Developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (with SBCJC approval)
- Utilizing the technical elective options in many of the curricula to customize programs

Table of Contents

Program Description

Radiographers perform imaging examinations and accompanying responsibilities at the request of physicians and/or qualified practitioners qualified to prescribe and/or perform radiologic procedures. They utilize equipment emitting ionizing radiation to produce radiographic images of the internal structures of human anatomy. These radiographic images are utilized by the physician for diagnostic and therapeutic purposes. The radiographer is responsible for all functions in the Radiology Department to insure consistent radiographic images and provide for personal and patient safety from ionizing radiation. In addition to producing diagnostic images and primary patient care, other responsibilities may include administrative and educational functions.

Graduates of this 2-year program will be awarded an Associate of Applied Science Degree in Radiologic Technology and are eligible to make application to the American Registry of Radiologic Technology in order to become a Registered Technologist Radiographer.

Industry standards are based on the *ARRT Content Specifications for the Examination in Radiography*.

Suggested Course Sequence*
Radiologic Technology

SUMMER TERM (2–5 week terms)

4 sch	Anatomy and Physiology I (BIO 1514)	4 sch	Anatomy and Physiology II (BIO 1524)
3 sch	Fundamentals of Radiography (RGT 1213)	3 sch	Patient Care and Radiography (RGT 1223)
7 sch		7 sch	

FIRST YEAR

3 sch	Math/Science Elective	3 sch	Written Communications Elective
4 sch	Clinical Education I (RGT 1114)	4 sch	Clinical Education II (RGT 1124)
2 sch	Principles of Radiation Protection (RGT 1312)	3 sch	Digital Imaging (RGT 1423)
3 sch	Imaging Principles (RGT 1413)	3 sch	Radiographic Procedures II (RGT 1523)
3 sch	Radiographic Procedures I (RGT 1513)	3 sch	Physics of Imaging Equipment (RGT 1613)
15 sch		16 sch	

SUMMER TERM (10–week term)

9 sch Clinical Education III (RGT 1139)

SECOND YEAR

3 sch	Social/Behavioral Science Elective	3 sch	Oral Communications Elective
2 sch	Ethical and Legal Responsibilities (RGT 2132)	7 sch	Clinical Education V (RGT 2157)
7 sch	Clinical Education IV (RGT 2147)	2 sch	Radiographic Procedures IV (RGT 2542)
3 sch	Humanities/Fine Arts Elective	1 sch	Radiation Biology (RGT 2911)
3 sch	Radiographic Procedures III (RGT 2532)	3 sch	Certification Fundamentals (RGT 2933)
1 sch	Radiographic Pathology (RGT 2921)	16 sch	
19 sch			

* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

Radiologic Technology Courses

Course Name: Clinical Education I

Course Abbreviation: RGT 1114

Classification: Vocational–Technical Core

Description: This course includes clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, radiation protection, operation of equipment, and radiologic procedures. (4 sch: 12-hr clinical)

Prerequisite: All core courses as scheduled. CPR-Health Care Provider must be completed before Clinical Education I experience begins.

Competencies and Suggested Objectives
1. Apply radiographic principles in the clinical setting with respect to program levels. a. Demonstrate skills in assessment and evaluation of psychological and physical changes in the patient's condition, and carry out appropriate actions. b. Manage interaction with the patient and family in a manner that provides the desired psychosocial support. c. Provide patient and family education appropriate to comprehension level of the patient and family. d. Apply radiation protection principles. e. Discuss basic X-ray production and interactions. f. Operate medical imaging equipment and accessory devices. g. Position the patient and medical imaging system to perform examinations and procedures. h. Apply knowledge of human structure, function, and pathology. i. Evaluate the performance of medical imaging systems. j. Evaluate medical images for technical quality. k. Apply knowledge and skills relating to recording medical image processing. l. Operate equipment within safety limits. m. Recognize equipment malfunctions, and report them to the proper authority. n. Apply knowledge and skills relating to verbal, nonverbal, and written medical communication in patient care intervention and professional relationships. o. Demonstrate safe, ethical, and legal practices. p. Abide by the profession's code of ethics, and comply with the recognized scope of practice for the profession. q. Practice standard precautions at all times.
2. Perform clinical application skills for radiographic procedures. a. Practice routine radiographic procedures including the following: (1) Chest (2) Abdomen (3) Upper extremities to include shoulder girdle (4) Digestive system

b. Perform image analysis of the following procedures:
   (1) Chest
   (2) Abdomen
   (3) Upper extremities to include shoulder girdle
   (4) Digestive system

3. Demonstrate tasks associated with radiographic procedures.
   a. Evaluate physician's orders and radiography requests.
   b. Verify patient identification.
   c. Prepare radiographic room.
   d. Manipulate radiographic equipment.
   e. Demonstrate patient transport techniques.
   f. Identify accessory equipment.
   g. Process radiographs.
   h. Follow line structure organization within departments and institutions.
   i. Apply basic radiation protection.
   j. Demonstrate effective communication skills.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)

A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Callaway, W. J. (2008). *Mosby's comprehensive review of radiography* (5th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Carter, C., & Veale, B. (2008). *Digital radiography and PACS*. St. Louis, MO: Mosby.

Eisenberg, R. L., & Johnson, N. M. (2007). *Comprehensive radiographic pathology* (4th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Clinical Education II

Course Abbreviation: RGT 1124

Classification: Vocational–Technical Core

Description: This course involves clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, radiation protection, operation of equipment, and radiologic procedures. (4 sch: 12-hr clinical)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Apply radiographic principles in the clinical setting with respect to program levels. a. Demonstrate skills in assessment and evaluation of psychological and physical changes in the patient's condition, and carry out appropriate actions. b. Manage interaction with the patient and family in a manner that provides the desired psychosocial support. c. Provide patient and family education appropriate to comprehension level of the patient and family. d. Apply radiation protection principles. e. Discuss basic X-ray production and interactions. f. Operate medical imaging equipment and accessory devices. g. Position the patient and medical imaging system to perform examinations and procedures. h. Apply knowledge of human structure, function, and pathology. i. Evaluate the performance of medical imaging systems. j. Evaluate medical images for technical quality. k. Apply knowledge and skills relating to recording medical image processing. l. Operate equipment within safety limits. m. Recognize equipment malfunctions, and report them to the proper authority. n. Apply knowledge and skills relating to verbal, nonverbal, and written medical communication in patient care intervention and professional relationships. o. Demonstrate safe, ethical, and legal practices. p. Abide by the profession's code of ethics, and comply with the recognized scope of practice for the profession. q. Practice standard precautions at all times.
2. Perform clinical application skills for radiographic procedures. a. Practice routine radiographic procedures including the following: (1) Spinal column (2) Pelvic girdle (3) Lower extremities (4) Urinary systems b. Perform image analysis on the following procedures: (1) Spinal column (2) Pelvic girdle

(3) Lower extremities
(4) Urinary systems
(5) Bony thorax

3. Demonstrate tasks associated with radiographic procedures.
   a. Perform routine radiographic procedures including the following:
      (1) Chest
      (2) Abdomen
      (3) Digestive system
      (4) Upper extremities and shoulder girdle
      (5) Evaluate image analysis.

STANDARDS

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RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
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A5 Measurement (money, time, temperature, length, area, volume)
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S1 Vowel (short, long)
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S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

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Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Clinical Education III

Course Abbreviation: RGT 1139

Classification: Vocational–Technical Core

Description: This course is a clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, radiation protection, operation of equipment, and radiologic procedures. (9 sch: 27-hr clinical)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Apply radiographic principles in the clinical setting with respect to program levels. a. Demonstrate skills in assessment and evaluation of psychological and physical changes in the patient's condition, and carry out appropriate actions. b. Manage interaction with the patient and family in a manner that provides the desired psychosocial support. c. Provide patient and family education appropriate to comprehension level of the patient and family. d. Apply radiation protection principles. e. Discuss basic X-ray production and interactions. f. Operate medical imaging equipment and accessory devices. g. Position the patient and medical imaging system to perform examinations and procedures. h. Apply knowledge of human structure, function, and pathology. i. Evaluate the performance of medical imaging systems. j. Evaluate medical images for technical quality. k. Apply knowledge and skills relating to recording medical image processing. l. Operate equipment within safety limits. m. Recognize equipment malfunctions, and report them to the proper authority. n. Apply knowledge and skills relating to verbal, nonverbal, and written medical communication in patient care intervention and professional relationships. o. Demonstrate safe, ethical, and legal practices. p. Abide by the profession's code of ethics, and comply with the recognized scope of practice for the profession. q. Practice standard precautions at all times. r. Adhere to concepts of team practice that focus on organizational theories, roles of team members, and conflict resolution. s. Evaluate procedure orders for accuracy, and follow up to make corrective changes. t. Exercise independent judgment and discretion in the technical performance of medical imaging procedures.
2. Perform clinical application skills for radiographic procedures. a. Practice routine radiographic procedures including the following: (1) Mobile (portable) radiography (2) Trauma

b. Perform image analysis of the following:
   (1) Mobile (portable) radiography
   (2) Trauma

3. Demonstrate tasks associated with radiographic procedures.
   a. Perform routine radiographic procedures including the following:
      (1) Spine
      (2) Pelvic girdle
      (3) Lower extremities
      (4) Urinary systems
      (5) Bony thorax
   b. Perform advanced radiographic procedures including the following:
      (1) Chest
      (2) Abdomen
      (3) Digestive system
      (4) Upper extremities including shoulder girdle
      (5) Bony thorax

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)

A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Callaway, W. J. (2008). *Mosby's comprehensive review of radiography* (5th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Carter, C., & Veale, B. (2008). *Digital radiography and PACS*. St. Louis, MO: Mosby.

Eisenberg, R. L., & Johnson, N. M. (2007). *Comprehensive radiographic pathology* (4th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Fundamentals of Radiography

Course Abbreviation: RGT 1213

Classification: Vocational–Technical Core

Description: This course is an introduction to Radiologic Technology including professional, departmental, and historical aspects. Included are terminology, medical ethics, and fundamental legal responsibilities. (3 sch: 3-hr lecture)

Prerequisites: None

Competencies and Suggested Objectives

1. Describe the role, organization, and structure of the program, radiology department, hospital, and professions.
   a. Identify other health science professions that participate in the patient's total health care.
   b. Describe the relationship of these health-care workers to the integrated care of patients.
   c. Identify the various sites and settings in which health care is delivered.
   d. Discuss the reimbursement and payment options for health-care services and the importance of CPT coding.
   e. Discuss the general employment outlook for the graduate radiographer.
   f. Discuss career advancement and opportunities for the radiographer.
   g. Identify the benefits of continuing education as related to improved patient care and professional enhancement.
   h. Discuss the philosophy and mission of the affiliated hospital and clinical education center(s).
   i. Identify selected administrative personnel, and discuss their relationship with the radiology department.
   j. Describe relationships and interdependencies of departments within the hospitals and clinical education center(s).
   k. Identify and discuss the responsibilities and relationships of all personnel in the radiology department.
   l. Explain patient services available in the radiology department.
   m. Define accreditation, credentialing, certification, licensure, and regulations.
   n. Describe how the JRCERT Standards for an accredited educational program in Radiologic Sciences relate to the educational program.
   o. Explain the difference between the accreditation and credentialing processes, and identify agencies involved in each process.
   p. Differentiate between programmatic and institutional accreditation.
   q. Identify the responsibilities of the health-care facility and members of the health-care team.
   r. List the general responsibilities of the radiographer.
   s. Describe the Scope of Practice for the radiographer as defined by the American Society of Radiologic Technologists (ASRT) and state licensure.
   t. Explain the use of various communication devices and systems.
   u. Explain the purpose, legal considerations, and procedures for reporting an accident or

incident.

2. Discuss ethical issues and dilemmas in health care.
   a. Describe specialized standards of behavior for the healing arts as a continuum, with historical and philosophical roots in the earliest periods of human history.
   b. List the major milestones in the development of codes of behavior and ethical standards in the healing arts.
   c. Explain ethics as a branch of philosophy and the moral, social, and cultural basis of the development of an ethic.
   d. Describe the moral, social, and cultural basis of ethics.
   e. Apply medical and professional ethics in the context of a broader societal ethic.
   f. Explain the role of ethical behavior in health-care delivery.
   g. Differentiate between empathetic rapport and sympathetic involvement in relationships with patients, and relate these to ethical conduct.
   h. Explain concepts of personal honesty, integrity, accountability, competence, and compassion as ethical imperatives in health care.
   i. Identify and describe accepted codes or guidelines for professional ethics in the chosen health profession.
   j. Identify specific ethical situations and dilemmas in health care that may impact the radiographer.
   k. Explain a basic system of examination, clarification, determination of alternatives, and decision making in addressing ethical questions and situations.
   l. Explain basic concepts embodied in principles of patients' rights, the doctrine of informed (patient) consent, and other issues related to patients' rights, including HIPAA.
   m. Identify the fundamental legal implications of professional liability, malpractice, professional negligence and carelessness, and other legal doctrines applicable to professional practice.

3. Translate medical terms, abbreviations, and symbols into common language.
   a. Define, spell, and pronounce medical terms.
   b. Understand the word building process.
   c. Interpret medical abbreviations and symbols.
   d. Understand orders, requests, and diagnostic reports.
   e. Comprehend radiation science terms.

STANDARDS

Content Specifications for the Examination in Radiography

RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)

R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Patient Care and Radiography

Course Abbreviation: RGT 1223

Classification: Vocational–Technical Core

Description: This course will provide the student with the basic concepts of patient care, including consideration for the physical and psychological needs of the patient and family. Routine and emergency patient care procedures will be described, as well as infection control procedures utilizing standard precautions. The role of the radiographer in patient education will be identified. (3 sch: 2-hr lecture, 2-hr lab)

Prerequisite: None

Competencies and Suggested Objectives

1. Employ interpersonal skills to alleviate patients' fears, and promote a professional environment.
   a. Discuss the responsibilities of the health-care facility.
   b. Discuss the responsibilities of the radiographer.
   c. Discuss the Scope of Practice for the radiographer.
   d. Discuss the perceptions of death and dying from patient and technologist viewpoints.
   e. Discuss ethical, emotional, personal, and physical aspects of death.
   f. List the stages of dying, and describe the characteristics of each stage.
   g. Identify the support mechanisms available to the terminally ill.
   h. Describe methods of determining the proper patient identification.
   i. Explain the use of the following:
      (1) Audio and visual communication systems
      (2) Immobilization devices
      (3) Machine type
      (4) Auxiliary equipment
   j. Alleviate fears by explaining the following:
      (1) Positioning for examination
      (2) Length of procedure
      (3) Room noises
      (4) Machine movement
      (5) Machine and patient contact
   k. Interact with patients' family members and friends using case studies.
   l. Identify select perceptions of death and dying from patient and technologist viewpoints.
   m. Identify ethical, emotional, personal, and physical aspects of death.
   n. Define communication.
   o. Identify methods of communication, and discuss how each can be utilized in patient education.
   p. Identify patient communication problems, and discuss how each can be overcome to provide patient education.
   q. Demonstrate explanations of radiographic examinations when given clinical simulations (e.g., chest, UGI, and extremity).

r. Demonstrate explanations for patients with various communication problems (e.g., hearing, vision, and speech problems; impaired mental function; altered states of consciousness; and patients who do not speak English) using clinical simulations.
s. Explain the role of the technologist in patient education.

2. Employ general environmental safety precautions.
   a. Demonstrate correct principles of body mechanics applicable to patient care.
   b. Demonstrate techniques for specific types of patient transfer.
   c. Demonstrate select procedures for turning patients with various health conditions.
   d. Describe select immobilization techniques for various types of procedures and patient conditions.
   e. Describe specific patient safety measures and concerns.
   f. Discuss procedures for assuring security of property of inpatients and outpatients.

3. Evaluate physical needs.
   a. Describe methods for evaluation of patient status.
   b. Identify the information to be collected prior to patient examination.
   c. Describe vital signs used to assess patient condition.
   d. Convert a Fahrenheit measurement to the Celsius equivalent.
   e. State the normal temperature values for the oral and rectal methods of measurement for temperature.
   f. Describe the method of monitoring respirations, and state the normal values expected.
   g. List the equipment necessary for acquisition of the blood pressure on a patient.
   h. Identify the normal values for blood pressure for males and females.
   i. Identify the seven major sites for monitoring the pulse, and indicate the normal values.
   j. Demonstrate the assessment of vital signs.
   k. List the normal ranges for specific laboratory studies.

4. Describe infection control precautions.
   a. Define terms related to infection control.
   b. Describe the importance of standard precautions and isolation procedures.
   c. Explain sources and modes of transmission of infections and diseases.
   d. List institutional and departmental procedures for infection control.
   e. Describe methods for the prevention of infection to the health worker and patient.

5. Recognize and employ appropriate responses to acute situations and medical emergencies.
   a. Identify symptoms related to specific emergency situations.
   b. Describe the emergency medical code system for the institution and the role of the student during a medical emergency.
   c. Demonstrate the use of specific medical emergency equipment and supplies.
   d. Given simulations, demonstrate the use of oxygen and suction equipment.
   e. Given simulations, demonstrate select first aid techniques.
   f. List the special considerations necessary when performing radiographic procedures on an infant or a child.
   g. List the special considerations necessary when performing radiographic procedures on a geriatric patient.
   h. List the symptoms and precautions taken for a patient with a head injury.
   i. List the symptoms and precautions taken for a patient with a spinal injury.
   j. List the types, immobilization devices, and positioning for upper and lower extremity fractures.

k. List the symptoms and precautions taken for a patient with massive wounds.
l. List the classifications and medical interventions for burns.
m. Describe the symptoms and medical interventions for a patient having a reaction to contrast agents.

6. Respond to patient needs in special situations.
   a. Explain the role of the technologist in patient education.
   b. Describe the different types of patient preparation for barium studies.
   c. Describe the procedure to properly prepare a patient for a barium study.
   d. Describe the purpose for using contrast agents.
   e. Explain the indication and procedure when given specific tube management situations (nasogastric, suction, tracheostomy, chest tube, tissue drains, oxygen administration, urinary collection, and other ostomies).
   f. Identify the precautions involved when given specific tube management situations (nasogastric, suction, tracheostomy, chest tube, tissue drains, oxygen administration, urinary collection, and other ostomies).
   g. Identify the steps in the operation and maintenance of suction equipment.
   h. Identify the monitoring, pre- and post-procedure care, drug administration, and special precautions for a patient undergoing myelography and urography.
   i. Demonstrate the appropriate procedure for gathering information prior to performing a bedside radiographic examination.
   j. Describe the initial steps in performing a bedside procedure.
   k. Describe the special precautions to be used when performing a procedure on a neonate.
   l. Explain the procedure for placing an image receptor under a patient in an orthopedic bed frame.
   m. Describe the special problems faced in performing procedures on patients with tracheotomy and specific tubes, drains, and catheters.
   n. Describe the procedure for producing diagnostic images in the surgical suite and endoscopy.

STANDARDS

Content Specifications for the Examination in Radiography

RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)

M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A2 Number Theory (ratio, proportion)
A5 Measurement (money, time, temperature, length, area, volume)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Principles of Radiation Protection

Course Abbreviation: RGT 1312

Classification: Vocational–Technical Core

Description: This course is designed to present an overview of the principles of radiation protection including the responsibilities of the radiographer for patients, personnel, and the public. Radiation health and safety requirements of federal and state regulatory agencies, accreditation agencies, and health-care organizations are incorporated. (2 sch: 2-hr lecture)

Prerequisite: None

Competencies and Suggested Objectives
1. Examine concepts involved in an effective radiation protection program. a. Identify and justify the need to minimize unproductive radiation exposure of humans. b. Distinguish between somatic and genetic radiation effects (immediate and latent), and provide examples of each. c. Differentiate between the stochastic and non-stochastic effects of radiation exposure, and provide examples of each. d. List the objectives of a radiation protection program, and demonstrate the ability to document the same. e. Identify effective dose equivalent limits for occupational and nonoccupational radiation exposure. f. Identify the acronym ALARA, and describe the concept (optimization). g. Identify the basis for occupational exposure limits: comparable risk. h. Describe the concept of negligible individual risk level (NIRL). i. Identify ionizing radiations from natural and man-made sources, and list their approximate dose equivalent contribution. j. Identify legal and ethical radiation protection responsibilities of radiation workers.
2. Discuss the methods of detection and measurement of ionizing radiation. a. Identify and define units of radiation for exposure, absorbed dose, dose equivalent, and radioactivity. b. Define and describe the interrelationship between relative biological effectiveness and quality factors. c. Describe how the quality factor is used to determine dose equivalent. d. State why the sievert is the appropriate unit for radiation protection work. e. Describe the theory and operation of the following radiation detection devices: ion-chambers, proportional counters, and thermoluminescent dosimeters (TLDs). f. List appropriate applications and limitations for each radiation detection device above. g. Define units of radiation measurement, and provide an example of radiology application. h. Describe the relationship between equipment exposure value and patient dose.
3. Review radiation surveys and regulatory agency regulations. a. State when a radiation protection survey should be conducted. b. Identify who should conduct the survey. c. Describe the conditions under which radiation protection surveys of equipment are made.

d. Identify various performance standards for beam directing, beam defining, and beam limiting devices that are evaluated in a radiation protection equipment survey of the following:
   (1) Radiographic equipment
   (2) Fluoroscopic equipment
e. Describe procedures used to verify performance standards for equipment in objective No. 3d.
f. Describe the operation of various interlocking systems for equipment in objective No. 3d, and indicate potential consequences of interlock system failure.
g. List conditions and locations evaluated in an area survey for radiation protection.
h. Distinguish between controlled and non-controlled areas, and list acceptable exposure levels.
i. Describe RADIATION AREA signs, and identify appropriate placement sites.
j. Identify the functions of the following agencies:
   (1) International Council on Radiation Protection and Measurements (ICRP)
   (2) National Council on Radiation Protection and Measurements (NCRP)
   (3) Nuclear Regulatory Commission (NRC)
k. Discuss the Consumer-Patient Radiation Health and Safety Act of 1981and the CARE (Consumer Assurance of Radiologic Excellence) Bill.
l. Describe the function of various state and local regulations governing radiation protection practices.
m. Describe the requirements and responsibilities for a radiation protection officer.

4. Identify occupational exposure limits and methods of personnel monitoring.
   a. Identify the need and importance of personnel monitoring for radiation workers.
   b. Identify and describe the following monitoring devices:
      (1) Body badge and ring badge
      (2) Thermoluminescent dosimeters (TLDs)
      (3) Pocket ionization chambers
   c. List applications, advantages, and limitations for each device in objective No. 4b.
   d. Interpret personnel monitoring reports.
   e. Identify those structures that are considered critical for potential late effects for whole body irradiation exposure.
   f. State dose limits with reference to the latest NCRP reports.

5. Analyze components of an effective patient protection program.
   a. Explain the relationship of beam limiting devices to patient radiation protection.
   b. Discuss added and inherent filtration in terms of the effect on patient dosage.
   c. Explain the purpose and importance of patient shielding.
   d. Correlate the method of shielding to the radiographic procedure using a list of patient shielding devices and radiographic procedures.
   e. Explain the relationship of exposure factors to patient dosage.
   f. Discuss various photon interactions in terms of description of interaction, relation to atomic number, and applications.
   g. Define photodisintegration.
   h. State the desired image receptor combination that will result in an optimum diagnostic image with the minimum radiation exposure to the patient using a list of various radiographic procedures.

i. Discuss methods to avoid repeat radiographs.
j. Discuss the importance of clear, concise instructions (effective communication skills) as a method of radiation protection.
k. Discuss the effect(s) of immobilization techniques to eliminate voluntary motion.
l. Describe the minimum source-to-tabletop distances for fixed and mobile fluoroscopes.
m. Discuss safety factors for the patient (and other patients) in the room during mobile radiographic procedures.

6. Utilize concepts of practical radiation protection.
   a. Describe how isoexposure curves are used for radiation protection.
   b. Distinguish between primary and secondary barriers.
   c. Describe how the following factors influence the design of X-ray installations:
      (1) Use (U)
      (2) Workload (W)
      (3) Occupancy (T)
      (4) Distance (d)
      (5) Material
   d. Describe how the operation of various X-ray and ancillary equipment influences radiation safety, and describe the potential consequences of failure of this equipment.
   e. Describe how the operation of various X-ray equipment influences radiation safety, and describe the potential of failure of this equipment.
   f. Identify who should evaluate the ancillary and X-ray equipment, indicate the frequency with which these evaluations should be made, and indicate how this is related to the quality assurance program for radiation safety.
   g. Demonstrate how time, distance, and shielding can be manipulated to keep radiation exposure to a minimum.
   h. Perform calculations of exposure with varying time, distance, and shielding.
   i. Discuss the relationship between half-value layer/tenth-value layer and shielding design.
   j. Identify emergency procedures to be followed during failures of X-ray mechanisms.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)

M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

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The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Saia, D. A. (2008). *Lange Q. & A.: Radiography examination* (7th ed.). New York, NY: McGraw Hill.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Course Name: Imaging Principles

Course Abbreviation: RGT 1413

Classification: Vocational–Technical Core

Description: This course is a study of the principles involving manipulation of factors controlling and influencing exposure and radiographic quality. Included are the prime factors of radiographic exposure, beam limiting devices, filtration, production and control of scatter and secondary radiation, exposure systems, technical conversions, and problem solving. This course presents an introduction to film processing including darkroom design and equipment. Included are chemistry of developing solutions, procedures of general maintenance, quality control, and silver recovery methods. (3 sch: 2-hr lecture, 2-hr lab)

Prerequisite: None

Competencies and Suggested Objectives
1. Analyze exposure factors to achieve optimum radiographic quality. a. Discuss practical considerations in setting imaging standards. b. Discuss acceptance limits.
2. Determine exposure factors to achieve optimum radiographic density with a minimum radiation exposure to the patient. a. Define radiographic density. b. Identify the acceptable range of radiographic density. c. Analyze relationships of factors affecting radiographic density.
3. Determine exposure factors to achieve optimum radiographic contrast with a minimum radiation exposure to the patient. a. Define radiographic contrast. b. Differentiate between subject contrast and film contrast. c. Analyze relationships of factors affecting radiographic contrast.
4. Determine exposure factors to achieve optimum radiographic detail with a minimum radiation exposure to the patient. a. Define recorded detail. b. Differentiate between umbra and penumbra. c. Analyze relationships of factors affecting recorded detail.
5. Determine exposure factors to achieve appropriate radiographic distortion with a minimum radiation exposure to the patient. a. Define distortion. b. Differentiate between shape distortion and size distortion. c. Analyze relationships of factors affecting distortion.
6. Determine exposure factors to achieve optimum exposure latitude with a minimum of radiation exposure to the patient. a. Define exposure latitude. b. Analyze relationships of factors affecting exposure latitude.
7. Use X-ray beam restrictors for radiation protection and optimal radiographic quality. a. List the types of beam limiting devices, and describe the operation and applications for

each.
b. Explain purposes of beam limiting devices in terms of patient dosage, scattered radiation production, radiographic density, and contrast.

8. Use X-ray beam filtration for radiation protection and optimal radiographic quality.
   a. Define beam filtration.
   b. Explain purposes of beam filtration in terms of patient dosage, scattered radiation production, radiographic density, and contrast.

9. Recognize the effects of scattered and secondary radiation on the radiographic image and patient dosage.
   a. Define scattered and secondary radiation.
   b. Describe interactions of X-rays with matter that produce scattered and secondary radiation.
   c. Analyze relationships of factors affecting scattered and secondary radiation.
   d. Discuss effects of scattered and secondary radiation in terms of patient dosage, image quality, and occupational exposure.

10. Utilize devices to control exit radiation.
    a. Explain the relationship between kVp and scattered and secondary radiation.
    b. Describe a grid in terms of its purpose, components, and construction.
    c. Differentiate among types of grids.
    d. Analyze grid efficiency in terms of grid ratio and frequency.
    e. Given technical information, select an appropriate grid.
    f. Define grid cutoff.
    g. Describe factors influencing grid cutoff.
    h. Describe various grid artifacts.
    i. Explain the relationship between beam limitation and scattered and secondary radiation.

11. Utilize various imaging systems with consideration for radiation protection and radiographic quality.
    a. Explain the purpose of an exposure system in terms of standardization of exposure and image consistency.
    b. Discuss considerations involved in exposure selection.
    c. Distinguish among various types of exposure systems.
    d. Demonstrate patient measurement and exposure selection given clinical simulations.

12. Perform mathematical calculations and measurement conversions used in radiologic technology.
    a. Analyze relationships of exposure factors and their effects on exposure calculations.
    b. Calculate the photographic effect given exposure factors.
    c. Calculate penumbra, magnification factor, and percent magnification given exposure problems.
    d. Apply Mas reciprocity to clinical situations.

13. Describe processing area, film, storage, and handling considerations.
    a. Discuss aspects of processing area location, construction, and function.
    b. Explain safe light illumination in terms of definition, bulb size and color, and testing for blue and green sensitive film emulsions.
    c. Describe the operation and utilization of day light processing.
    d. Discuss processing area ventilation including considerations of temperature control and light proofing.

e. Discuss the location, purpose, function, and operation of each piece of processing area equipment and furnishings.
f. Analyze the effects of processing considerations on film quality.
g. Analyze the effects of storage considerations on film quality.

14. Describe characteristics of films utilized in radiographic procedures.
    a. Label the components, and describe the structure and function of each component given cross-sectional diagrams of radiographic film.
    b. Define properties of radiographic film, and analyze the influence of each on the resultant image.
    c. Relate properties of radiographic film to specific procedure applications.
    d. Define latent image formation.
    e. Explain how sensitization specks contribute to latent image formation.
    f. Define characteristic curve, and explain its purpose.
    g. Graph characteristic curves for radiographic film using density values.
    h. Interpret characteristic curves for radiographic film.
    i. Analyze characteristic curves for various radiographic film, and evaluate various films for specific procedures.

15. Evaluate the use of film holders and intensifying screens.
    a. Discuss various film holders in terms of purpose, construction, application, patient dosage, loading and unloading, and maintenance.
    b. Explain the construction and purpose of intensifying screens.
    c. Describe the principles and function of intensifying screens.
    d. Explain classifications of intensifying screens and the applications of each.
    e. Discuss the maintenance of intensifying screens in terms of handling, cleaning, testing, and evaluation.

16. Assess the automatic processor systems, function, and maintenance.
    a. Discuss the purpose of the automatic processor.
    b. Label the components of automatic processors, and explain the function of each using diagrams.
    c. Describe systems of the automatic processor and functions of each.
    d. Demonstrate how various types and sizes of film are fed into the processor.
    e. Explain the components of the processing cycle providing the specific action and duration of time for each component.
    f. Discuss daily and periodic aspects of processor maintenance and cleaning.
    g. Describe the types of artifacts including the cause and effect on a radiograph and methods of preventing each.
    h. Identify the type of artifact, its cause, and methods of prevention using selected radiographs.
    i. Evaluate Material Safety Data Sheets (MSDSs).
    j. Describe OSHA standards effecting image processing.

17. Evaluate artifacts processing.
    a. Define the term “artifact.”
    b. Describe types of artifacts including the cause and effect on a radiograph and method of prevention for each.
    c. Identify the type of artifact, its cause, and methods of prevention using selected radiographs.

18. Discuss the principles of silver recovery.
    a. Define silver recovery.
    b. Explain the rationale for silver recovery.
    c. Discuss methods of reclamation including process, advantages, and disadvantages of each method.
    d. Discuss silver recovery security as it relates to control, theft, and misappropriation.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Saia, D. A. (2008). *Lange Q. & A.: Radiography examination* (7th ed.). New York, NY: McGraw Hill.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Course Name: Digital Imaging

Course Abbreviation: RGT 1423

Classification: Vocational–Technical Core

Description: This course is designed to impart an understanding of the components, principles, and operation of digital imaging systems found in diagnostic radiology. Included are factors that impact image acquisition, display, archiving, and retrieval. In addition, principles of digital system quality assurance and maintenance are introduced along with guidelines for selecting exposure factors and evaluating images within a digital system to assist students to bridge between film-based and digital imaging systems.(3 sch: 2-hr lecture, 2-hr lab)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Discuss the fundamentals of digital radiography, distinguishing between cassette-based systems and cassette-less systems. a. Define terminology associated with digital imaging systems. b. Describe the various types of digital receptors. c. Apply the fundamental principles to digital detectors. d. Describe the fundamental physical principles of exposure for digital detectors.
2. Compare the image acquisition and extraction of cassette-based vs. cassette-less systems, including detector mechanism, initial image processing, histogram analysis, automatic rescaling, and exposure index determination. a. Compare the advantages and limits of each system. b. Describe the evaluative criteria for digital radiography detectors. c. Describe the response of digital detectors to exposure variations. d. Describe the histogram and the process or histogram analysis as it relates to automatic rescaling and determining an exposure indicator. e. Compare dynamic range to latitude of a screen/film receptor system to that of a digital radiography system. f. Given the performance criteria for a digital radiography detector, evaluate the spatial resolution and dose effectiveness. g. Describe or identify the exposure indices used by each photostimulable phosphor (PSP)-based system. h. Employ appropriate beam/part/receptor alignment to avoid histogram analysis errors. i. Describe the various image processing employed for digital images. j. Evaluate the effect of a given exposure change on histogram shape, data width, and image appearance. k. Associate impact of image processing parameters to the image appearance.
3. Describe the difference between dose area product (DAP) measured with a flat panel system vs. the exposure index for a PSP-based system. a. Identify common limitations and technical problems encountered when using PSP systems. b. Relate the receptor exposure indicator values to technical factors, system calibration,

part/beam/plate alignment, and patient exposure.
   c. Describe image acquisition precautions necessary for CR imaging.
   d. Describe the response of PSP systems to background and scatter radiation.

4. Associate effects of inappropriate processing on image clarity or conspicuity.
   a. Describe the selection of technical factors and technical factor systems to assure appropriate receptor exposure levels for digital detectors.
   b. Describe the conditions that cause quantum mottle in a digital image.
   c. Utilize appropriate means of scatter control.
   d. Avoid grid use errors associated with grid cutoff and Moiré effect.
   e. Formulate a procedure or process to minimize histogram analysis and rescaling errors.

5. Define digital imaging and communications in medicine (DICOM).
   a. Describe Picture Archival and Communications System (PACS) and its function.
   b. Identify components of a PACS system.
   c. Describe patient benefits gained through the use of teleradiology.
   d. Identify modality types that may be incorporated into a PACS.
   e. Define accession number.
   f. Describe worklist and correct usage.
   g. Describe how an image is associated with a radiology order to create a DICOM image.
   h. Describe data flow for a DICOM image from an imaging modality to a PACS.
   i. Describe HIPPA concerns with electronic information.
   j. Identify common problems associated with retrieving/viewing images within a PACS.
   k. Identify the primary uses of the diagnostic display workstation and clinical display workstation.

6. Examine the potential impact of digital radiographic systems on patient exposure and methods of practicing the as low as reasonably achievable (ALARA) concept with digital systems.
   a. Describe the exposure precautions and limitations associated with PSP-based systems.
   b. Avoid poor quality images by observing acquisition precautions.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)

R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
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M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Saia, D. A. (2008). *Lange Q. & A.: Radiography examination* (7th ed.). New York, NY: McGraw Hill.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Course Name: Radiographic Procedures I

Course Abbreviation: RGT 1513

Classification: Vocational–Technical Core

Description: This course includes terminology, principles, and procedures involved in routine radiographic positioning for demonstration of the chest, abdomen, upper extremities, and digestive system. Included is a review of radiographic anatomy on each procedure. (3 sch: 2-hr lecture, 2-hr lab)

Pre/Corequisite: Anatomy and Physiology I (BIO 1514)

Competencies and Suggested Objectives
1. Identify basic radiographic positioning skills. a. Define the following radiographic terms: (1) View (2) Position (3) Projection b. Define various terms of position. c. Describe various positioning aids, and discuss the application and advantages and disadvantages of each. d. Describe various accessory equipment, and discuss each in terms of function and application.
2. Discuss general procedural considerations for radiographic examinations. a. Discuss general considerations for radiographic procedures. b. Explain the general considerations involved in various radiographic procedures using clinical simulations. c. Demonstrate general considerations involved with various radiographic procedures through role-playing. d. Discuss positioning considerations for radiographic procedures. e. Explain the positioning considerations involved for various radiographic procedures given clinical simulations. f. Demonstrate positioning considerations involved with various radiographic procedures through role-playing.
3. Identify positioning considerations for routine radiographic procedures. a. Describe routine and special views of the abdominal cavity in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations. b. Identify areas of the abdomen including the following: (1) Abdominal regions (2) Abdominal quadrants c. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved for routine and special views of the abdominal cavity given clinical simulations. d. Simulate radiographic procedures related to the abdominal cavity in a laboratory environment.

e. Evaluate given radiographs of body cavities in terms of positioning accuracy and image quality.
f. Describe routine and special views of the skeletal system relating to the upper extremities in terms of structure(s) visualized and function(s) demonstrated, including general and positioning considerations.
g. Explain the structure(s) visualized and function(s) demonstrated, including general and positioning considerations given clinical simulations for routine and special views of the skeletal system relating to the upper extremities and shoulder girdle.
h. In a laboratory environment, simulate radiographic procedures of the skeletal system relating to the upper extremities.
i. Evaluate radiographs of various parts of the skeletal system relating to the upper extremities in terms of positioning accuracy and image quality.
j. Describe routine and special views of the respiratory system in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations.
k. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved for routine and special views of the respiratory system given clinical simulations.
l. Simulate radiographic procedures related to the respiratory system in a laboratory environment.
m. Evaluate radiographs of various parts of the respiratory system in terms of positioning accuracy and image quality.

4. Identify positioning considerations for routine contrast studies.
   a. Discuss equipment and supplies necessary for contrast studies identified in this course.
   b. Describe patient preparation necessary for various contrast studies.
   c. Describe the general procedure for each of the radiographic studies identified in this course.
   d. Describe routine and special views of the digestive system and accessory organs in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations.
   e. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved for routine and special views of the digestive system and accessory organs given clinical simulations.
   f. In a laboratory environment, simulate radiographic procedures related to the digestive system and accessory organs.
   g. Evaluate radiographs of various parts of the digestive system and accessory organs in terms of positioning accuracy and image quality.

5. Identify procedural considerations for special studies.
   a. Apply a working knowledge of gastrointestinal contrast media currently used in the radiology department.
   b. Identify the possible actions and reactions of gastrointestinal contrast media used in health-care institutions.
   c. Define the categories of gastrointestinal contrast media, and give specific examples for each category.
   d. Discuss the pharmacology of barium compounds in regard to the following:
      (1) Patient history and allergy
      (2) Chemical composition

(3) Patient precautions
(4) Patient reactions
(5) Emergency care

e. Describe methods of administering gastrointestinal contrast media, and discuss administration techniques for each method.

6. Identify positioning considerations for mobile and trauma radiography for those areas of the body included in this course.
   a. Describe alternate positions for mobile and trauma procedures.
   b. Identify the locks and control panel components on a mobile radiography unit.
   c. Describe special radiation protection considerations when performing mobile radiography.
   d. Describe special radiation protection considerations when performing mobile radiography.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
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L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Jensen, S. C., & Peppers, M. P. (2006). *Pharmacology and drug administration for imaging technologists* (2nd ed.). St. Louis, MO: Mosby.

Kowalczyk, N., & Mace, J. D. (2009). *Radiologic pathology for technologists* (5th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Course Name: Radiographic Procedures II

Course Abbreviation: RGT 1523

Classification: Vocational–Technical Core

Description: This course includes principles and procedures involved in the radiographic positioning of the spinal column, urinary system, pelvic girdle, lower extremities, bony thorax, and mobile and trauma radiography procedures. Included is a review of radiographic anatomy on each procedure. (3 sch: 2-hr lecture, 2-hr lab)

Prerequisites: Radiographic Procedures I (RGT 1513)

Competencies and Suggested Objectives
1. Identify positioning considerations for routine radiographic procedures. a. Describe routine and special views of the skeletal system relating to the pelvic girdle, lower extremities, bony thorax, and the spinal column in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations involved. b. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved using clinical simulations and routine and special views of the skeletal system relating to the pelvic girdle, lower extremities, bony thorax, and spinal column to include scoliosis survey. c. In a laboratory environment, simulate radiographic procedures of the skeletal system relating to the pelvic girdle, lower extremities, bony thorax, and spinal column. d. Evaluate radiographs of various parts of the skeletal system relating to the pelvic girdle, lower extremities, bony thorax, and spinal column, in terms of positioning accuracy and image quality. e. Describe routine and special views of the urinary system in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations. f Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved for routine and special views of the urinary system given clinical simulations. g. Simulate procedures related to the urinary system in a laboratory environment. h. Evaluate radiographs of various parts of the urinary system in terms of positioning accuracy and image quality.
2. Identify positioning considerations for mobile and trauma radiography for those areas of the body included in this course. a. Describe alternate positions for mobile and trauma procedures. b. Identify the locks and control panel components on a mobile radiography unit. c. Describe special radiation protection considerations when performing mobile radiography.
3. Demonstrate the drug administration procedure. a. Identify and describe the routes of drug administration. b. Discuss the purposes and advantages of intravenous drug administration over other routes. c. Differentiate between the two major sites of intravenous drug administration.

d. Identify, describe, and document complications associated with intravenous drug administration and appropriate actions to resolve these complications.
e. Discuss the various elements of initiating and discontinuing intravenous drug administration.
f. Differentiate and document dose calculations for adult and pediatric patients.
g. Prepare contrast agents and intravenous medications for injection utilizing aseptic technique.
h. Discuss the radiographer's role in contrast media and drug administration.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Jensen, S. C., & Peppers, M. P. (2006). *Pharmacology and drug administration for imaging technologists* (2nd ed.). St. Louis, MO: Mosby.

Kowalczyk, N., & Mace, J. D. (2009). *Radiologic pathology for technologists* (5th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Course Name: Physics of Imaging Equipment

Course Abbreviation: RGT 1613

Classification: Vocational–Technical Core

Description: This course is designed to establish knowledge based in radiographic, fluoroscopic, mobile, and tomographic equipment requirements and design. The content will also provide a basic knowledge of quality control. Computer applications in the radiologic sciences related to image capture, display, storage, and distribution are presented. (3 sch: 3-hr lecture)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Describe X-ray production, and identify properties of X-rays as related to exposure and measurement of radiation. a. State the principles of X-ray production. b. Compare the production of bremsstrahlung with the production of characteristic radiations. c. Describe the conditions necessary to produce x-radiation. d. Describe the nature of light. e. Define and describe wavelength and frequency and how they are related to velocity. f. Describe the electromagnetic spectrum. g. Explain the relationship of energy and frequency to Planck's Constant.
2. Utilize diagnostic imaging equipment. a. Define potential difference, current, and resistance. b. Describe the characteristics of direct and alternating currents. c. Explain electrical protective devices. d. Identify the general components and function of the primary and secondary filament circuits and X-ray tubes. e. Identify the function of solid-state rectification. f. Compare single-phase, three-phase, high frequency, and falling load generators in terms of radiation production and efficiency. g. Discuss permanent installation of radiographic equipment in terms of purpose, components, types, and applications. h. Demonstrate operation of various types of permanently installed radiographic equipment. i. Discuss mobile units in terms of purpose, components, types, and applications. j. Demonstrate operation of various types of mobile unit radiographic equipment. k. Identify general radiation protection rules related to installation of new radiographic equipment. l. Discuss the application of automatic exposure devices. m. Explain image-intensified fluoroscopy. n. Discuss gain and conversion factors as related to intensification. o. Discuss image formation in terms of image size and brightness. p. Indicate the purpose, construction, and application of video camera tubes, TV monitors, and video records.

q. Identify the purpose, construction, and application of cine radiographic equipment and processor.
r. Describe the purpose, construction, and application of film cameras.
s. Discuss the purpose, construction, and application of automatic film changers.
t. Explain the purpose, principles, motion, equipment, procedure, and application of conventional tomography.
u. Discuss the purpose and procedure of radiographic magnification.
v. Discuss electronic imaging equipment used in radiography and fluoroscopy.
w. Discuss flat panel detectors used in digital electronic X-ray equipment.

3. Describe the components of the CT imaging system.
   a. Differentiate between conventional and spiral/helical CT scanning.
   b. Explain the functions of collimators in CT.
   c. List the CT computer data processing steps.
   d. Name the functions of the array processor used for image reconstruction.
   e. Define the term "algorithm," and explain its impact on image scan factors and reconstruction.
   f. Define the terms "raw data" and "image data."
   g. Explain the difference between reconstructing and reformatting an image.
   h. Describe the application of the following terms to CT:
      (1) Pixel
      (2) Matrix
      (3) Voxel
      (4) Linear attenuation coefficient
      (5) CT/Hounsfield number
      (6) Partial volume averaging
      (7) Window width (ww) and window level (wl)
      (8) Spatial resolution
      (9) Contrast resolution
      (10) Noise
      (11) Annotation
      (12) Region of interest (ROI)
      (13) Standard vs. volumetric data acquisition
   i. Name the common controls found on CT operator consoles, and describe how and why each is used.
   j. Identify the types and appearance of artifacts most commonly affecting CT images.
   k. Explain how artifacts can be reduced or eliminated.
   l. List and describe current data storage techniques used in CT.
   m. Name the radiation protection devices that can be used to reduce patient dose in CT, and describe the correct application of each.

4. Differentiate among quality improvement and management, quality assurance, and quality control.
   a. List the benefits of a quality management program to the patient and to the department.
   b. List elements of a quality management program, and discuss how each is related to the quality management program.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness

CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Saia, D. A. (2008). *Lange Q. & A.: Radiography examination* (7th ed.). New York, NY: McGraw Hill.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Course Name: Ethical and Legal Responsibilities

Course Abbreviation: RGT 2132

Classification: Vocational–Technical Core

Description: Legal terminology, concepts, and principles will be presented in this course. Topics include misconduct, malpractice, legal and professional standards, and the ASRT scope of practice. The importance of proper documentation and informed consent is emphasized. This course will prepare students to better understand their patients, the patients' families, and professional peers through comparison of diverse populations based on their value systems, cultural and ethnic influences, communication styles, socioeconomic influences, health risks, and life stages. (2 sch: 2-hr lecture)

Prerequisite: Fundamentals of Radiography (RGT 1213)

Competencies and Suggested Objectives
1. Apply medical and professional ethics in the context of a broader society. a. Examine the interrelationship between personal, community, and societal values. b. Explain the influence a person's value system has on his or her behavior. c. Examine how professional values are imparted. d. Assess the effect of a conflict between a patient's values and a health professional's values on the resultant care that a patient may receive. e. Discuss morality and its development. f. Contrast culture and ethnicity, and provide examples of each. g. Explain how a person's cultural bias toward illness affects his or her recovery. h. Explain the roots of medical ethnocentrism. i. Discuss the societal factors that influence the quality of health care a patient may receive. j. Describe the culture of poverty and the effect and delivery on the health-care system. k. Discuss the patient advocacy role of the health professional in relation to effective patient communication. l. Discuss the importance of understanding verbal and nonverbal communications in various cultures.
2. Discuss the appropriate physical boundaries in relation to touching with no formal consent. a. Compare pity, sympathy, and empathy in relation to a patient's situation. b. Discuss family dynamics in a cultural, social, ethnic, and lifestyle sense.
3. Identify legal and professional standards and their relationship to practice in health professions. a. Describe accepted codes or guidelines for professional ethics in their chosen health profession. b. Identify specific ethical situations and dilemmas in health care that may impact the radiographer. c. Employ a basic system of examination, clarification, determination of alternatives, and decision making in addressing ethical questions and situations. d. Explain select concepts embodied in principles of patients' rights, the doctrine of informed (patient) consent, and other issues related to patients' rights.

e. Identify the legal implications of professional liability, malpractice, professional negligence and carelessness, and other legal doctrines applicable to professional practice.
f. Discuss the importance of accurate, complete, and correct methods of documentation as a legal and ethical imperative.
g. In groups and individually, explore responses to theoretical situations and questions relating to the ethics of care and health-care delivery.
h. Explain specific legal terms, principles, and laws.
i. Identify the elements necessary for valid malpractice claim.
j. Define specific legal doctrines to include vicarious liability, respondeat superior, and res ipsa loquitur.
k. Describe the ASRT Scope of Practice for the radiographer, the elements that comprise it, and the responsibilities of the radiographer.
l. Differentiate between professional and legal standards, and describe how each relates to radiography practice.
m. Identify institutional and professional liability protection typically available to the radiographer.
n. Describe the elements and implications of informed consent.
o. Identify standards for disclosure relative to informed consent.
p. Describe how consent forms are utilized relative to specific radiographic procedures.

STANDARDS

Content Specifications for the Examination in Radiography

RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Course Name: Clinical Education IV

Course Abbreviation: RGT 2147

Classification: Vocational–Technical Core

Description: This course is a clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, radiation protection, operation of equipment, and radiologic procedures. (7 sch: 21-hr clinical)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Apply radiographic principles in the clinical setting with respect to program levels. a. Demonstrate skills in assessment and evaluation of psychological and physical changes in the patient's condition, and carry out appropriate actions. b. Manage interaction with the patient and family in a manner that provides the desired psychosocial support. c. Provide patient and family education appropriate to the comprehension level of the patient and family. d. Apply radiation protection principles. e. Discuss basic X-ray production and interactions. f. Operate medical imaging equipment and accessory devices. g. Position the patient and medical imaging system to perform examinations and procedures. h. Apply knowledge of human structure, function, and pathology. i. Evaluate the performance of medical imaging systems. j. Evaluate medical images for technical quality. k. Apply knowledge and skills relating to recording medical image processing. l. Operate equipment within safety limits. m. Recognize equipment malfunctions, and report them to the proper authority. n. Apply knowledge and skills relating to verbal, nonverbal, and written medical communication in patient care intervention and professional relationships. o. Demonstrate safe, ethical, and legal practices. p. Abide by the profession's code of ethics, and comply with the recognized scope of practice for the profession. q. Practice standard precautions at all times. r. Adhere to concepts of team practice that focus on organizational theories, roles of team members, and conflict resolution. s. Evaluate procedure orders for accuracy, and follow up to make corrective changes. t. Exercise independent judgment and discretion in the technical performance of medical imaging procedures. u. Establish patient centered clinically effective service for all patients regardless of age, gender, disability, ethnicity, and culture. v. Differentiate among gender, cultural, age, and socioeconomic related factors that influence patient compliance with procedures, diagnosis, treatment, and follow-up of

patients.
w. Adapt procedures to meet age-specific, disease-specific, and cultural needs of patients.
x. Interpret patient side effects and complications of radiologic procedures, contrast administration and other procedures, and take appropriate actions.
y. Document care in the patient's record.

2. Perform clinical application skills for radiographic procedures.
   a. Practice routine radiographic procedures including the following:
      (1) Cranium procedures
      (2) Routine and advanced facial bones
      (3) Procedural adjustments for trauma
      (4) Advanced mobile (portable) radiography
   b. Perform image analysis on the following:
      (1) Cranium procedures
      (2) Routine and advanced facial bones
      (3) Procedural adjustments for trauma
      (4) Advanced mobile (portable) radiography

3. Demonstrate tasks associated with radiographic procedures.
   a. Perform routine radiographic procedures including the following:
      (1) Bony thorax
      (2) Mobile (portable) radiography
   b. Perform advanced radiographic procedures including the following:
      (1) Spinal column
      (2) Pelvic girdle
      (3) Lower extremities
      (4) Urinary systems
   c. Demonstrate procedural adjustments to accommodate trauma cases.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)

M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Callaway, W. J. (2008). *Mosby's comprehensive review of radiography* (5th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Carter, C., & Veale, B. (2008). *Digital radiography and PACS*. St. Louis, MO: Mosby.

Eisenberg, R. L., & Johnson, N. M. (2007). *Comprehensive radiographic pathology* (4th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Clinical Education V

Course Abbreviation: RGT 2157

Classification: Vocational–Technical Core

Description: This course is a clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, radiation protection, operation of equipment, and radiologic procedures. (7 sch: 21-hr clinical)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Apply radiographic principles in the clinical setting with respect to program levels. a. Demonstrate skills in assessment and evaluation of psychological and physical changes in the patient's condition, and carry out appropriate actions. b. Manage interaction with the patient and family in a manner that provides the desired psychosocial support. c. Provide patient and family education appropriate to the comprehension level of the patient and family. d. Apply radiation protection principles. e. Discuss basic X-ray production and interactions. f. Operate medical imaging equipment and accessory devices. g. Position the patient and medical imaging system to perform examinations and procedures. h. Apply knowledge of human structure, function, and pathology. i. Evaluate the performance of medical imaging systems. j. Evaluate medical images for technical quality. k. Apply knowledge and skills relating to recording medical image processing. l. Operate equipment within safety limits. m. Apply knowledge and skills relating to verbal, nonverbal, and written medical communication in patient care intervention and professional relationships. n. Demonstrate safe, ethical, and legal practices. o. Abide by the profession's code of ethics, and comply with the recognized scope of practice for the profession. p. Practice standard precautions at all times. q. Adhere to concepts of team practice that focus on organizational theories, roles of team members, and conflict resolution. r. Evaluate procedure orders for accuracy, and follow up to make corrective changes. s. Exercise independent judgment and discretion in the technical performance of medical imaging procedures. t. Establish patient-centered, clinically effective service for all patients regardless of age, gender, disability, ethnicity, and culture. u. Differentiate gender, cultural, age, and socioeconomic related factors that influence patient compliance with procedures, diagnosis, treatment, and follow-up of patients. v. Adapt procedures to meet age-specific, disease-specific, and cultural needs of patients.

w. Interpret patient side effects and complications of radiologic procedures, contrast administration, and other procedures, and take appropriate actions.
x. Document care in the patient's record.
y. Differentiate between normal ECG rhythms and abnormal ECG tracings.
z. Apply the principles of total quality management.
aa. Report equipment malfunctions to assist with appropriate corrective actions.

2. Demonstrate tasks associated with radiographic procedures.
   a. Perform radiographic procedures on facial bones.
   b. Perform radiographic procedures on nasal bones.
   c. Perform radiographic procedures on paranasal sinuses.
   d. Perform radiographic surgical procedures.
   e. Perform advanced mobile (portable) radiography.

3. Integrate didactic and clinical competencies to perform radiographic procedures.
   a. Demonstrate knowledge of anatomy, physiology, positioning, and radiographic techniques to accurately demonstrate anatomical structures on a radiograph or other imaging receptor.
   b. Determine exposure factors to achieve optimum radiographic techniques with minimum radiation exposure to the patient.
   c. Evaluate radiographic images for appropriate positioning and image quality.
   d. Apply the principles of radiation protection to the patient, self, and others.
   e. Provide patient care and comfort.
   f. Recognize emergency patient conditions; initiate lifesaving first aid and basic life support.
   g. Detect equipment malfunctions; report same to the proper authority, and know the safe limits of equipment operation.
   h. Exercise independent judgment and discretion in the technical performance of medical imaging procedures.
   i. Participate in radiologic quality assurance programs.
   j. Provide patient and public education related to radiologic procedures and radiation protection and safety.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)

R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

The American Registry of Radiologic Technologists. (n.d.). Retrieved May 21, 2008, from http://www.arrt.org/index.html

The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Callaway, W. J. (2008). *Mosby's comprehensive review of radiography* (5th ed.). St. Louis, MO: Mosby.

Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Carter, C., & Veale, B. (2008). *Digital radiography and PACS*. St. Louis, MO: Mosby.

Eisenberg, R. L., & Johnson, N. M. (2007). *Comprehensive radiographic pathology* (4th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Course Name: Radiographic Procedures III

Course Abbreviation: RGT 2533

Classification: Vocational–Technical Core

Description: This course includes principles and procedures involved in radiographic positioning of the entire cranium and facial bones. Included is a review of radiographic anatomy on each procedure. (3 sch: 2-hr lecture, 2-hr lab)

Prerequisites: Radiographic Procedures II (RGT 1523)

Competencies and Suggested Objectives
1. Identify positioning considerations for routine skull procedures. a. Describe routine views of the skull in terms of structure(s) visualized including general and positioning considerations involved. b. Perform the routine views of the skull in a laboratory environment. c. Evaluate radiographs of the skull in terms of positioning accuracy and image quality.
2. Identify procedural considerations for special views of the face and cranium. a. Describe routine and special views of the cranium and specific structures within the cranium and facial bones in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations. b. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved in routine and special views of the cranium and specific structures within the cranium and facial bones, given clinical simulations. c. In a laboratory environment, perform radiographic procedures of the skeletal system relating to the cranium and specific structures within the cranium and facial bones. d. Evaluate radiographs of various parts of the cranium and structures within the cranium, and evaluate facial bones in terms of positioning accuracy and image quality. e. Evaluate cranial cross-sectional anatomy.

STANDARDS

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RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)

R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's atlas of radiographic positioning and radiologic procedures* (11th ed., Vols. 1–3). St. Louis, MO: Mosby.

Jensen, S. C., & Peppers, M. P. (2006). *Pharmacology and drug administration for imaging technologists* (2nd ed.). St. Louis, MO: Mosby.

Kowalczyk, N., & Mace, J. D. (2009). *Radiologic pathology for technologists* (5th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Course Name: Radiographic Procedures IV

Course Abbreviation: RGT 2542

Classification: Vocational–Technical Core

Description: This course is a study of special radiographic procedures that utilizes sterile techniques and specialized equipment. It also includes basic concepts of pharmacology. In addition, it also includes principles and procedures involved in radiographic positioning of the reproductive system. (2 sch: 2-hr lecture)

Prerequisites: Radiographic Procedures III (RGT 2532)

Competencies and Suggested Objectives
1. Identify procedural considerations for special routine radiographic studies. a. Describe routine and special views of arthrography in regard to structure and positioning considerations. b. Describe routine and special views of myleography in regard to structure and positioning considerations. c. Describe routine and special views of venography in regard to structure and positioning considerations.
2. Identify procedural considerations for special radiographic studies. a. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved for routine and special views of the soft tissue structures of the joints given clinical simulations. b. Evaluate radiographs of the various parts of the soft tissue structures of the joints in terms of positioning accuracy and image quality. c. Discuss imaging and other equipment used in various special studies. d. Describe special studies performed on various parts including bone survey, long bone measurement, and bone age. e. Describe the contrast medium utilized for each study in terms of type, administration method, and quantity when given various special studies. f. Describe the patient preparation for various special studies.
3. Identify various types of drugs and interactions. a. Distinguish between the chemical, generic, and trade names for select drugs. b. Describe pharmacokinetic and pharmacodynamic principles of drugs. c. Classify drugs according to specific categories. d. Explain the action uses and side effects for select drugs. e. Explain the effects of select drugs on imaging procedures. f. Describe methods and techniques for the administration of various types of contrast agents. g. Identify and describe the routes of drug administration. h. Discuss the purposes and advantages of intravenous drug administration over other routes. i. Differentiate between the two major sites of intravenous drug administration. j. Identify, describe, and document complications associated with intravenous drug therapy

and appropriate actions to resolve these complications. k. Discuss the various elements of initiating and discontinuing intravenous drug therapy. l. Differentiate between and document dose calculations for adult and pediatric patients. m. Prepare contrast agents and intravenous medications for injection, utilizing aseptic technique.
4. Identify and describe diagnostic contrast agents. a. Define the categories of contrast agents, and give specific examples for each category. b. Explain the pharmacology of barium and iodine compounds.
5. Identify procedural considerations for the reproductive system. a. Describe routine and special views of the reproductive system in terms of structure(s) visualized and function(s) demonstrated including general and positioning considerations. b. Explain the structure(s) visualized and function(s) demonstrated including general and positioning considerations involved using clinical simulations. c. In a laboratory environment, perform radiographic procedures related to the reproductive system. d. Evaluate radiographs of various parts of the reproductive system in terms of positioning accuracy and image quality.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bontrager, K. L., & Lampignano, J. (2005). *Radiologic positioning and related anatomy workbook and laboratory manual set* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

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Kowalczyk, N., & Mace, J. D. (2009). *Radiologic pathology for technologists* (5th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Tortorici, M. R., & Apfel, P. J. (1995). *Advanced radiographic and angiographic procedures with an introduction to specialized imaging.* Philadelphia, PA: F.A. Davis.

Course Name: Radiation Biology

Course Abbreviation: RGT 2911

Classification: Vocational–Technical Core

Description: This course is a study of the biological effects of radiation upon living matter. It includes genetic and somatic effects. (1 sch: 1-hr lecture)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Evaluate biophysical events relating to radiation exposure. a. Identify sources of electromagnetic and particulate ionizing radiations. b. Discuss directly and indirectly ionizing radiations. c. Identify sources of radiation exposure. d. Describe radiation induced chemical reactions, and analyze biologic damage.
2. Analyze radiation effects on living organisms. a. Identify methods to measure radiation response. b. Describe physical, chemical, and biologic factors influencing radiation response of cells and tissues. c. Explain factors influencing radiosensitivity. d. Recognize the clinical significance of $LD_{50/30}$ and LD_{30}.
3. Demonstrate comprehension of radiosensitivity and response. a. Examine effects of limited versus total body exposure. b. Relate short-term and long-term effects as a consequence of high and low radiation doses. c. Differentiate between somatic and genetic radiation effects as well as discuss specific diseases or syndromes associated with them. d. Discuss stochastic and non-stochastic (deterministic) effects. e. Discuss risk estimates for radiation-induced malignancies. f. Employ dose response curves to study the relationship between radiation dose levels and the degree of biologic response. g. Discuss use of and information to be gained from various dose/response curves. h. Discuss factors affecting radiation patient dose, such as ESE, bone marrow, and gonadal dose.

STANDARDS

Content Specifications for the Examination in Radiography

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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The American Society of Radiologic Technologists. (n.d.) Retrieved May 21, 2008, from http://www.asrt.org/

American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

REMS Software (2006). [Computer software]. Upper Montclair, NJ: REMS Software.

Course Name: Radiographic Pathology

Course Abbreviation: RGT 2921

Classification: Vocational–Technical Core

Description: This course is designed to introduce theories of disease causation and the pathophysiologic disorders that compromise healthy systems. Etiology, pathophysiologic responses, clinical manifestations, radiographic appearance, and management of alterations in body systems will be presented. (1 sch: 1-hr lecture)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Identify terms and conditions related to pathology. a. Define terms related to pathology. b. Discuss manifestations of pathological conditions and their relevance to radiographic procedures.
2. Relate radiographic diagnosis to the classification of trauma and physical injury. a. Discuss the classifications of trauma. b. Describe examples and sites, complications, and prognosis for classifications of trauma. c. Describe radiologic procedures used in the diagnosis for trauma.
3. Explain classification and radiographic demonstration of systemic disease. a. List the systemic classifications of disease, and define them. b. Describe the various systemic classifications of disease in terms of etiology, types, common sites, complications, and prognosis. c. Discuss the radiographic appearance of selected diseases. d. Describe radiographic procedures and interventional techniques appropriate for different examples of disease in each of the systemic classifications.
4. Discuss damage and repair of tissue. a. Discuss the causes of tissue disruption; for the different causes, describe the process, and give examples. b. Describe the healing process. c. Discuss complications connected with the repair and replacement tissue.

STANDARDS

Content Specifications for the Examination in Radiography

RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
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21st Century Skills

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Course Name: Certification Fundamentals

Course Abbreviation: RGT 2933

Classification: Vocational–Technical Core

Description: This course is designed to correlate scientific components of radiography to entry-level knowledge required by the profession. (3 sch: 3-hr lecture)

Prerequisites: All core courses as scheduled

Competencies and Suggested Objectives
1. Recall radiation protection standards. a. Identify the biological effects of radiation. b. Describe how exposure factors, shielding, beam restriction, filtration, and other appropriate devices minimize patient exposure. c. Differentiate among the various sources of radiation exposure. d. Utilize NCRP recommendations for protective devices. e. Explain the units of measurement. f. Critique radiation exposure and monitoring.
2. Identify equipment operation and maintenance practices. a. Identify components of basic radiographic units. b. Describe basic principles of operations of X-ray generators, transformers, and rectification systems. c. Describe the operation and maintenance of fluoroscopic units. d. Identify the implementation of performance evaluations for radiographic units and accessories. e. Describe the operation of digital imaging equipment.
3. Summarize image production and evaluation methods. a. Critique the factors used in the selection of technical factors. b. Evaluate recorded detail, distortion, density, and contrast in image production. c. Analyze film processing, image acquisition, and quality assurance. d. Evaluate the diagnostic quality of radiographs.
4. Summarize the routine radiographic procedures. a. Identify the general procedural considerations. b. Identify the positioning, anatomy, physiology, and pathology for each of the specific imaging procedure categories: (1) Thorax (2) Abdomen and GI series (3) Urological studies (4) Extremities (5) Spine and pelvis (6) Head and neck (7) Other
5. Identify all aspects of patient care. a. Describe legal and professional responsibilities.

b. Provide patient education and safety.
c. Utilize universal precautions, and help prevent the control of infection.
d. Identify patient condition.
e. Identify contrast media and contraindications.

STANDARDS

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RAD1 Radiation Protection
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RAD5 Patient Care and Education

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
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M1 Addition of Whole Numbers (no regrouping, regrouping)
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M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
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L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS1 Global Awareness
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American Society of Radiologic Technologists. (n.d.) Retrieved June 3, 2008, from https://www.asrt.org/CONTENT/Publications/RadiologicTechnology/Radiologic_Technology.aspx

Adler, A. M., & Carlton, R. R. (2007). *Introduction to radiologic sciences and patient care* (4th ed.). St. Louis, MO: Saunders.

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Bontrager, K. L., & Lampignano, J. (2005). *Textbook of radiographic positioning and related anatomy* (6th ed.). St. Louis, MO: Mosby.

Bontrager, K. L. (2002). *Pocket atlas handbook of radiologic positioning and techniques* (4th ed.). Phoenix, AZ: Bontrager Publishing.

Bushong, S. C. (2009). *Radiologic science for technologists* (9th ed.). St. Louis, MO: Mosby.

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Carlton, R. R., & Adler, A. M. (2006). *Principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Carter, C., & Veale, B. (2008). *Digital radiography and PACS*. St. Louis, MO: Mosby.

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Frank, E. D., Long, B. W., & Smith, B. J. (2007). *Merrill's pocket guide to radiography* (6th ed.). St. Louis, MO: Mosby.

Jensen, S. C., & Peppers, M. P. (2006). *Pharmacology and drug administration for imaging technologists* (2nd ed.). St. Louis, MO: Mosby.

Kowalczyk, N., & Mace, J. D. (2009). *Radiologic pathology for technologists* (5th ed.). St. Louis, MO: Mosby.

Poelhuis, D. J., Kowalczyk, N., Carlton, R. R., & Adler, A. M. (2006). *Workbook with lab exercises to accompany principles of radiographic imaging: An art and a science* (4th ed.). Clifton Park, NJ: Thomson/Delmar.

Pozgar, G. D. (2007). *Legal aspects of health care administration* (10th ed.). Sudbury, MA: Jones and Bartlett.

REMS Software (2006). [Computer software]. Upper Montclair, NJ: REMS Software.

Saia, D. A. (2008). *Lange Q. & A.: Radiography examination* (7th ed.). New York, NY: McGraw Hill.

Statkiewicz Sherer, M. A., Visconti, P. J., & Ritenour, E. R. (2006). *Radiation protection in medical radiography* (5th ed.). St. Louis, MO: Mosby.

Tortorici, M. R., & Apfel, P. J. (1995). *Advanced radiographic and angiographic procedures with an introduction to specialized imaging.* Philadelphia, PA: F.A. Davis.

Towsley-Cook, D. M., & Young, T. A. (2007). *Ethical and legal issues for imaging professionals* (2nd ed.). St. Louis, MO: Mosby.

Vaughn, D. (2004). *Medical terminology 350* (2nd ed.).Westwood, MA: DCM Instructional Systems.

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Angulator (1 per 5 students)
2. Arm, blood pressure simulator (1 per 10 students)
3. Arm, injectable IV training simulator (1 per 10 students)
4. Cassette, radiographic film holder 30 cm by 35 cm (6 per lab)
5. Computer (1 per 2 students)
6. Computer workstation (1 per computer)
7. Digital densitometer with carrying case (1 per 10 students)
8. Film ID flasher (1 per lab)
9. Film storage bin (Darkroom) (1 per darkroom)
10. Grid cap 14 by 17 in. (1 per lab)
11. Grid cap 10 by 12 in. (1 per lab)
12. Holder, phantom head positioning (1 per 10 students)
13. Human sexless torso (1 per lab)
14. Illuminators, mobile stand system (1 per 5 students)
15. Illuminator, portable (1 per classroom)
16. Illuminator, portable, single (1 per lab)
17. Illuminator, wall mounted (1 per lab)
18. Interactive video equipment (1 per 5 students)
19. Intravenous continuous pump (1 per 10 students)
20. Laser printer (1 per 2 computers)
21. Lockable student storage (1 per student)
22. Patient care simulator (1 per program)
23. Patient restraint/Immobilizer/Positioner (1 per lab)
24. Patient transfer device adult positioner (1 per lab)
25. Phantom, sectional chest (1 per lab)
26. Phantom, sectional, elbow AP and 90 flexion (1 per lab)
27. Phantom, sectional, foot (1 per lab)
28. Phantom, sectional, hand PA: Lateral (1 per lab)
29. Phantom, sectional, head with cervical (1 per lab)
30. Phantom, sectional, knee AP and 90 flexion (1 per lab)
31. Phantom, sectional, pelvis (1 per lab)
32. Phantom patient, whole body with lungs (1 per lab)
33. Pneumonic compression paddle (1 per lab)
34. Processor, radiographic (1 per darkroom)
35. Quality assurance system (1 per lab)
36. Safelight illuminators (Darkroom) (1 per darkroom)
37. Sensitometer (1 per 10 students)
38. Silver recovery unit (1 per darkroom)
39. Stretcher (1 per lab)
40. Tool modulator transfer tester (1 per program)
41. Wheelchair with IV pole attachment (1 per lab)

42. X-ray radiography system (1 per 10 students)
43. X-ray radiography system, portable (1 per program)
44. Phantom, entire upper extremity (1 per lab)
45. Phantom, entire lower extremity (1 per lab)
46. Projector screen (1 per room)
47. Skeleton human bones, disarticulated (1 per room or 2 per program)
48. Skeleton, with stand, human adult (1 per room or 2 per program)
49. Supply storage cabinet, lockable (1 per program)
50. CR radiography system (1 per program)
51. DR radiography system (1 per program)

NON-CAPITALIZED ITEMS

1. Calipers (1 per lab)
2. Cart, film (1 per program)
3. Cassette holder, portable (1 per radiographic room)
4. Cassette, radiographic film holder 8 by10 in. (6 per program)
5. Cassette, radiographic film holder extremity 8 by 10 in. (6 per lab)
6. Cassette, radiographic film holder extremity 24 by 30 cm (6 per lab)
7. Cassette, radiographic film holders 35 by 43cm (6 per lab)
8. Cassette, radiographic film holders 24 by 30 cm (6 per lab)
9. Cassette, radiographic film holders 18 by 43 cm (6 per lab)
10. Cassette, radiographic film holders 18 by 34 cm (6 per lab)
11. Cervical sandbags (1 set per lab)
12. Clock (1 per lab)
13. Deluxe enclosed film marking devices (1 per lab)
14. Gowns, cloth (1 per student)
15. Heart model (1 per 10 students)
16. IV Pole, on wheels (1 per lab)
17. Kidney model with base (1 per lab)
18. Lead apron (2 per lab)
19. Lead gloves (2 per lab)
20. Lead (flat shields) (3 per room)
21. Pillows (3 per lab)
22. Pillow cases (1 per pillow)
23. Positioning blocks, various sizes and shapes (1 per lab)
24. Portable AV security cabinet with electronic hookups (1 per program)
25. Safe light filters (1 per safe light)
26. Skull, disarticulated (2 per program)
27. Sheets (2 per stretcher)
28. Sphygmomanometer with stethoscope (1 per 2 students)
29. Stool, step (1 per lab)
30. Stool, adjustable (1 per lab)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Television (1 per room)
2. VCR/DVD (1 per room)
3. Video camera standard VHS (1 per lab)
4. ELMO presentation system (1 per program)
5. Projector, overhead (1 per room)
6. Table, mobile for portable overhead projector (desk type) (1 per program)
7. Electrical cart, steel, for AV equipment (1 per program)
8. Interactive whiteboard (1 per program)

Appendix A: Content Specifications for the Examination in Radiography[1]

RAD1 Radiation Protection
RAD2 Equipment Operation and Quality Control
RAD3 Image Production and Evaluation
RAD4 Radiographic Procedures
RAD5 Patient Care and Education

[1] The American Registry of Radiologic Technologists. (2007). *Content specifications for the examination in radiography*. St. Paul, MN: Author.

Appendix B: Related Academic Standards[2]

Reading
R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause–effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

Mathematics Computation
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations

Applied Mathematics
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)

Language
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on sentence, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

Spelling
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

[2] CTB/McGraw-Hill LLC. (1994). *Tests of adult basic education, Forms 7 and 8.* Monterey, CA: Author.

Appendix C: 21st Century Skills[3]

CS1 Global Awareness

- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Promoting the study of non-English language as a tool for understanding other nations and cultures

CS2 Financial, Economic, and Business Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy and the role of business in the economy
- Applying appropriate 21st century skills to function as a productive contributor within an organizational setting
- Integrating oneself within and adapting continually to the nation's evolving economic and business environment

CS3 Civic Literacy

- Being an informed citizen to participate effectively in government
- Exercising the rights and obligations of citizenship at local, state, national, and global levels
- Understanding the local and global implications of civic decisions
- Applying 21st century skills to make intelligent choices as a citizen

CS4 Information and Communication Skills

- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
- Communication skills: Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts

CS5 Thinking and Problem-Solving Skills

- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices; understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others: staying open and responsive to new and diverse perspectives

CS6 Interpersonal and Self-Directional Skills

- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, and respecting diverse perspectives
- Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, and transferring learning from one domain to another
- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for one's self and others; tolerating ambiguity

[3] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts