Radiologic Technology
Mississippi Curriculum Framework

Program CIP: 51.0911 – Radiologic Technology/Science - Radiographer
November 2014

Published by:
Mississippi Community College Board
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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

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RESEARCH ABSTRACT

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.

The last validated and approved revision of this curriculum took place in 2008. In the fall of 2014, the Office of Curriculum and Instruction (OCI) met with different industry/program visits. An industry questionnaire was used to gather feedback concerning the trends and needs, both current and future, of their field. Industry members stated the curriculum was strong, but we might want to encourage students upon completion of this program to continue becoming certified in additional modalities. Currently there are some areas where students are being hired as part-time employees waiting on something full-time to open in the radiologic technology field. The Office of Curriculum and Instruction also met with advisory committee members who reiterated what industry had stated. Program faculty, administrators, and industry members were consulted regarding industry workforce needs and trends.

After validation and approval we will go back and add to this curriculum.

The major change within the revision process this time was the adoption of the American Society of Radiologic Technologists Radiography Curriculum standards. Other changes are as follows:

- Competencies/objectives were changed to Student Learning Outcomes (SLO).
- All course prerequisites were changed to “Instructor Approved.”
- In RGT 1114 SLO “3a” was changed from Evaluate physician’s orders and radiography requests to abide by physician’s orders and radiography requests.
- RGT 2921 Radiographic Pathology was changed to RGT 2922 and became a two hour course to meet the needs of the community colleges.
- RGT 1139 Clinical Education III was changed to RGT 113(5-9) Clinical Education III to meet the needs for the colleges based on when the course if offered.
- In RGT 1223 SLO “1f” was removed. Student learning outcome “1d” was changed to identify and discuss the perceptions and stages of death and dying from patient and technologist viewpoints. Also SLO “1m” was combined with “1e”. Student Learning Outcome “1n” was also combined with “1d”.
- In RGT 1413 Imaging Principles, SLO “13c” was removed.
- In RGT 1213 SLO “1d” was changed from Discuss the reimbursement and payment options for health-care services and the importance of CPT coding to define the reimbursement and payment options for health-care services and the importance of CPT coding.
- RGT 1513 SLO “6d” was removed.
- In RGT 1613, Physics of Imaging Equipment, SLO 3 was removed and placed in RGT 2133 Computed Tomography.
- The Recommended Tools and Equipment list was also updated.

ADOPTION OF NATIONAL CERTIFICATION STANDARDS

The American Society of Radiologic Technologists Radiography Curriculum competencies and objectives were adopted for this curriculum. The American Registry of Radiologic Technologists (ARRT) is the world's largest credentialing organization that seeks to ensure high quality patient care in medical imaging, interventional procedures, and radiation therapy.

In support of this mission, the ARRT:

- Adopts and upholds standards for educational preparation for entry into the profession;
- Adopts and upholds standards of professional behavior consistent with the level of responsibility required by professional practice; and
- Develops and administers examinations which assess the knowledge and skills underlying the intelligent performance of the tasks typically required by professional practice in the discipline.

In addition to initial recognition, ARRT provides a mechanism to recognize individuals who continue to demonstrate their qualifications through adherence to the standards of professional behavior and compliance with continuing education requirements.

More information related to these standards can be found at the following website:

http://www.asrt.org/docs/default-source/educators/ed_curr_rad2012approved_

Industry standards are based on the American Registry of Radiologic Technologists (ARRT) Content Specifications for the Examination in Radiography.

Permission was granted by the American Society of Radiologic Technologists Organization to include the competencies and objectives in this curriculum. More information can be found at:

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INDUSTRY JOB PROJECTION DATA

The field of radiologic technology is growing steadily. This field provides not only opportunities in direct radiologic technology work but also room for multiple modality skill certifications. There is an 18.23%% increase in occupational demand at the regional level and a 19.67% increase at the state level. Median annual income for radiologic technologists is $43,992.00 at the state and regional level. A summary of occupational data from the State Workforce Investment Board Data Center is displayed below:

Table 1: Education Level

Program Occupations	**Education Level**
Radiologic Technologists	Associate Degree

Table 2: Occupational Overview

	Region	**State**	**United States**
2010 Occupational Jobs	1,437	2,272	216,600
2020 Occupational Jobs	1,699	2,721	254,164
Total Change	262	449	37,564
Total % Change	18.23%	19.76%	17.34%
2010 Median Hourly Earnings	$21.15	$21.15	
2010 Median Annual Earnings	$43,992.00	$43,992.00	$0.00
Annual Openings	26	44	3,756

Table 3: Occupational Breakdown

Description	**2010 Jobs**	**2020 Jobs**	**Annual Openings**	**2010 Hourly Earnings**	**2010 Annual Earnings 2,080 Work Hours**
Radiologic Technologists	1,437	1,699	26	$21.15	$43,992.00

Table 4: Occupational Change

Description	**Regional Change**	**Regional % Change**	**State % Change**	**National % Change**
Radiologic Technologists	262	18.23%	19.76%	17.34%

ARTICULATION

No articulated credit will be offered upon implementation of this curriculum. Local agreements and dual credit partnerships are encouraged.

TECHNICAL SKILLS ASSESSMENT

Colleges should report the following for students who complete the program with an Associate of Applied Science Degrees for technical skills attainment:

The *American Registry of Radiologic Technologists (ARRT) Examination* will be used to assess students upon completion of this program, after meeting the requirements for the AAS degree. The cost for the ARRT exam is $200.00. (price subject to change)

ONLINE AND BLENDED LEARNING OPPORTUNITIES

Course content includes lecture and laboratory semester credit hours. Faculty members are encouraged to present lecture related content to students in an online or blended learning environment. Training related to online and blended learning will be available to faculty members through the MS Community College Board.

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 purposes. The radiographer is responsible for all functions in the Radiology Department to ensure 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, such as completing the requirements for an Associate of Applied Science Degree in Radiologic Technology.

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*.

More information for ARRT can be found at https://www.arrt.org/content-specifications

SUGGESTED COURSE SEQUENCE

Associate of Applied Science Required Courses

			SCH Breakdown				Contact Hour Breakdown			Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Clinical/ Internship	Total Contact Hours	Lecture	Lab	Clinical/ Internship	Certification Name
RGT 1213	Fundamentals of Radiography	3	3			45	45			
RGT 1223	Patient Care and Radiography	3	2	2		60	30	30		
RGT 1114	Clinical Education I	4			12	180			180	
RGT 1124	Clinical Education II	4			12	180			180	
RGT 1139	Clinical Education III	9			27	405			405	
RGT 1312	Principles of Radiation Protection	2	2			30	30			
RGT 1413	Imaging Principles	3	2	2		60	30	30		
RGT 1423	Digital Imaging	3	2	2		60	30	30		
RGT 1513	Radiographic Procedures I	3	2	2		60	30	30		
RGT 1523	Radiographic Procedures II	3	2	2		60	30	30		
RGT 1613	Physics of Imaging Equipment	3	3			45	45			
RGT 2132	Ethical and Legal Responsibilities	2	2			30	30			
RGT 2147	Clinical Education IV	7			21	315			315	
RGT 2157	Clinical Education V	7			21	315			315	
RGT 2532	Radiographic Procedures III	2	1	2		45	15	30		
RGT 2542	Radiographic Procedures IV	2	2			30	30			
RGT 2911	Radiation Biology	1	1			15	15			American Registry of Radiologic Technologist (ARRT) Examination
RGT 2922	Radiographic Pathology	2	2			30	30			
RGT 2933	Certification Fundamentals	3	3			45	45			
	Total	**65**	**28**	**12**	**93**	**2010**	**435**	**180**	**1395**	

Academic Courses for Radiologic Technology

			SCH Breakdown			Credit Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Credit Hours	Lecture	Lab	Certification Name
BIO 1514 or 2514	Anatomy and Physiology I with Lab							
BIO 1524 or 2524	Anatomy and Physiology II with Lab							
MAT 1313	College Algebra*							
	Humanities/Fine Arts							
	Natural Science/Mathematics							
	Social/Behavioral Sciences							
	Other instructor approved courses per local community college requirements to meet for AAS degree.							
TOTAL								

*MAT 1233 Intermediate Algebra may be taken in lieu of MAT 1313 College Algebra

Approved Program Electives

			SCH Breakdown			Credit Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Credit Hours	Lecture	Lab	Certification Name
RGT 2113	Mammography	3						
RGT 2123	Section Anatomy	3						
RGT 2133	Computed Tomography	3						
RGT 2143	Magnetic Resonance Imaging	3						
RGT 1111	Radiologic Seminar I	1						
RGT 1121	Radiologic Seminar II	1						
RGT 2111	Radiologic Seminar III	1						
RGT 2121	Radiologic Seminar IV	1						
	All other electives approved by instructor							
TOTAL								

General Education Core Courses

To receive the Associate of Applied Science Degree, a student must complete all of the required coursework found in the Career Certificate option, Technical Certificate option and a minimum of 15 semester hours of General Education Core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college. The Southern Association of Colleges and Schools (SACS) Commission on Colleges Standard 2.7.3 from the Principles of Accreditation: Foundations for Quality Enhancement1 describes the general education core.

Section 2.7.3 In each undergraduate degree program, the institution requires the successful completion of a general education component at the collegiate level that (1) is substantial component of each undergraduate degree, (2) ensures breadth of knowledge, and (3) is based on a coherent rationale. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours or the equivalent. These credit hours are to be drawn from and include at least one course from the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. The courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

1 Southern Association of Colleges and Schools Commission on Colleges. (2012). *The principles of accreditation: Foundations for quality enhancement*. Retrieved from http://www.sacscoc.org/pdf/2012PrinciplesOfAcreditation.pdf

ASSOCIATE OF APPLIED SCIENCE REQUIRED COURSES

Course Number and Name: **RGT 1213 Fundamentals of Radiography**

Classification: Associate of Applied Science Degree Requirement

Description: This course is an introduction to Radiologic Technology including professional, departmental, and historical aspects. Included are terminology, medical ethics, and fundamental legal responsibilities.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

National Assessment: Components of the *American Registry Radiologic Technologist* (ARRT) *Examination*

Prerequisite: Instructor Approved

Student Learning Outcomes:

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. Define 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.

ASRT - Medical Terminology

1. Apply the word-building process.
2. Interpret medical abbreviations and symbols.
3. Critique orders, requests and diagnostic reports.
4. Define medical imaging and radiation oncology terms.
5. Translate medical terms, abbreviations and symbols into common language from a medical report.

ASRT - Introduction to Radiologic Science and Health Care

1. Identify other health science professions that participate in the patient's total health care.
2. Identify various settings involved in the delivery of health care.
3. Discuss the reimbursement/payment options for health care services.
4. Discuss the role and value of a mission statement to the operation of an institution.
5. Describe relationships and interdependencies of departments within a health care institution.
6. Discuss the responsibilities and relationships of all personnel in the radiology department.
7. Differentiate between quality improvement/management, quality assurance and quality control.
8. Differentiate among accreditation types.
9. Define credentialing, certification, registration, licensure and regulations.
10. Discuss career opportunities and advancement for the radiographer.

11. Identify the benefits of continuing education as related to improved patient care and professional enhancement.

Course Number and Name: **RGT 1223 Patient Care and Radiography**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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. Identify and discuss the perceptions and stages of death and dying from patient and technologist viewpoints.
   e. List the stages of dying, and describe the characteristics of each stage.
   f. Identify the support mechanisms available to the terminally ill.
   g. Describe methods of determining the proper patient identification.
   h. Explain the use of the following:
      (1) Audio and visual communication systems
      (2) Immobilization devices
      (3) Machine type
      (4) Auxiliary equipment
   i. 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
   j. Interact with patients' family members and friends using case studies.
   k. Identify and discuss ethical, emotional, personal, and physical aspects of death.
   l. Identify and define methods of communication, and discuss how each can be utilized in patient education.
   m. Identify patient communication problems, and discuss how each can be overcome to provide patient education.
   n. Demonstrate explanations of radiographic examinations when given clinical simulations (e.g., chest, UGI, and extremity).
   o. 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.
   p. 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.

ASRT - Patient Care in Radiologic Sciences

1. Identify the responsibilities of the health care facility and members of the health care team.
2. List the general responsibilities of the radiographer.
3. Describe the practice standards for the radiographer as defined by the ASRT and state licensure.
4. Differentiate between culture and ethnicity.
5. Explain how a person's cultural beliefs toward illness and health affect his or her health status.
6. Explain perceptions of dying and death from the viewpoint of both patient and radiographer.
7. Describe the characteristics of each stage of grief.
8. Identify methods for determining the correct patient for a given procedure.
9. Explain the use of various communication devices and systems.
10. Explain specific aspects of a radiographic procedure to the patient.
11. Demonstrate correct principles of body mechanics applicable to patient care.
12. Demonstrate techniques for specific types of patient transfer.
13. Demonstrate select procedures to turn patients with various health conditions.
14. Describe select immobilization techniques for various types of procedures and patient conditions.
15. Describe specific patient safety measures and concerns.
16. Explain the purpose, legal considerations and procedures for incident reporting.
17. Describe methods to evaluate patient physical status.
18. List the information to be collected prior to a patient examination.
19. Describe vital signs and lab values used to assess patient condition, including sites for assessment and normal values.
20. Define terms related to infection control.
21. Describe the importance of standard precautions and isolation procedures, including sources and modes of transmission of infection and disease and institutional control procedures.
22. Identify symptoms related to specific emergency situations.

23. Describe the institution's emergency medical code system and the role of the student during a medical emergency.
24. Explain the age-specific considerations necessary when performing radiographic procedures.
25. Describe appropriate procedures for management of various types of trauma situations.
26. Describe the symptoms and medical interventions for a patient with a contrast agent reaction.
27. Explain the role of the radiographer in patient education.
28. Describe the patient preparation for contrast studies.
29. Identify specific types of tubes, lines, catheters and collection devices.
30. Outline the steps in the operation and maintenance of suction equipment.
31. Outline the steps in the operation and maintenance of oxygen equipment and demonstrate proper use.
32. Demonstrate competency in basic life support (BLS).
33. Describe the steps in performing various mobile procedures.
34. Describe the special problems faced in performing procedures on a patient with a tracheotomy and specific tubes, drains and catheters.
35. Describe the procedure for producing diagnostic images in the surgical suite.
36. Explain the appropriate radiation protection required when performing mobile/surgical radiography.

ASRT - Pharmacology and Venipuncture

1. Distinguish among the chemical, generic and trade names for drugs in general.
2. Describe pharmacokinetic and pharmacodynamic principles of drugs.
3. Explain the uses and impact of drug categories on the patient.
4. Define the categories of contrast agents and give specific examples for each category.
5. Explain the pharmacology of contrast agents.
6. Describe methods and techniques for administering various types of contrast agents.
7. Identify and describe the routes of drug administration.
8. Demonstrate appropriate venipuncture technique.
9. Differentiate between the two major sites of intravenous drug administration.
10. Identify, describe and document complications associated with venipuncture and appropriate actions to resolve these complications.
11. Discuss the various elements of initiating and discontinuing intravenous access.
12. Differentiate and document dose calculations for adult and pediatric patients.
13. Prepare for injection of contrast agents/intravenous medications using aseptic technique.
14. Explain the current legal status and professional liability issues of the radiographer's role in contrast and/or drug administration.

Course Number and Name: **RGT 1114 Clinical Education I**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
4		12	180

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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. Abide by 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.

ASRT - Clinical Practice

1. Exercise the priorities required in daily clinical practice.
2. Execute medical imaging procedures under the appropriate level of supervision.
3. Adhere to team practice concepts that focus on organizational theories, roles of team members and conflict resolution.
4. Adapt to changes and varying clinical situations.
5. Describe the role of health care team members in responding/reacting to a local or national emergency.
6. Provide patient-centered, clinically effective care for all patients regardless of age, gender, disability, special needs, ethnicity or culture.
7. Integrate the use of appropriate and effective written, oral and nonverbal communication with patients, the public and members of the health care team in the clinical setting.
8. Integrate appropriate personal and professional values into clinical practice.
9. Recognize the influence of professional values on patient care.
10. Explain how a person's cultural beliefs toward illness and health affect his or her health status.
11. Use patient and family education strategies appropriate to the comprehension level of the patient/family.
12. Provide desired psychosocial support to the patient and family.
13. Demonstrate competent assessment skills through effective management of the patient's physical and mental status.
14. Respond appropriately to medical emergencies.
15. Examine demographic factors that influence patient compliance with medical care.
16. Adapt procedures to meet age-specific, disease-specific and cultural needs of patients.
17. Assess the patient and record clinical history.
18. Demonstrate basic life support procedures.
19. Use appropriate charting methods.
20. Recognize life-threatening electrocardiogram (ECG) tracing.
21. Apply standard and transmission-based precautions.
22. Apply the appropriate medical asepsis and sterile technique.
23. Demonstrate competency in the principles of radiation protection standards.
24. Apply the principles of total quality management.
25. Report equipment malfunctions.
26. Examine procedure orders for accuracy and make corrective actions when applicable.
27. Demonstrate safe, ethical and legal practices.
28. Integrate the radiographer's practice standards into clinical practice setting.

29. Maintain patient confidentiality standards and meet HIPAA requirements.
30. Demonstrate the principles of transferring, positioning and immobilizing patients.
31. Comply with departmental and institutional response to emergencies, disasters and accidents.
32. Differentiate between emergency and non-emergency procedures.
33. Adhere to national, institutional and departmental standards, policies and procedures regarding care of patients, providing radiologic procedures and reducing medical errors.
34. Select technical factors to produce quality diagnostic images with the lowest radiation exposure possible.
35. Critique images for appropriate anatomy, image quality and patient identification.
36. Determine corrective measures to improve inadequate images.

Course Number and Name: **RGT 1124 Clinical Education II**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
4		12	180

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

ASRT - Clinical Practice

1. Exercise the priorities required in daily clinical practice.
2. Execute medical imaging procedures under the appropriate level of supervision.
3. Adhere to team practice concepts that focus on organizational theories, roles of team members and conflict resolution.
4. Adapt to changes and varying clinical situations.
5. Describe the role of health care team members in responding/reacting to a local or national emergency.
6. Provide patient-centered, clinically effective care for all patients regardless of age, gender, disability, special needs, ethnicity or culture.
7. Integrate the use of appropriate and effective written, oral and nonverbal communication with patients, the public and members of the health care team in the clinical setting.
8. Integrate appropriate personal and professional values into clinical practice.
9. Recognize the influence of professional values on patient care.
10. Explain how a person's cultural beliefs toward illness and health affect his or her health status.
11. Use patient and family education strategies appropriate to the comprehension level of the patient/family.
12. Provide desired psychosocial support to the patient and family.
13. Demonstrate competent assessment skills through effective management of the patient's physical and mental status.
14. Respond appropriately to medical emergencies.
15. Examine demographic factors that influence patient compliance with medical care.
16. Adapt procedures to meet age-specific, disease-specific and cultural needs of patients.
17. Assess the patient and record clinical history.
18. Demonstrate basic life support procedures.
19. Use appropriate charting methods.
20. Recognize life-threatening electrocardiogram (ECG) tracing.
21. Apply standard and transmission-based precautions.
22. Apply the appropriate medical asepsis and sterile technique.
23. Demonstrate competency in the principles of radiation protection standards.
24. Apply the principles of total quality management.
25. Report equipment malfunctions.
26. Examine procedure orders for accuracy and make corrective actions when applicable.
27. Demonstrate safe, ethical and legal practices.
28. Integrate the radiographer's practice standards into clinical practice setting.
29. Maintain patient confidentiality standards and meet HIPAA requirements.
30. Demonstrate the principles of transferring, positioning and immobilizing patients.
31. Comply with departmental and institutional response to emergencies, disasters and accidents.
32. Differentiate between emergency and non-emergency procedures.

33. Adhere to national, institutional and departmental standards, policies and procedures regarding care of patients, providing radiologic procedures and reducing medical errors.
34. Select technical factors to produce quality diagnostic images with the lowest radiation exposure possible.
35. Critique images for appropriate anatomy, image quality and patient identification.
36. Determine corrective measures to improve inadequate images.

Course Number and Name: **RGT 113(5-9) Clinical Education III**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
5		15	75
6		18	90
7		21	105
8		24	120
9		27	135

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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 Outline documentation procedures when abuse is suspected.

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

ASRT - Clinical Practice

1. Exercise the priorities required in daily clinical practice.
2. Execute medical imaging procedures under the appropriate level of supervision.
3. Adhere to team practice concepts that focus on organizational theories, roles of team members and conflict resolution.
4. Adapt to changes and varying clinical situations.
5. Describe the role of health care team members in responding/reacting to a local or national emergency.
6. Provide patient-centered, clinically effective care for all patients regardless of age, gender, disability, special needs, ethnicity or culture.
7. Integrate the use of appropriate and effective written, oral and nonverbal communication with patients, the public and members of the health care team in the clinical setting.
8. Integrate appropriate personal and professional values into clinical practice.
9. Recognize the influence of professional values on patient care.
10. Explain how a person's cultural beliefs toward illness and health affect his or her health status.
11. Use patient and family education strategies appropriate to the comprehension level of the patient/family.
12. Provide desired psychosocial support to the patient and family.
13. Demonstrate competent assessment skills through effective management of the patient's physical and mental status.
14. Respond appropriately to medical emergencies.
15. Examine demographic factors that influence patient compliance with medical care.
16. Adapt procedures to meet age-specific, disease-specific and cultural needs of patients.
17. Assess the patient and record clinical history.
18. Demonstrate basic life support procedures.
19. Use appropriate charting methods.
20. Recognize life-threatening electrocardiogram (ECG) tracing.
21. Apply standard and transmission-based precautions.
22. Apply the appropriate medical asepsis and sterile technique.

23. Demonstrate competency in the principles of radiation protection standards.
24. Apply the principles of total quality management.
25. Report equipment malfunctions.
26. Examine procedure orders for accuracy and make corrective actions when applicable.
27. Demonstrate safe, ethical and legal practices.
28. Integrate the radiographer's practice standards into clinical practice setting.
29. Maintain patient confidentiality standards and meet HIPAA requirements.
30. Demonstrate the principles of transferring, positioning and immobilizing patients.
31. Comply with departmental and institutional response to emergencies, disasters and accidents.
32. Differentiate between emergency and non-emergency procedures.
33. Adhere to national, institutional and departmental standards, policies and procedures regarding care of patients, providing radiologic procedures and reducing medical errors.
34. Select technical factors to produce quality diagnostic images with the lowest radiation exposure possible.
35. Critique images for appropriate anatomy, image quality and patient identification.
36. Determine corrective measures to improve inadequate images.

Course Number and Name: **RGT 1312 Principles of Radiation Protection**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	2		30

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

ASRT – Radiation Protection

1. Identify and justify the need to minimize unnecessary radiation exposure of humans.
2. Distinguish between somatic and genetic radiation effects.
3. Differentiate between the stochastic (probabilistic) and nonstochastic (deterministic) effects of radiation exposure.
4. Explain the objectives of a radiation protection program.
5. Define radiation and radioactivity units of measurement.
6. Identify effective dose limits (EDL) for occupational and nonoccupational radiation exposure.
7. Describe the ALARA concept.
8. Identify the basis for occupational exposure limits.
9. Distinguish between perceived risk and comparable risk.
10. Describe the concept of the negligible individual dose (NID).
11. Identify ionizing radiation sources from natural and man-made sources.
12. Comply with legal and ethical radiation protection responsibilities of radiation workers.
13. Describe the relationship between irradiated area and effective dose.
14. Describe the theory and operation of radiation detection devices.
15. Identify appropriate applications and limitations for each radiation detection device.
16. Describe how isoexposure curves are used for radiation protection.
17. Identify performance standards for beam-limiting devices.
18. Describe procedures used to verify performance standards for equipment and indicate the potential consequences if the performance standards fail.
19. Describe the operation of various interlocking systems for equipment and indicate potential consequences of interlock system failure.
20. Identify conditions and locations evaluated in an area survey for radiation protection.
21. Distinguish between controlled and non-controlled areas and list acceptable exposure levels.
22. Describe “Radiation Area” signs and identify appropriate placement sites.
23. Describe the function of federal, state and local regulations governing radiation protection practices.
24. Describe the requirements for and responsibilities of a radiation safety officer.
25. Express the need and importance of personnel monitoring for radiation workers.
26. Describe personnel monitoring devices, including applications, advantages and limitations for each device.

27. Interpret personnel monitoring reports.
28. Compare values for individual effective dose limits for occupational radiation exposures (annual and lifetime).
29. Identify anatomical structures that are considered critical for potential late effects of whole body irradiation exposure.
30. Identify effective dose limits for the embryo and fetus in occupationally exposed women
31. Distinguish between primary and secondary radiation barriers.
32. Demonstrate how the operation of various x-ray and ancillary equipment influences radiation safety and describe the potential consequences of equipment failure.
33. Perform calculations of exposure with varying time, distance and shielding.
34. Discuss the relationship between workload, energy, half-value layer (HVL), tenth-value layer (TVL), use factor and shielding design.
35. Identify emergency procedures to be followed during failures of x-ray equipment.
36. Demonstrate how time, distance and shielding can be manipulated to keep radiation exposures to a minimum.
37. Explain the relationship of beam-limiting devices to patient radiation protection.
38. Discuss added and inherent filtration in terms of the effect on patient dosage.
39. Explain the purpose and importance of patient shielding.
40. Identify various types of patient shielding and state the advantages and disadvantages of each type.
41. Use the appropriate method of shielding for a given radiographic procedure.
42. Explain the relationship of exposure factors to patient dosage.
43. Explain how patient position affects dose to radiosensitive organs.
44. Identify the appropriate image receptor that will result in an optimum diagnostic image with the minimum radiation exposure to the patient.
45. Select the immobilization techniques used to eliminate voluntary motion.
46. Describe the minimum source-to-tabletop distances for fixed and mobile fluoroscopic devices.
47. Apply safety factors for the patient, health care personnel and family members in the room during radiographic procedures.

Course Number and Name: **RGT 1413 Imaging Principles**

Classification: Associate of Applied Science Degree Requirement

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 developing solutions, procedures of general maintenance, quality control, and silver recovery methods.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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. Discuss processing area ventilation including considerations of temperature control and light proofing.
    d. Discuss the location, purpose, function, and operation of each piece of processing area equipment and furnishings.
    e. Analyze the effects of processing considerations on film quality.

f. 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.

ASRT - Image Analysis

1. Discuss the elements of a radiographic image.
2. Identify anatomy on radiographic images.
3. Apply a problem-solving process used for image analysis.
4. Describe an effective image analysis method.
5. Describe the role of the radiographer in image analysis.
6. Apply the process for evaluating images for adequate density/brightness, contrast, recorded detail/spatial resolution and acceptable limits of distortion.
7. Explain how the radiographer determines that an adequate level of penetration has been applied to produce an acceptable image.
8. Summarize the importance of proper positioning.
9. Discuss the impact of patient preparation on the resulting radiographic image.
10. Analyze images to determine the appropriate use of beam restriction.
11. Identify common equipment malfunctions that affect image quality, and corrective action.
12. Differentiate between technical factor problems, procedural factor problems and equipment malfunctions.
13. Critique images for appropriate technical, procedural and pathologic factors, and employ corrective actions if necessary.
14. Differentiate images produced by various modalities.

ASRT - Principles of Imaging

1. Discuss practical considerations in setting standards for acceptable image quality.
2. Assess radiographic exposure on radiographic images.
3. Analyze the relationships of factors that control and affect image exposure.
4. Critique the radiographic contrast within various radiographic images.
5. Analyze the relationship of factors that control and affect radiographic contrast.
6. Critique recorded detail on various radiographic images.
7. Analyze the relationships of factors that control and affect recorded detail.
8. Differentiate between size and shape distortion.
9. Perform calculations to determine image magnification and percent magnification.
10. Summarize the relationship of factors that control and affect distortion.
11. Summarize the relationship of factors affecting exposure latitude.
12. Explain the rationale for using beam-limiting devices.
13. Describe the operation and applications for different types of beam-limiting devices.
14. Explain how beam filtration affects x-ray beam intensity, beam quality and resultant patient exposure.
15. Describe the change in the half-value layer (HVL) when filtration is added or removed in the beam.
16. Summarize the relationship of factors affecting scattered and secondary radiation.
17. Evaluate the effects of scattered radiation on the image.
18. Compare grid types.
19. Select the most appropriate grid for a given clinical situation.
20. Interpret grid efficiency in terms of grid ratio and frequency.
21. Summarize the factors that influence grid cutoff.
22. Evaluate grid artifacts.
23. Explain the use of standardized radiographic technique charts.
24. Explain exposure factor considerations involved in selecting techniques.
25. Compare fixed kilovoltage peak (kVp) and variable kVp systems.
26. Apply the reciprocity law to clinical situations.
27. Apply conversion factors for changes in the following areas: distance, grid, image receptors, reciprocity law and 15 percent rule.

Course Number and Name: **RGT 1423 Digital Imaging**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

ASRT - Digital Image Acquisition and Display

1. Define terminology associated with digital imaging systems.
2. Describe the various types of digital receptors.
3. Describe the response of digital detectors to exposure variations.
4. Compare the advantages and limits of each receptor type.
5. Evaluate the spatial resolution and dose effectiveness for digital radiography detectors.
6. Describe the histogram and the process or histogram analysis as it relates to automatic rescaling and determining an exposure indicator.
7. Relate the receptor exposure indicator values to technical factors, system calibration, part/beam/plate alignment and patient exposure.
8. Describe the response of PSP systems to background and scatter radiation.
9. Use appropriate means of scatter control.
10. Avoid grid use errors associated with grid cutoff and Moiré effect.
11. Identify common limitations and technical problems encountered when using PSP systems.
12. Employ appropriate beam/part/receptor alignment to avoid histogram analysis errors.
13. Associate impact of image processing parameters to the image appearance.
14. Apply the fundamental principles to digital detectors.
15. Evaluate the effect of a given exposure change on histogram shape, data width and image appearance.
16. Describe the conditions that cause quantum mottle in a digital image.
17. Formulate a procedure or process to minimize histogram analysis and rescaling errors.

18. 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.
19. Describe picture archival and communications system (PACS) and its function.
20. Identify components of a PACS.
21. Define digital imaging and communications in medicine (DICOM).
22. Describe HIPAA concerns with electronic information.
23. Identify common problems associated with retrieving/viewing images within a PACS

ASRT - **Introduction to Computed Tomography –**

1. Describe the components of the CT imaging system.
2. Explain the functions of collimators in CT.
3. List the CT computer data processing steps.
4. Define algorithm and explain its impact on image scan factors and reconstruction.
5. Define raw data and image data.
6. Describe the following terms in relation to the CT data acquisition process:
    a. Pixel.
    b. Matrix.
    c. Voxel.
    d. Linear attenuation coefficient.
    e. CT/Hounsfield number.
    f. Partial volume averaging.
    g. Window width (ww) and window level (wl).
    h. Spatial resolution.
    i. Contrast resolution.
    j. Noise.
    k. Annotation.
    l. Region of interest (ROI).
7. Name the common controls found on CT operator consoles and describe how and why each is used.
8. Identify the types and appearance of artifacts most commonly affecting CT images.
9. Name the radiation protection devices that can be used to reduce patient dose in CT and describe the correct application of each.
10. Describe the general purpose of commonly performed CT studies.
11. Discuss general radiation safety and protection practices associated with examinations in CT.

Course Number and Name: **RGT 1513 Radiographic Procedures I**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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/or 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 and/or trauma radiography.

ASRT - Radiographic Procedures

1. Describe standard positioning terms.
2. Demonstrate proper use of positioning aids.
3. Discuss general procedural considerations for radiographic exams.
4. Identify methods and barriers of communication and describe how each may be used or overcome effectively during patient education.
5. Explain radiographic procedures to patients/family members.
6. Modify directions to patients with various communication problems.
7. Develop an awareness of cultural factors that necessitate adapting standard exam protocols.
8. Adapt general procedural considerations to specific clinical settings.
9. Identify the structures demonstrated on routine radiographic and fluoroscopic images.
10. Adapt radiographic and fluoroscopic procedures for special considerations.
11. Simulate radiographic and fluoroscopic procedures on a person or phantom in a laboratory setting.
12. Evaluate images for positioning, centering, appropriate anatomy and overall image quality.
13. Discuss equipment and supplies necessary to complete basic radiographic and fluoroscopic procedures.
14. Explain the patient preparation necessary for various contrast and special studies.
15. Explain the routine and special positions/projections for all radiographic/fluoroscopic procedures.
16. Explain the purpose for using contrast media.
17. Name the type, dosage and route of administration of contrast media commonly used to perform radiographic contrast and special studies.
18. Describe the general purpose of radiographic and fluoroscopic studies.
19. Apply general radiation safety and protection practices associated with radiographic and fluoroscopic examinations.

Course Number and Name: **RGT 1523 Radiographic Procedures II**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

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.

ASRT - Radiographic Procedures

1. Describe standard positioning terms.
2. Demonstrate proper use of positioning aids.
3. Discuss general procedural considerations for radiographic exams.
4. Identify methods and barriers of communication and describe how each may be used or overcome effectively during patient education.
5. Explain radiographic procedures to patients/family members.
6. Modify directions to patients with various communication problems.
7. Develop an awareness of cultural factors that necessitate adapting standard exam protocols.
8. Adapt general procedural considerations to specific clinical settings.
9. Identify the structures demonstrated on routine radiographic and fluoroscopic images.
10. Adapt radiographic and fluoroscopic procedures for special considerations.
11. Simulate radiographic and fluoroscopic procedures on a person or phantom in a laboratory setting.
12. Evaluate images for positioning, centering, appropriate anatomy and overall image quality.
13. Discuss equipment and supplies necessary to complete basic radiographic and fluoroscopic procedures.
14. Explain the patient preparation necessary for various contrast and special studies.
15. Explain the routine and special positions/projections for all radiographic/fluoroscopic procedures.
16. Explain the purpose for using contrast media.
17. Name the type, dosage and route of administration of contrast media commonly used to perform radiographic contrast and special studies.
18. Describe the general purpose of radiographic and fluoroscopic studies.
19. Apply general radiation safety and protection practices associated with radiographic and fluoroscopic examinations.

Course Number and Name: **RGT 1613 Physics of Imaging Equipment**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

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.

ASRT - Imaging Equipment

1. Define potential difference, current and resistance.
2. Identify the general components and functions of the tube and filament circuits.
3. Compare generators in terms of radiation produced and efficiency.
4. Discuss permanent installation of radiographic equipment in terms of purpose, components, types and applications.
5. Demonstrate operation of various types of permanently installed and mobile radiographic equipment.
6. Discuss mobile units in terms of purpose, components, types and applications.
7. Describe functions of components of automatic exposure control (AEC) devices.
8. Demonstrate proper use of AEC devices.
9. Identify the components of diagnostic x-ray tubes.
10. Explain protocols used to extend x-ray tube life.
11. Explain image-intensified and digital fluoroscopy.
12. Indicate the purpose, construction and application of video camera tubes, CCD and TV monitors.
13. Differentiate between quality improvement/management, quality assurance and quality control.
14. List the benefits of a quality control to the patient and to the department.
15. Discuss the proper test equipment/procedures for evaluating the operation of an x-ray generator.
16. Evaluate the results of basic QC tests.
17. Discuss the basic principles of operation of various imaging modalities and radiation therapy.

ASRT – Radiation Production and Characteristics

1. Describe fundamental atomic structure.
2. Explain the processes of ionization and excitation.
3. Describe the electromagnetic spectrum.
4. Describe wavelength and frequency and how they are related to velocity.
5. Explain the relationship of energy, wavelength and frequency.
6. Explain the wave-particle duality phenomena.
7. Identify the properties of x-rays.
8. Describe the processes of ionization and excitation.
9. Describe charged and uncharged forms of particulate radiation.
10. Differentiate between ionizing and nonionizing radiation.
11. Describe radioactivity and radioactive decay in terms of alpha, beta and gamma emission.
12. Compare the production of bremsstrahlung and characteristic radiations.
13. Describe the conditions necessary to produce x-radiation.
14. Describe the x-ray emission spectra.
15. Identify the factors that affect the x-ray emission spectra.
16. Discuss various photon interactions with matter by describing the interaction, relation to atomic number, photon energy and part density, and their applications in diagnostic radiology.
17. Discuss relationships of wavelength and frequency to beam characteristics.
18. Discuss the clinical significance of the photoelectric and modified scattering interactions in diagnostic

Course Number and Name: **RGT 2132 Ethical and Legal Responsibilities**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	2		30

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

ASRT - Ethics and Law in the Radiologic Sciences

1. Discuss the origins of medical ethics.
2. Apply medical/professional ethics in the context of a broader societal ethic.
3. Explain the role of ethical behavior in health care delivery.
4. Explain concepts of personal honesty, integrity, accountability, competence and compassion as ethical imperatives in health care.
5. Identify legal and professional standards and relate each to practice in health professions.
6. Identify specific situations and conditions that give rise to ethical dilemmas in health care.
7. Explain select concepts embodied in the principles of patients' rights, the doctrine of informed (patient) consent and other issues related to patients' rights.
8. Explain the legal implications of professional liability, malpractice, professional negligence and other legal doctrines applicable to professional practice.
9. Describe the importance of accurate, complete and correct methods of documentation as a legal/ethical imperative.
10. Explore theoretical situations and questions relating to the ethics of care and health care delivery.
11. Explain legal terms, principles, doctrines and laws specific to the radiologic sciences.
12. Outline the conditions necessary for a valid malpractice claim.
13. Describe institutional and professional liability protection typically available to the radiographer.
14. Describe the components and implications of informed consent.
15. Identify standards for disclosure relative to informed consent.
16. Describe how consent forms are used relative to specific radiographic procedures.
17. Differentiate between civil and criminal liability.
18. Define tort and explain the differences between intentional and unintentional torts.

Course Number and Name: **RGT 2147 Clinical Education IV**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
7		21	315

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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 technical adjustments to accommodate trauma procedures.

ASRT - **Clinical Practice**

1. Exercise the priorities required in daily clinical practice.
2. Execute medical imaging procedures under the appropriate level of supervision.
3. Adhere to team practice concepts that focus on organizational theories, roles of team members and conflict resolution.
4. Adapt to changes and varying clinical situations.
5. Describe the role of health care team members in responding/reacting to a local or national emergency.
6. Provide patient-centered, clinically effective care for all patients regardless of age, gender, disability, special needs, ethnicity or culture.
7. Integrate the use of appropriate and effective written, oral and nonverbal communication with patients, the public and members of the health care team in the clinical setting.
8. Integrate appropriate personal and professional values into clinical practice.
9. Recognize the influence of professional values on patient care.
10. Explain how a person's cultural beliefs toward illness and health affect his or her health status.
11. Use patient and family education strategies appropriate to the comprehension level of the patient/family.
12. Provide desired psychosocial support to the patient and family.
13. Demonstrate competent assessment skills through effective management of the patient's physical and mental status.
14. Respond appropriately to medical emergencies.
15. Examine demographic factors that influence patient compliance with medical care.
16. Adapt procedures to meet age-specific, disease-specific and cultural needs of patients.
17. Assess the patient and record clinical history.
18. Demonstrate basic life support procedures.

19. Use appropriate charting methods.
20. Recognize life-threatening electrocardiogram (ECG) tracing.
21. Apply standard and transmission-based precautions.
22. Apply the appropriate medical asepsis and sterile technique.
23. Demonstrate competency in the principles of radiation protection standards.
24. Apply the principles of total quality management.
25. Report equipment malfunctions.
26. Examine procedure orders for accuracy and make corrective actions when applicable.
27. Demonstrate safe, ethical and legal practices.
28. Integrate the radiographer's practice standards into clinical practice setting.
29. Maintain patient confidentiality standards and meet HIPAA requirements.
30. Demonstrate the principles of transferring, positioning and immobilizing patients.
31. Comply with departmental and institutional response to emergencies, disasters and accidents.
32. Differentiate between emergency and non-emergency procedures.
33. Adhere to national, institutional and departmental standards, policies and procedures regarding care of patients, providing radiologic procedures and reducing medical errors.
34. Select technical factors to produce quality diagnostic images with the lowest radiation exposure possible.
35. Critique images for appropriate anatomy, image quality and patient identification.
36. Determine corrective measures to improve inadequate images.

Course Number and Name: **RGT 2157 Clinical Education V**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Clinical	Contact Hours
7		21	315

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.
(1) 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.

ASRT - Clinical Practice

1. Exercise the priorities required in daily clinical practice.
2. Execute medical imaging procedures under the appropriate level of supervision.
3. Adhere to team practice concepts that focus on organizational theories, roles of team members and conflict resolution.
4. Adapt to changes and varying clinical situations.
5. Describe the role of health care team members in responding/reacting to a local or national emergency.
6. Provide patient-centered, clinically effective care for all patients regardless of age, gender, disability, special needs, ethnicity or culture.
7. Integrate the use of appropriate and effective written, oral and nonverbal communication with patients, the public and members of the health care team in the clinical setting.
8. Integrate appropriate personal and professional values into clinical practice.
9. Recognize the influence of professional values on patient care.
10. Explain how a person's cultural beliefs toward illness and health affect his or her health status.
11. Use patient and family education strategies appropriate to the comprehension level of the patient/family.
12. Provide desired psychosocial support to the patient and family.
13. Demonstrate competent assessment skills through effective management of the patient's physical and mental status.
14. Respond appropriately to medical emergencies.
15. Examine demographic factors that influence patient compliance with medical care.
16. Adapt procedures to meet age-specific, disease-specific and cultural needs of patients.
17. Assess the patient and record clinical history.
18. Demonstrate basic life support procedures.
19. Use appropriate charting methods.

20. Recognize life-threatening electrocardiogram (ECG) tracing.
21. Apply standard and transmission-based precautions.
22. Apply the appropriate medical asepsis and sterile technique.
23. Demonstrate competency in the principles of radiation protection standards.
24. Apply the principles of total quality management.
25. Report equipment malfunctions.
26. Examine procedure orders for accuracy and make corrective actions when applicable.
27. Demonstrate safe, ethical and legal practices.
28. Integrate the radiographer's practice standards into clinical practice setting.
29. Maintain patient confidentiality standards and meet HIPAA requirements.
30. Demonstrate the principles of transferring, positioning and immobilizing patients.
31. Comply with departmental and institutional response to emergencies, disasters and accidents.
32. Differentiate between emergency and non-emergency procedures.
33. Adhere to national, institutional and departmental standards, policies and procedures regarding care of patients, providing radiologic procedures and reducing medical errors.
34. Select technical factors to produce quality diagnostic images with the lowest radiation exposure possible.
35. Critique images for appropriate anatomy, image quality and patient identification.
36. Determine corrective measures to improve inadequate images.

Course Number and Course Name: **RGT 2532** **Radiographic Procedures III**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	1	2	45

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

ASRT - Radiographic Procedures

1. Describe standard positioning terms.
2. Demonstrate proper use of positioning aids.
3. Discuss general procedural considerations for radiographic exams.
4. Identify methods and barriers of communication and describe how each may be used or overcome effectively during patient education.
5. Explain radiographic procedures to patients/family members.
6. Modify directions to patients with various communication problems.
7. Develop an awareness of cultural factors that necessitate adapting standard exam protocols.
8. Adapt general procedural considerations to specific clinical settings.
9. Identify the structures demonstrated on routine radiographic and fluoroscopic images.
10. Adapt radiographic and fluoroscopic procedures for special considerations.
11. Simulate radiographic and fluoroscopic procedures on a person or phantom in a laboratory setting.

12. Evaluate images for positioning, centering, appropriate anatomy and overall image quality.
13. Discuss equipment and supplies necessary to complete basic radiographic and fluoroscopic procedures.
14. Explain the patient preparation necessary for various contrast and special studies.
15. Explain the routine and special positions/projections for all radiographic/fluoroscopic procedures.
16. Explain the purpose for using contrast media.
17. Name the type, dosage and route of administration of contrast media commonly used to perform radiographic contrast and special studies.
18. Describe the general purpose of radiographic and fluoroscopic studies.
19. Apply general radiation safety and protection practices associated with radiographic and fluoroscopic examinations.

Course Number and Course Name: **RGT 2542** **Radiographic Procedures IV**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	2		30

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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.

ASRT - Radiographic Procedures

1. Describe standard positioning terms.
2. Demonstrate proper use of positioning aids.
3. Discuss general procedural considerations for radiographic exams.
4. Identify methods and barriers of communication and describe how each may be used or overcome effectively during patient education.
5. Explain radiographic procedures to patients/family members.
6. Modify directions to patients with various communication problems.
7. Develop an awareness of cultural factors that necessitate adapting standard exam protocols.
8. Adapt general procedural considerations to specific clinical settings.
9. Identify the structures demonstrated on routine radiographic and fluoroscopic images.
10. Adapt radiographic and fluoroscopic procedures for special considerations.
11. Simulate radiographic and fluoroscopic procedures on a person or phantom in a laboratory setting.
12. Evaluate images for positioning, centering, appropriate anatomy and overall image quality.
13. Discuss equipment and supplies necessary to complete basic radiographic and fluoroscopic procedures.
14. Explain the patient preparation necessary for various contrast and special studies.
15. Explain the routine and special positions/projections for all radiographic/fluoroscopic procedures.
16. Explain the purpose for using contrast media.
17. Name the type, dosage and route of administration of contrast media commonly used to perform radiographic contrast and special studies.
18. Describe the general purpose of radiographic and fluoroscopic studies.
19. Apply general radiation safety and protection practices associated with radiographic and fluoroscopic examinations.

Course Number and Course Name: **RGT 2911** **Radiation Biology**

Classification: Associate of Applied Science Degree Requirement

Description: This course is a study of the biological effects of radiation upon living matter. It includes genetic and somatic effects.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	1		15

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Evaluate biophysical events relating to radiation exposure.
   a. Identify sources of electromagnetic and particulate ionizing radiations.
   b. Discuss direct or indirect effects of 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 lethal dose.

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.

ASRT – Radiation Biology

1. Differentiate between ionic and covalent molecular bonds.
2. Describe principles of cellular biology.
3. Identify sources of electromagnetic and particulate ionizing radiations.
4. Discriminate between direct and indirect ionizing radiation.
5. Discriminate between the direct and indirect effects of radiation.
6. Identify sources of radiation exposure.
7. Describe radiation-induced chemical reactions and potential biologic damage.
8. Evaluate factors influencing radiobiologic/biophysical events at the cellular and subcellular level.
9. Identify methods to measure radiation response.
10. Describe physical, chemical and biologic factors influencing radiation response of cells and tissues.

11. Explain factors influencing radiosensitivity.
12. Recognize the clinical significance of lethal dose (LD).
13. Identify specific cells from most radiosensitive to least radiosensitive.
14. Employ dose response curves to study the relationship between radiation dose levels and the degree of biologic response.
15. Examine effects of limited vs. total body exposure.
16. Relate short-term and long-term effects as a consequence of high and low radiation doses.
17. Differentiate between somatic and genetic radiation effects and discuss specific diseases or syndromes associated with them.
18. Discuss stochastic (probabilistic) and nonstochastic (deterministic) effects.
19. Discuss embryo and fetal effects of radiation exposure.
20. Discuss risk estimates for radiation-induced malignancies.
21. Discuss acute radiation syndromes.

Course Number and Course Name: **RGT 2922** **Radiographic Pathology**

Classification: Associate of Applied Science Degree Requirement

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.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
2	2		30

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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 of tissue.

ASRT – Radiographic Pathology

1. Define basic terms related to pathology.
2. Describe the basic manifestations of pathological conditions and their relevance to radiologic procedures.
3. Discuss the classifications of trauma.
4. Describe imaging procedures used in diagnosing disease.
5. List the causes of tissue disruption.
6. Describe the healing process.
7. Identify complications connected with the repair and replacement of tissue.
8. Describe the various systemic classifications of disease in terms of etiology, types, common sites, complications and prognosis.
9. Describe the radiographic appearance of diseases.

10. Identify imaging procedures and interventional techniques appropriate for diseases common to each body system.
11. Identify diseases caused by or connected to genetic factors.

Course Number and Course Name: **RGT 2933** **Certification Fundamentals**

Classification: Associate of Applied Science Degree Requirement

Description: This course is designed to correlate scientific components of radiography to entry-level knowledge required by the profession.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

National Assessment: Components of the ARRT Examination

Prerequisite: Instructor Approved

Student Learning Outcomes:

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 National Council of Radiation Protection (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.

The following ASRT standards are taught in other academic/technical courses that are not listed as Radiologic Technology courses:

ASRT - Human Structure and Function

1. Discuss the basics of anatomical nomenclature.
2. Describe the chemical composition of the human body.
3. Identify cell structure and elements of genetic control.
4. Explain the essentials of human metabolism.
5. Describe the types and functions of human tissues.
6. Classify tissue types, describe the functional characteristics of each and give examples of their location within the human body.
7. Describe the composition and characteristics of bone.
8. Identify and locate the bones of the human skeleton.
9. Identify bony processes and depressions found on the human skeleton.
10. Describe articulations of the axial and appendicular skeleton.
11. Differentiate the primary and secondary curves of the spine.
12. Summarize the functions of the skeletal system.
13. Label different types of articulations.
14. Compare the types, locations and movements permitted by the different types of articulations.
15. Examine how muscle is organized at the gross and microscopic levels.
16. Differentiate between the structures of each type of muscle tissue.
17. State the function of each type of muscle tissue.
18. Name and locate the major muscles of the skeleton.
19. Differentiate between the structure and function of different types of nerve cells.
20. State the structure of the brain and the relationship of its component parts.
21. Describe brain functions.
22. List the meninges and describe the function of each.
23. Outline how cerebrospinal fluid forms, circulates and functions.
24. Describe the structure and function of the spinal cord.
25. Determine the distribution and function of cranial and spinal nerves.
26. Summarize the structure and function of components that comprise the autonomic nervous system.
27. Describe the structures and functions of the components that comprise the human eye and ear.
28. List the component body parts involved in the senses of smell and taste.
29. List the somatic senses.
30. Define endocrine.
31. Describe the characteristics and functions of the components that comprise the endocrine system.
32. Describe the hard and soft palates.
33. Describe the structure and function of the tongue.
34. Identify the structure, function and locations of the salivary glands.

35. Describe the composition and characteristics of the primary organs of the digestive system.
36. Describe the function(s) of each primary organ of the digestive system.
37. Differentiate between the layers of tissue that comprise the esophagus, stomach, small intestine, large intestine and rectum.
38. Differentiate between peritoneum, omentum and mesentery.
39. List and label the accessory organs of the digestive system and describe their function.
40. Identify the secretions and function of each accessory organ of the digestive system.
41. Explain the purpose of digestion.
42. List the digestive processes that occur in the body.
43. Describe the composition and characteristics of blood.
44. List the types of blood cells and state their functions.
45. Differentiate between blood plasma and serum.
46. Outline the clotting mechanism.
47. List the blood types.
48. Explain the term Rh factor.
49. Explain the antigen/antibody relationship and its use in blood typing.
50. Label the parts of the human heart.
51. Describe the flow of blood through the body and identify the main vessels.
52. Describe the structure and function of arteries, veins and capillaries.
53. Differentiate between arterial blood in systemic circulation and arterial blood in pulmonary circulation.
54. Outline the major pathways of lymphatic circulation.
55. Correlate cardiac electrophysiology to a normal ECG tracing.
56. Differentiate between nonspecific defenses and specific immunity.
57. Explain antibody production and function.
58. List the different types and functions of T- and B-cells and explain their functions.
59. Label the components of the respiratory system.
60. Describe the physiology and regulation of respiration.
61. Label the parts of the kidneys, ureters, bladder and urethra.
62. Describe the function of each organ of the urinary system.
63. Describe the composition and formation of urine.
64. Explain micturition.
65. Label the anatomy of the male and female reproductive organs.
66. Analyze the function of each of the male and female reproductive organs.
67. Identify major sectional anatomical structures found within the head/neck, thorax and abdomen

PROGRAM ELECTIVES

Course Number and Course Name: **RGT 1111** **Radiologic Seminar I**

Classification: Technical Elective

Description: This course is designed for students to participate in activities of various professional organizations such as the Radiologic Technology Student Organization, HOSA and other student activities. Leadership skills, an understanding of group dynamics, educational enrichment, stimulation of enthusiasm and interest, community service and rapport among health education professionals are outcomes of this course. One hour per week with additional activities to meet organizational goals.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	1		15

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Interaction and cooperation in the modern workplace
   a. Demonstrate communication skills by actively participating in program and campus activities.
   b. Evaluate new materials added to the classroom.

2. Community participation
   a. Actively participate in a class organized community service project.

Course Number and Course Name: **RGT 1121 Radiologic Seminar II**

Classification: Technical Elective

Description: This course is designed for students to participate in activities of various professional organizations such as the Radiologic Technology Student Organization, HOSA and other student activities. Leadership skills, an understanding of group dynamics, educational enrichment, stimulation of enthusiasm and interest, community service and rapport among health education professionals are outcomes of this course. One hour per week with additional activities to meet organizational goals.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	1		15

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Interaction and cooperation in the modern workplace
   a. Demonstrate problem-solving skills by actively participating in program and campus activities.
   b. Locate and utilize local resource sources.

2. Community participation
   a. Actively participate in a class organized community service project.

Course Number and Course Name: **RGT 2111 Radiologic Seminar III**

Classification: Technical Elective

Description: This course is designed for students to participate in activities of various professional organizations such as the Radiologic Technology Student Organization, HOSA and other student activities. Leadership skills, an understanding of group dynamics, educational enrichment, stimulation of enthusiasm and interest, community service and rapport among health education professionals are outcomes of this course. One hour per week with additional activities to meet organizational goals.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	1		15

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Interaction and cooperation in the modern workplace
   a. Demonstrate problem-solving skills by actively participating in program and campus activities.
   b. Locate and utilize local resource sources.

2. Community participation
   a. Actively participate in a class organized community service project.

Course Number and Course Name: **RGT 2121 Radiologic Seminar IV**

Classification: Technical Elective

Description: This course is designed for students to participate in activities of various professional organizations such as the Radiologic Technology Student Organization, HOSA and other student activities. Leadership skills, an understanding of group dynamics, educational enrichment, stimulation of enthusiasm and interest, community service and rapport among health education professionals are outcomes of this course. One hour per week with additional activities to meet organizational goals.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	1		15

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Interaction and cooperation in the modern workplace
   a. Demonstrate problem-solving skills by actively participating in program and campus activities.
   b. Locate and utilize local resource sources.

2. Community participation
   a. Actively participate in a class organized community service project.

Course Number and Course Name: **RGT 2113** **Mammography**

Classification: Technical Elective

Description: This course is designed to provide the professional community with a cognitive online base of entry-level education in the practice of Mammography.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Identify and label anatomical structures of the breast, male and female.
2. Identify and label the breakdown of the single lobe.
3. Identify the three arterial branches supplying the breast and the three venous drainage channels.
4. Describe the lymphatic system and lymphatic drainage.
5. Correlate breast anatomical structures to mammographic anatomical structures.
6. Identify and label mammographic anatomical structures when presented with a mammographic image.
7. Discuss and understand the changes the breast undergoes due to hormonal influences during puberty, menses, pregnancy and the postmenopausal life cycles.
8. Describe the physiologic changes caused by estrogen, progesterone and prolactin.
9. Describe breast augmentation and identify the types of implants, common implant locations and the anatomical changes to the augmented breast.
10. Describe the anomalies of development that can occur in the breast.
11. Recognize clinical breast changes.
12. List the physical changes of the breast related to pathology.
13. List the mammographic changes of the breast related to pathology and, given mammographic images, identify the common mammographic appearance of breast pathology.
14. Identify risk factors limited to breast cancer.
15. State the recommendations for asymptomatic women regarding mammography.
16. Provide information on the importance of manual and visual breast self-examination.
17. Define treatment options for breast cancer.
18. Describe the generally accepted (postulated) progression of breast cancers from the ductal epithelium and nonepithelial tissues.
19. Describe changes seen after breast reduction surgery or following lumpectomy and surgical excision.
20. Identify current epidemiology and risk factors of breast cancer.
21. Describe elements of breast cancer screening protocols.
22. Demonstrate an understanding of breast anatomy and topographical orientation.
23. Detail a breast assessment.
24. Explain proper techniques and procedures for conducting a breast assessment.
25. Use nondiagnostic descriptors to record findings and document observations arising from the breast exam.
26. Participate in patient education regarding breast self-examination.
27. Discuss procedures to assist patients with special needs
28. Explain patient services in the mammography department.
29. Discuss MQSA, American College of Radiology and Food and Drug Administration (FDA) guidelines and accreditations.
30. Label the components of the mammographic unit.

31. Demonstrate understanding of properly operated mammography equipment and demonstrate the understanding of correct use of compression devices, filtration devices, the magnification setup, use of grids and automatic exposure controls.
32. State the specifications of the various components in a mammography unit (half-value layer, focal spot size, source-to-image distance and the minimum requirements based on MQSA guidelines).
33. Define heel effect.
34. Define reciprocity law failure.
35. Differentiate between the various types of x-ray generators used in mammography.
36. Discuss and define digital mammography.
37. Explain the additional functions available with digital imaging – measuring the area of interest, filtration of image, magnification, contrast, density, subtraction of image.
38. Define compression, its usefulness and minimum and maximum requirements, based on MQSA guidelines.
39. State the purpose of magnification.
40. State the procedure used when magnifying breast tissue.
41. Accessorize equipment according to the procedure being performed.
42. Demonstrate the knowledge of setting appropriate kVp, mA and time or automatic exposure control (AEC) and the correct position of the photosensor.
43. Review film processing and reloading cassettes with mammography film.
44. Explain the process of producing hard copy images of digital images.
45. Describe standard needle lesion localization.
46. Decribe stereotactic lesion localization.
47. Describe fine-needle aspiration biopsy.
48. Delineate Galactography.
49. Describe a stereotactic or core biopsy
50. Describe the performance of quality control test procedures according to ACR and MQSA guidelines.
51. Outline safety checks on radiographic equipment and accessories.
52. Explain procedure and the need for compression to the patient before proceeding with the mammogram.
53. Achieve the best demonstration of breast tissue by manipulating the breast into proper placement, adjusting the patient, mammography equipment and cassettes, and placing the marker correctly.
54. Describe processing and evaluating the completed image.
55. Identify the qualities necessary for an acceptable mammogram.
56. Repeat films or additional views if necessary.
57. Be professional, competent, confident and nonjudgmental
58. Describe how kVp, mA, time and compression affect the mammographic image and patient dose.
59. Identify the maximum permissible dose per mammography exam based on MQSA standards.
60. Identify the average dose per mammographic exposure.
61. Describe selecting the correct technical variable based on variations in breast anatomy.
62. Identify processing and imaging artifacts on mammography film.
63. Describe different types of processing and their importance in the mammographic imaging chain.
64. Describe sonographys role in mammography

Course Number and Course Name: **RGT 2123** **Sectional Anatomy**

Classification: Technical Elective

Description: This course is designed to study human sectional anatomy, including location, structure, and function, as well as relationships among structures. Radiographs, Computed Tomography (CT) images, and Magnetic Resonance Imaging (MRI), Ultrasound and PET images may be used to demonstrate the characteristic appearance of anatomic structures.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Describe the anatomy and physiology of the human body.
    a. Review the location and describe the relationship of the structures to surrounding structures.
    b. Review the function of the structures of the human body.
2. Identify the structures of each of the anatomical regions as they appear in sectional illustrations.
    a. Identify the structures of the head and brain as they appear in sectional illustrations.
    b. Identify the structures of the neck as they appear in sectional illustrations.
    c. Identify the structures of the chest and mediastinum as they appear in sectional illustrations.
    d. Identify the structures of the abdomen as they appear in sectional illustrations.
    e. Identify the structures of the pelvis as they appear in sectional illustrations.
    f. Identify the structures of the musculoskeletal system and spine as they appear in sectional illustrations.
3. Locate the structures of each of the anatomical regions as they appear on a CT image and a MR image and ultrasound images in the transverse axial, coronal, sagittal, and orthogonal (oblique) cross-sectional imaging planes.
    a. Locate the structures of the head and brain as they appear in sectional illustrations.
    b. Locate the structures of the neck as they appear in sectional illustrations.
    c. Locate the structures of the chest and mediastinum as they appear in sectional illustrations.
    d. Locate the structures of the abdomen as they appear in sectional illustrations.
    e. Locate the structures of the pelvis as they appear in sectional illustrations.
    f. Locate the structures of the musculoskeletal system and spine as they appear in sectional illustrations.

Course Number and Course Name: **RGT 2133 Computed Tomography**

Classification: Technical Elective

Description: This course is designed to explore the technical principles of Computed Tomography (CT). A review of patient care, contrast media and adverse reactions, common CT procedures and protocols, image characteristics, and image quality control methods are taught.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Describe preparation, assessment, and monitoring of the patient for a CT procedure.
    a. Describe screening and consent procedures.
    b. Explain patient education.
    c. Discuss immobilization techniques.
    d. Summarize assessment and monitoring techniques, to include history, vital signs, lab values, and medications.

2. Discuss the use and administration of intravenous and oral contrast agents.
    a. Explain venipuncture and injection techniques in CT procedures.
    b. List types of contrast agents.
    c. Describe the route of administration.
    d. Perform dosage calculations.
    e. Identify special considerations in contrast administration.
    f. Discuss recognition, treatment, and documentation of adverse reactions.

3. Describe radiation safety measures in CT procedures.
    a. Discuss the CT technical factors affecting patient dose including dose modulation techniques.
    b. Discuss CTDI, MSAD, DLP and other methods of dose measurement.
    c. Discuss radiation protection guidelines for personnel.
    d. Discuss radiation protection guidelines for pediatric dose reduction.
    e. Discuss radiation protection guidelines for adult patient dose reduction.

4. Identify correct acquisition methods and protocols for CT examination of each of the anatomical regions of the body, to include modifications for pathology, trauma, and special procedures.
    a. Identify correct acquisition methods and protocols for CT examination of the head and brain.
    b. Identify correct acquisition methods and protocols for CT examination of the neck.
    c. Identify correct acquisition methods and protocols for CT examination of the chest and mediastinum.
    d. Identify correct acquisition methods and protocols for CT examination of the abdomen.
    e. Identify correct acquisition methods and protocols for CT examination of the pelvis.
    f. Identify correct acquisition methods and protocols for CT examination of the musculoskeletal system and spine.

5. Discuss equipment operation and image processing.
    a. Describe the components of the CT unit.

b. Describe image acquisition and attenuation.
c. Discuss image processing and display, to include image reconstruction, display, post-processing, and data management.
d. Define the components of image quality.
e. Explain artifact recognition and reduction.

6. Compare normal and abnormal structures in each of the anatomical regions of the body.
    a. Compare normal and abnormal structures and pathology of the head and brain.
    b. Compare normal and abnormal structures and pathology of the neck.
    c. Compare normal and abnormal structures and pathology of the chest and mediastinum.
    d. Compare normal and abnormal structures and pathology of the abdomen.
    e. Compare normal and abnormal structures and pathology of the pelvis.
    f. Compare normal and abnormal structures and pathology of the musculoskeletal system and spine.

ASRT - Introduction to Computed Tomography

1. Describe the components of the CT imaging system.
2. Explain the functions of collimators in CT.
3. List the CT computer data processing steps.
4. Define algorithm and explain its impact on image scan factors and reconstruction.
5. Define raw data and image data.
6. Describe the following terms in relation to the CT data acquisition process:
    m. Pixel.
    n. Matrix.
    o. Voxel.
    p. Linear attenuation coefficient.
    q. CT/Hounsfield number.
    r. Partial volume averaging.
    s. Window width (ww) and window level (wl).
    t. Spatial resolution.
    u. Contrast resolution.
    v. Noise.
    w. Annotation.
    x. Region of interest (ROI).
7. Name the common controls found on CT operator consoles and describe how and why each is used.
8. Identify the types and appearance of artifacts most commonly affecting CT images.
9. Name the radiation protection devices that can be used to reduce patient dose in CT and describe the correct application of each.
10. Describe the general purpose of commonly performed CT studies.
11. Discuss general radiation safety and protection practices associated with examinations in CT.

Course Number and Course Name: **RGT 2143** **Magnetic Resonance Imaging**

Classification: Technical Elective

Description: This course provides a basic foundation of Magnetic Resonance Imaging (MRI). The physical and technical principles, imaging sequences, image artifacts, clinical applications, system components, and safety issues will be discussed. Images of sectional anatomy related to MRI will also be explored.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3			45

National Assessment:

Prerequisite: Instructor Approved

Student Learning Outcomes:

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 storage bin (Darkroom) (1 per darkroom)
9. Grid cap 14 by 17 in. (1 per lab)
10. Grid cap 10 by 12 in. (1 per lab)
11. Holder, phantom head positioning (1 per 10 students)
12. Human sexless torso (1 per lab)
13. Illuminators, mobile stand system (1 per 5 students)
14. Illuminator, portable (1 per classroom)
15. Illuminator, portable, single (1 per lab)
16. Illuminator, wall mounted (1 per lab)
17. Interactive video equipment (1 per 5 students)
18. Intravenous continuous pump (1 per 10 students)
19. Laser printer (1 per 2 computers)
20. Lockable student storage (1 per student)
21. Patient care simulator (1 per program)
22. Patient restraint/Immobilizer/Positioner (1 per lab)
23. Patient transfer device adult positioner (1 per lab)
24. Phantom, sectional chest (1 per lab)
25. Phantom, sectional, elbow AP and 90 flexion (1 per lab)
26. Phantom, sectional, foot (1 per lab)
27. Phantom, sectional, hand PA: Lateral (1 per lab)
28. Phantom, sectional, head with cervical (1 per lab)
29. Phantom, sectional, knee AP and 90 flexion (1 per lab)
30. Phantom, sectional, pelvis (1 per lab)
31. Phantom patient, whole body with lungs (1 per lab)
32. Pneumonic compression paddle (1 per lab)
33. Processor, radiographic (1 per darkroom)
34. Quality assurance system (1 per lab)
35. Safelight illuminators (Darkroom) (1 per darkroom)
36. Sensitometer (1 per 10 students)
37. Stretcher (1 per lab)
38. Wheelchair with IV pole attachment (1 per lab)
39. X-ray radiography system (1 per 10 students)
40. X-ray radiography system, portable (1 per program)
41. Phantom, entire upper extremity (1 per lab)
42. Phantom, entire lower extremity (1 per lab)
43. Projector screen (1 per room)
44. Skeleton human bones, disarticulated (1 per room or 2 per program)
45. Skeleton, with stand, human adult (1 per room or 2 per program)
46. Supply storage cabinet, lockable (1 per program)
47. CR radiography system (1 per program)
48. DR radiography system (1 per program)

49. Resolution Grid

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 10 by 12 in. (6 per lab)
7. Cassette, radiographic film holders 14 by 17 in. (6 per lab)
8. Cassette, radiographic film holders 10 by 12 in. (6 per lab)
9. Cassette, radiographic film holders 7 by 17 in. (6 per lab)
10. Cassette, radiographic film holders 7 by 14 in. (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)

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)
9. IPads (1 per instructor)

CURRICULUM DEFINITIONS AND TERMS

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

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

Classification – Courses may be classified as the following:

a. Career Certificate Required Course – A required course for all students completing a career certificate.
b. Technical Certificate Required Course – A required course for all students completing a technical certificate.
c. Technical Elective – Elective courses that are available for colleges to offer to students.

Description – A short narrative that includes the major purpose(s) of the

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

Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) 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 or revised

Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs

Individualized learning activities, including work-site 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 college. 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 all of the required Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.

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

Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework.
Revising or extending the student learning outcomes
Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)