

# Course Outline

Health Science and Medical Technology

REVISED: August/2017

**Job Title:**  
Radiologic Technologist

**77-20-70**

**Career Pathway:**  
Patient Care

## Radiologic Technologist

**Industry Sector:**  
Health Science and Medical  
Technology

**Credits:** 40

**Hours:** 1550

**O\*NET-SOC CODE:**  
29-2034.00

### Course Description:

This competency-based course is designed to provide the essential information needed by student radiographers to pass the state certification examinations in Diagnostic Radiologic Technology and Fluoroscopy. This course also develops the necessary skills and abilities needed to meet the requirements of their job description and provide optimal patient care. Along with didactic instruction, students are prepared clinically in health care facilities with instructor and staff member supervision. Passing the state examination will allow graduates to work as radiologic technologists under a supervising licentiate. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

**CBEDS Title:**  
Healthcare Occupations

### Prerequisites:

Enrollment requires a copy of current California State X-Ray Technician Certificate/Permit (verifying state licensure in at least chest, extremities, and torsoskeleton), sealed official transcripts verifying graduation from a California state approved X-Ray technology program, pass a radiology exam with 70% accuracy rate, pass an assessment at 10th grade reading level, a U.S. High School diploma or high school equivalency certificate, evidence of computer literacy, participation in a qualifying interview; present a satisfactory physical examination and current American Heart Association (AHA) or Basic Life Support (BLS) for Healthcare Providers Cardiopulmonary Resuscitation Certificate **PRIOR TO CLINICAL ROTATION.**

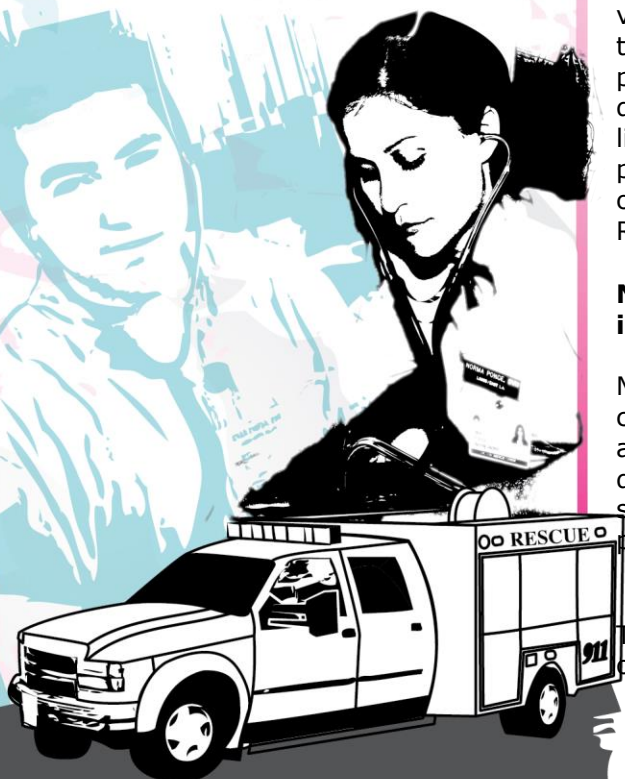
**CBEDS No.:**  
4257

**NOTE:** For Perkins purposes this course has been designated as an **introductory/concentrator/capstone** course.

**MISSION STATEMENT:** The Radiologic Technology Program is committed to providing accessible and affordable quality education to assist current California State certificated x-ray technicians in developing and achieving their short-term goal of upgrading their skills and knowledge towards becoming competent radiographers in a process of lifelong learning.

This course cannot be repeated once a student receives a Certificate of Completion.

Los Angeles Unified School District  
District Office for Career, Technical,  
Instructional and Counseling Services Unit  
Adult Curriculum Office  
www.wearedace.org



## **COURSE OUTLINE COMPETENCY-BASED COMPONENTS**

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

### **COURSE OUTLINE COMPONENTS**

### **LOCATION**

#### **GOALS AND PURPOSES**

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

#### **PERFORMANCE OBJECTIVES OR COMPETENCIES**

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Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

**COURSE OUTLINE COMPETENCY-BASED COMPONENTS**  
**(continued)**

**COURSE OUTLINE COMPONENTS**

**LOCATION**

**INSTRUCTIONAL STRATEGIES**

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Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

**UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT**

Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.

pp. 7-35

Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

**EVALUATION PROCEDURES**

pp. 38-39

The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

**REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT**

Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

## **ACKNOWLEDGMENTS**

Thanks to AARON SAENZ and LUZ GRANADOS for developing and editing this course outline. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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**CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS**  
**Health Science and Medical Technology Industry Sector**  
**Knowledge and Performance Anchor Standards**

**1.0 Academics**

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Health Science and Medical Technology academic alignment matrix for identification of standards.

**2.0 Communications**

Acquire and accurately use Health Science and Medical Technology sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

**3.0 Career Planning and Management**

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

**4.0 Technology**

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Health Science and Medical Technology sector workplace environment.

**5.0 Problem Solving and Critical Thinking**

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Health Science and Medical Technology sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

**6.0 Health and Safety**

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Health Science and Medical Technology sector workplace environment.

**7.0 Responsibility and Flexibility**

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Health Science and Medical Technology sector workplace environment and community settings.

**8.0 Ethics and Legal Responsibilities**

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

**9.0 Leadership and Teamwork**

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the Cal-HOSA career technical student organization.

**10.0 Technical Knowledge and Skills**

Apply essential technical knowledge and skills common to all pathways in the Health Science and Medical Technology sector, following procedures when carrying out experiments or performing technical tasks.

**11.0 Demonstration and Application**

Demonstrate and apply the knowledge and skills contained in the Health Science and Medical Technology anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings and through the Cal-HOSA career technical student organization.

## ***Health Science and Medical Technology Pathway Standards***

### **B. Patient Care Pathway**

The standards for the Patient Care pathway apply to occupations or functions involved in the prevention, treatment, and management of illness and the preservation of mental and physical well-being through the services offered by the medical and allied health professions. The standards specify the knowledge and skills needed by professional and technical personnel pursuing careers in this pathway.

#### **Sample occupations associated with this pathway:**

- ◆ Kinesiotherapist
- ◆ Nurse Anesthetist
- ◆ Respiratory Therapist
- ◆ Radiologic Technician
- ◆ Dental Hygienist

- B1.0 Recognize the integrated systems approach to health care delivery services: prevention, diagnosis, pathology, and treatment
- B2.0 Understand the basic structure and function of the human body and relate normal function to common disorders.
- B3.0 Know how to apply mathematical computations used in health care delivery system.
- B4.0 Recognize and practice components of an intake assessment relevant to patient care.
- B5.0 Know the definition, spelling, pronunciation, and use of appropriate terminology in the health care setting.
- B6.0 Communicate procedures and goals to patients using various communication strategies to respond to questions and concerns.
- B7.0 Apply observation techniques to detect changes in the health status of patients.
- B8.0 Demonstrate the principles of body mechanics as they apply to the positioning, transferring, and transporting of patients.
- B9.0 Implement wellness strategies for the prevention of injury and disease behaviors that prevent injury and illness
- B10.0 Comply with protocols and preventative health practices necessary to maintain a safe
- B11.0 Comply with hazardous waste disposal policies and procedures, including documentation, to ensure that regulated waste is handled, packaged, stored, and disposed of in accordance with federal, state, and local regulations.
- B12.0 Adhere to the roles and responsibilities, within the scope of practice, that contribute to the design and implementation of treatment planning
- B13.0 Research factors that define cultural differences between and among different ethnic, racial, and cultural groups and special populations.

**CBE**  
**Competency-Based Education**

**COMPETENCY-BASED COMPONENTS**  
**for the Radiologic Technologist Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. INTRODUCTION TO RADIOLOGIC TECHNOLOGY</p> <p>Understand, apply, and evaluate classroom and workplace policies and procedures.</p>	<ol style="list-style-type: none"> <li>1. Participate in student introductions.</li> <li>2. Identify local school administrators.</li> <li>3. Demonstrate an understanding of classroom policies and procedures.</li> <li>4. Locate and describe program policies and Department of Health Services-Radiological Health Branch (DHS-RHB) policies pertaining to the radiologic technologist program.</li> <li>5. Examine the impact of thinking on learning and the practice of radiography.</li> <li>6. Describe the importance of metacognition.</li> <li>7. Create a framework for developing the critical thinking skills required of a radiographer.</li> <li>8. Describe and practice each step of this framework in given decision-making situations.</li> <li>9. Develop strategies/skills that help make information more understandable.</li> <li>10. Develop strategies to discover, retain, and utilize information from the text/lecture.</li> <li>11. Develop skills of self-monitoring while reading.</li> <li>12. Describe four methods to improve concentration for more effective learning.</li> <li>13. Identify five ways to become an effective listener.</li> <li>14. Describe three methods to improve listening skills and reading effectiveness.</li> <li>15. Describe the use of rhymes, mnemonics, associations, and other techniques for learning.</li> <li>16. Identify three types of material located in the classroom reference library.</li> <li>17. Describe four strategies for addressing conflict resolution and high stress situations.</li> <li>18. Identify four needs common to all human beings.</li> <li>19. Examine your lifestyle to identify causes of stress and conflict.</li> <li>20. Describe the employment outlook, career advancements, and opportunities for graduates.</li> <li>21. Explain the relationship between clinical education and the theory component of the x-ray technology curriculum.</li> <li>22. Identify the responsibilities of the student during internship.</li> <li>23. Describe the importance of the following personal skills in the health career's environment:</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12</p> <p><b>CTE Anchor:</b> Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 Career Planning and Management: 3.1, 3.2, 3.4, 3.5, 3.6, 3.9 Technology: 4.3 Problem Solving and Critical Thinking: 5.2, 5.3, 5.4, 5.6 Health and Safety: 6.2, 6.4, 6.5, 6.6 Responsibility and Flexibility: 7.2, 7.7 Ethics and Legal Responsibilities: 8.2, 8.4 Leadership and Teamwork: 9.1 Technical Knowledge and Skills: 10.1, 10.2, 10.3, 10.5 Demonstration and Application: 11.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> <li>a. positive attitude</li> <li>b. self-confidence</li> <li>c. honesty</li> <li>d. perseverance</li> <li>e. work ethic</li> <li>f. pride in work</li> <li>g. dependability</li> </ul> <ol style="list-style-type: none"> <li>24. List and describe competencies evaluated in the clinical and didactic portion of the program.</li> <li>25. Explain what is involved in developing skills and maintaining competency in radiographers.</li> <li>26. Prepare the radiographic facility for procedure following established protocol.</li> <li>27. Appropriately identify patient for exam.</li> <li>28. Utilize proper body mechanics to assist patients, as needed.</li> <li>29. Observe patient physical/emotional responses to radiographic exam.</li> <li>30. Describe four essentials for patient/radiographer interaction.</li> <li>31. Describe quality care from the patient's perspective.</li> <li>32. Describe what is meant by optimum patient care as it relates to a radiographer.</li> <li>33. Describe four methods to enhance verbal and written communications.</li> <li>34. Compare and contrast the role of the x-ray technician with that of the radiologic technologist.</li> <li>35. Determine the legal requirements for the practice of radiography in California.</li> <li>36. Describe a typical radiology department.</li> <li>37. Describe departmental administrative and office procedures.</li> <li>38. Describe relationships and interdependencies of departments within the clinical facility.</li> <li>39. Describe the role and the function of the policy and procedure manual in the radiology department.</li> <li>40. Describe how radiology requests are made and received.</li> <li>41. Explain the economics of equipment purchasing in a radiology department.</li> <li>42. Identify five steps you can take to economize in the radiology department.</li> <li>43. Explain the significance of a quality assurance program from the standpoint of patient care, economics, and staff development.</li> <li>44. Explain the primary mission of the American Society of Radiologic Technologists (ASRT).</li> <li>45. Explain how membership in a professional organization benefits the personal practice of radiographers.</li> <li>46. Describe the scope and practice of several areas of specialization within the Imaging Field.</li> <li>47. List requirements for entry into specialty programs and qualifications for certification.</li> </ol>	<p><b>CTE Pathway:</b>  B1.2, B2.1, B6.1,  B6.3, B6.6, B7.12,  B8.1, B8.2, B8.3,  B8.5, B9.4, B12.1,  B12.2, B12.3, B12.4,  B13.3, B13.4, B13.5</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> <li>48. Describe the special equipment required in ultra sound, nuclear medicine, computed tomography, and magnetic resonance imaging.</li> <li>49. Compare images produced with ultra sound, computed tomography and magnetic resonance imaging to images produced with radiation.</li> <li>50. Describe upward mobility career routes for radiographers.</li> <li>51. Understand the required number of credits needed to renew California certification.</li> <li>52. Establish goals for self-improvement and further education/training.</li> <li>53. Understand the importance of initiative and leadership.</li> <li>54. Understand the importance of lifelong learning.</li> <li>55. Understand the implications of noncompliance with continuing education requirements.</li> <li>56. Describe the role of the radiologic technologist in patient education.</li> <li>57. Explain the role of ethical behavior in health care delivery.</li> <li>58. Describe the Code of Ethics for Imaging Health Care Professionals.</li> <li>59. List and explain at least six viewpoints of the radiologic technologist's code of ethics.</li> <li>60. Describe the typical work environment and the duties of a radiologic technologist.</li> <li>61. Explain the importance of having a thorough understanding of the technical aspects of x-ray technology.</li> <li>62. Describe and demonstrate professional, civil, and considerate interactions with patients and peers.</li> <li>63. Explain what professional confidentiality means.</li> <li>64. Explain the importance of complying with the Health Insurance Portability and Accountability Act (HIPAA).</li> <li>65. Describe and demonstrate effective and non-effective communication techniques.</li> <li>66. Describe three ways to avoid miscommunications.</li> <li>67. List four suggestions for creating positive interactions with patients and peers.</li> <li>68. List and explain five barriers to establishing positive relations.</li> <li>69. List three suggestions for improving relationships with coworkers, doctors, and supervisors.</li> <li>70. Given sample patient questions, concerns, and statements; use paraphrasing techniques to form a written response.</li> <li>71. Describe procedures for protecting patient modesty and self-esteem.</li> <li>72. Explain how to project a professional image in attire and conduct.</li> <li>73. Describe personal obligations that radiologic technologists have to their patients and to their profession.</li> <li>74. Describe how to prevent injury to the patient during a radiographic examination.</li> </ol>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	<ul style="list-style-type: none"> <li>75. List and explain two methods for protecting the patient, yourself, and others from contagious diseases.</li> <li>76. List and explain three methods that will reassure and comfort, within the limits of your training, the anxious and fearful patient.</li> <li>77. Describe and demonstrate proper body mechanics in moving and transferring patients.</li> <li>78. Describe the significance of requiring clinical information when radiographic service is requested.</li> <li>79. Describe the impact of medical malpractice on society.</li> <li>80. Identify and describe the Patient's Bill of Rights and the radiographer's role in assuring these rights.</li> <li>81. List at least five points in the Patient's Bill of Rights.</li> <li>82. List legal/professional standards and their relationship to practice in health professions.</li> <li>83. Explain specific legal terms, principles, and laws.</li> <li>84. Describe steps a radiographer may take to prevent a lawsuit against a health provider.</li> <li>85. Demonstrate competency in cardiopulmonary resuscitation (CPR).</li> <li>86. Demonstrate first aid techniques.</li> <li>87. Explain the importance of anatomical side markers and proper film identification.</li> </ul>	
<p>B. RADIOBIOLOGY AND RADIATION SAFETY</p> <p>Understand the principles of radiation biology and radiation protection; the effects of radiation and factors affecting biological response; review and understand the practices, standards, and regulations used to protect occupationally exposed individuals, including the responsibilities of the radiographer.</p>	<ul style="list-style-type: none"> <li>1. Describe the characteristics of a molecule.</li> <li>2. Describe the principles of cellular biology.</li> <li>3. Identify sources of radiation exposure.</li> <li>4. Identify principal source of ionizing radiation.</li> <li>5. Identify ionizing radiation sources from natural and man-made sources.</li> <li>6. Describe the nature of ionizing radiation.</li> <li>7. Describe the devices used to detect and measure radiation.</li> <li>8. State the units used to measure radiation intensity, radiation dose, and dose equivalents in both the conventional and the (International Standards) SI system.</li> <li>9. Given a set of x-ray exposure factors, calculate the entrance skin exposure using a dose graph.</li> <li>10. List the events that occur when radiation passes through the human body.</li> <li>11. Explain the difference between Compton scattering, photoelectric effect, and pair production, and coherent scattering.</li> <li>12. List and explain three types of interactions between radiation and matter that produce Scatter Radiation.</li> <li>13. Describe the biology of the human cell.</li> <li>14. List and explain four possible results when photons of radiation strike human cells.</li> <li>15. Explain factors influencing radiosensitivity.</li> <li>16. Differentiate between cells that are highly radiosensitive vs. those that have low radiosensitivity.</li> </ul>	<p><b>Career Ready Practice:</b> 1, 2, 5, 6, 7, 8, 10</p> <p><b>CTE Anchor:</b> Academics: 1.0 Problem Solving and Critical Thinking: 5.2, 5.3, 5.4, 5.5, 5.6 Health and Safety: 6.2, 6.6, 6.8 Ethics and Legal Responsibilities: 8.2, 8.3 Technical Knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> <li>17. Differentiate between direct and indirect effect of radiation.</li> <li>18. Describe radiolysis of water.</li> <li>19. Describe irradiation of macromolecules.</li> <li>20. Identify the characteristics of radiation dose-response relationships and draw diagrams demonstrating them.</li> <li>21. Examine effects of limited vs. total body exposure.</li> <li>22. List and explain four short term effects of exposure to radiation.</li> <li>23. List and explain four long term effects of exposure to radiation.</li> <li>24. Relate short-term and long-term effects as a consequence of high and low radiation doses.</li> <li>25. Differentiate between somatic and genetic radiation effects as well as describe specific diseases or syndromes associated with them.</li> <li>26. Describe risk estimates for radiation-induced malignancies.</li> <li>27. Describe life span shortening.</li> <li>28. Differentiate between genetic and biological damage due to irradiation.</li> <li>29. Compare the radiation effects on an embryo-fetus to those on children and adults.</li> <li>30. Identify the time periods of greatest radiosensitivity.</li> <li>31. Explain the concept of lethal dose (LD) 50/30 and indicate the LD 50/30 for humans.</li> <li>32. Describe the Law of Bergonie and Tribondeau.</li> <li>33. Describe the relationship between x-ray interactions and technical factor selections.</li> <li>34. Explain the effects of scatter, relative to your patient and yourself.</li> <li>35. Identify types of potential biological effects of ionizing radiation.</li> <li>36. List and explain the significance of radiation effects on the total body.</li> <li>37. Define and compare radiation risks according to type: somatic v. genetic; stochastic v. unstochastic; short term v. long term.</li> <li>38. Describe the risks of exposure of low doses of ionizing radiation and compare these to other similar health risks.</li> <li>39. Explain the significance of the As Low as Reasonably Achievable (ALARA) concept.</li> <li>40. List, explain, and demonstrate ten methods for minimizing patient dose during radiography.</li> <li>41. Describe how beam-limiting apparatus limits patient's exposure to radiation.</li> <li>42. Explain the purpose of x-ray filtration in radiography.</li> <li>43. Differentiate between inherent, added, and total filtration.</li> <li>44. Describe added and inherent filtration in terms of the effect on patient dosage.</li> <li>45. State the reasons for using gonad shielding during radiographic exams and recognize the varieties of shields employed.</li> <li>46. Describe the need for using correct exposure factors for all radiographic exams.</li> <li>47. Explain the relationship of exposure factors to patient dosage.</li> </ol>	<p><b>CTE Pathway:</b>  B1.2, B3.1, B3.2,  B10.4, B12.1, B12.2,  B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 20 hours)	<ol style="list-style-type: none"> <li>48. Demonstrate how the use of high speed film-screen combinations decreases radiographic exposure to patients.</li> <li>49. Explain the rationale for decreasing the number of repeat radiographs.</li> <li>50. Differentiate between high dose techniques and low dose techniques.</li> <li>51. List, explain, and demonstrate radiation-safety precautions for the radiographers.</li> <li>52. List three possible risks of radiation exposure during pregnancy and explain ways to reduce these risks.</li> <li>53. Explain the need for radiation protection efforts by radiographers.</li> <li>54. Define radiation units of measurement such as roentgen, rad, rem, gray, and sievert.</li> <li>55. List, explain, and demonstrate the radiation protection methods expected of all radiographers on each radiograph exam.</li> <li>56. List, describe, and compare instruments for monitoring personnel exposures to radiation.</li> <li>57. Interpret dosimetry reports.</li> <li>58. Define and calculate the dose-limiting recommendations for radiology personnel.</li> <li>59. Explain the structural shielding construction and list items that influence this construction.</li> <li>60. Describe the relationship between Half Value Layer (HVL) and shielding design.</li> <li>61. Demonstrate how time, distance, and shielding can be manipulated to decrease the radiation exposure.</li> <li>62. Illustrate the inverse square law.</li> <li>63. Identify garments that can be worn to reduce radiation exposure and explain when such garments should be used.</li> <li>64. List the people and the methods that can help with patient immobilization during an x-ray exposure.</li> <li>65. Identify dose limits for occupational and non-occupational exposure.</li> <li>66. Explain the objectives of a radiation protection program.</li> <li>67. Distinguish between controlled and non-controlled areas.</li> <li>68. List acceptable exposure levels.</li> <li>69. Describe "Radiation Area" signs and identify appropriate placement sites.</li> <li>70. Describe procedures used to verify performance standards for equipment and indicate potential consequences of performance standards failure.</li> <li>71. Comply with legal and ethical radiation protection responsibilities of radiation workers.</li> <li>72. Identify State Regulations-Title 17.</li> <li>73. Describe the latest National Council on Radiation Protection and Measurements (NCRP) reports regarding radiation safety.</li> <li>74. Pass the radiation safety test.</li> <li>75. Identify legal and ethical radiation protection responsibilities of the radiographer.</li> </ol>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>C. RADIOLOGIC IMAGE FORMATION</p> <p>Understand the parts, along with the proper use and care of radiographic equipment (fluoroscopic, mobile, and tomographic). Understand the principles involved in the operation of the radiographic equipment and radiographic exposure parameters.</p>	<ol style="list-style-type: none"> <li>1. Differentiate between matter and energy.</li> <li>2. Draw and describe the basic structure of matter.</li> <li>3. Name the fundamental particles of the atom and the characteristics of each.</li> <li>4. Draw and describe a model of atomic structures.</li> <li>5. Given the chemical symbol of an element and a periodic table of elements, state the number of protons, neutrons, and electrons.</li> <li>6. Identify various forms of energy.</li> <li>7. Describe the energy levels of the atom.</li> <li>8. Explain the processes of ionization and excitation.</li> <li>9. Draw a sine wave and describe its wavelength.</li> <li>10. Compare and contrast the characteristics of x-rays with short wavelengths vs. long wavelengths.</li> <li>11. Explain the relationship between electromotive force, current, and resistance in an electric circuit and state the units used to measure them.</li> <li>12. Draw and describe the difference in waveform between a direct current and an alternating current.</li> <li>13. Identify the function of solid-state rectification.</li> <li>14. Identify the general components and function of the primary, secondary, and filament circuits.</li> <li>15. Describe the process of electromagnetic induction.</li> <li>16. Use correct terminology while describing x-ray equipment and its parts.</li> <li>17. List essential features of a typical x-ray room.</li> <li>18. Explain the purposes of the control booth and the transformer cabinet.</li> <li>19. Safely change the positions of the radiographic table and the x-ray tube.</li> <li>20. Locate and identify each part of the radiographic machine.</li> <li>21. List the primary features of the x-ray machine's control panel.</li> <li>22. Describe the construction of the glass envelope and the protective tube housing.</li> <li>23. Define and display the radiation field and the central ray.</li> <li>24. Compare and contrast the following types of radiation: primary radiations, Scatter Radiation, and remnant radiation, leakage radiation, useful radiation and non-useful radiation.</li> <li>25. List effects of Scatter Radiation.</li> <li>26. Explain the purpose of the collimator.</li> <li>27. Differentiate between inherent filtration, added filtration, total filtration, and compensating filter.</li> <li>28. Explain the concept of half-value layer and give a demonstration of its calculation.</li> <li>29. Describe the effects of filtration on the primary x-ray beam.</li> <li>30. Describe precautions to be taken to ensure personnel safety from radiation exposure.</li> <li>31. Describe the principles involved in the operation of the x-ray machine.</li> <li>32. Demonstrate inspection procedures for testing equipment.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 6</p> <p><b>CTE Anchor:</b> Academics: 1.0 Problem Solving and Critical Thinking: 5.2, 5.4, 5.5, 5.6 Health and Safety: 6.3, 6.6 Technical Knowledge and Skills: 10.1, 10.3</p> <p><b>CTE Pathway:</b> B3.1, B3.2, B8.4, B9.3, B12.1, B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> <li>33. Demonstrate the care and maintenance of radiographic equipment.</li> <li>34. Describe quality assurance relative to the radiographic equipment.</li> <li>35. Draw a basic x-ray tube diagram and label its parts.</li> <li>36. Describe both the makeup and the function of the basic parts of the x-ray tube.</li> <li>37. On an actual x-ray tube, locate and identify each part.</li> <li>38. Describe the requirements for the production of x-rays.</li> <li>39. Describe the process of thermionic emission.</li> <li>40. Describe the production of <i>bremsstrahlung</i> ("braking" or "slowing down") and characteristic radiation, and explain what determines the wavelength of each.</li> <li>41. Describe the x-ray emission spectra.</li> <li>42. Identify the factors affecting the x-ray emission spectra</li> <li>43. Describe the clinical significance of the photoelectric, Compton, and modified scattering interactions in diagnostic imaging.</li> <li>44. Describe the conversion of electron energy to x-ray energy in the x-ray tube.</li> <li>45. Describe the classification and identify properties of x-rays.</li> <li>46. Explain what is meant by dual focus tube and describe its advantages.</li> <li>47. Define effective focal spot and state its significance with respect to the radiographic image.</li> <li>48. Explain the function of a rotating anode and state its purpose.</li> <li>49. State the effect of changes in milliamperage (mA) and kilovoltage peak (kVp) on the resulting x-ray beam.</li> <li>50. Describe the production of the anode heel effect and how it can assist radiographers.</li> <li>51. Given an unlabeled x-ray circuit diagram, label the parts and state the function of each.</li> <li>52. Differentiate between an autotransformer, step-up transformer, and a step-down transformer; describe their respective location within the equipment's circuitry.</li> <li>53. Draw a simple diagram of a step-up transformer and a step-down transformer.</li> <li>54. Compare single phase, three phase, high frequency, and falling load generators in terms of radiation production and efficiency.</li> <li>55. Define and explain what is meant by rectification and compare the three basic types.</li> <li>56. Draw the current waveform for each of the following: unrectified, half-wave rectification, full-wave rectification, three-phase rectified, and high frequency.</li> <li>57. List five possible causes of tube failure and describe methods to prevent each.</li> <li>58. State and be able to apply the formula for measurement of heat units.</li> <li>59. Calculate safe exposures when provided with a tube rating chart and an anode cooling chart.</li> <li>60. Describe the development of fluoroscopy.</li> </ol>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 60 hours, Lab: 15 hours)	<ol style="list-style-type: none"> <li>61. List and explain the functions of each component of a fluoroscope.</li> <li>62. Describe the effects of magnification and flux gain on total brightness gain.</li> <li>63. Describe the factors that affect fluoroscopy image contrast, resolution, distortion, and quantum mottle.</li> <li>64. List appropriate kilovoltage peak levels for common fluoroscopic exams.</li> <li>65. Evaluate the three basic types of fluoroscopic viewing systems.</li> <li>66. Evaluate the various types of fluoroscopic recording systems for various clinical situations.</li> <li>67. Explain the uses of dynamic and static fluoroscopic viewing systems.</li> <li>68. Explain the operation of a cineradiographic camera, a spot film recording system, 105 mm chip film and 70 mm roll film recording systems, and magnetic and laser video disc recorders.</li> <li>69. Describe the resolving ability of various videotape recording equipment.</li> <li>70. Describe problems with mobile radiographic equipment versus problems with mobile fluoroscopic equipment.</li> <li>71. Describe fluoroscopy regulations and radiation safety.</li> <li>72. Describe various methods of reducing dose to the patient, the radiographer, and the radiologist during a fluoroscopic exam.</li> <li>73. Describe eye anatomy and physiology and their relationship to fluoroscopy.</li> <li>74. Explain the differences between the operation of fluoroscopic equipment and diagnostic equipment.</li> <li>75. Differentiate between fluoroscopic exams and typical radiographic exams.</li> </ol>	
<p>D. INTRODUCTION TO DIGITAL IMAGING</p> <p>Understand the components, principles, and operation of digital imaging systems found in diagnostic radiology.</p> <p>(7 hours)</p>	<ol style="list-style-type: none"> <li>1. Define digital imaging, dynamic range, postprocessing image enhancement, matrix, pixel, imaging plate (IP), histogram, algorithms, window level, and window width.</li> <li>2. Identify the modalities that use digital imaging.</li> <li>3. Compare the process of digital radiography with conventional radiography.</li> <li>4. Explain the three-step imaging process in digital radiography.</li> <li>5. Describe the primary factors controlling image quality in digital radiography.</li> <li>6. Compare the process of digital fluoroscopy with conventional fluoroscopy.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 11</p> <p><b>CTE Anchor:</b> Academics: 1.0 Technology: 4.5 Problem Solving and Critical Thinking: 5.4 Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> B12.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>E. PRINCIPLES OF EXPOSURE AND IMAGE QUALITY</p> <p>Interpret radiographic calculations and exposure conditions affecting the quality of radiographs; develop a “problem-solving technique” for analyzing radiographic images.</p>	<ol style="list-style-type: none"> <li>1. List the prime factors of exposure.</li> <li>2. Calculate mAs when given mA and exposure time, mA when given mAs and exposure time, and exposure time when given mAs and mA.</li> <li>3. Explain and demonstrate application of the reciprocity law.</li> <li>4. Evaluate the relationships between mA, exposure time, mAs and the quantity of x-rays produced.</li> <li>5. Explain the radiographic effect caused by changes in each of the four prime factors of exposure.</li> <li>6. Recognize changes in radiographic density and state the exposure factors used to control radiographic density.</li> <li>7. Assess radiographic density on radiographic images.</li> <li>8. Identify high, low, and optimum contrast on a radiograph and state the exposure factor that primarily controls radiographic contrast.</li> <li>9. Differentiate between short-scale contrast and long-scale contrast.</li> <li>10. Utilizing radiographs, distinguish between acceptable and unacceptable levels of density and contrast.</li> <li>11. Explain the effects of kVp and the primary beam.</li> <li>12. Explain and demonstrate application of the 15% rule.</li> <li>13. Calculate the new kVp needed to maintain density when changes are made in mAs, using the 15% rule.</li> <li>14. Explain and demonstrate application of the inverse square law.</li> <li>15. Calculate milliroentgen (mR) when the source-to-image receptor distance (SID) is changed.</li> <li>16. Calculate mAs needed to maintain density when changes are made in SID.</li> <li>17. Define radiographic distortion and explain the difference between magnification and shape distortion.</li> <li>18. Define radiographic definition and list factors that influence definition.</li> <li>19. List and explain the geometric factors that affect radiographic definition and explain why magnification affects definition.</li> <li>20. List, describe, and demonstrate methods for minimizing motion blur on radiographs.</li> <li>21. Assess radiographs for “optimum quality.”</li> <li>22. Describe the effect of patient size on the attenuation of the x-ray beam.</li> <li>23. Describe the relationship of the patient to the density, contrast, detail, and distortion of the recorded image.</li> <li>24. Describe the effect of pathology on radiation absorption.</li> <li>25. Identify pathologic conditions that result in increased attenuation of the x-ray beam.</li> <li>26. Identify pathologic conditions that result in decreased attenuation of the x-ray beam.</li> <li>27. Read and use an x-ray technique chart.</li> <li>28. List methods for creating an x-ray technique chart.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 6, 7, 8, 10, 12</p> <p><b>CTE Anchor:</b> Academics: 1.0 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 Ethics and Legal Responsibilities: 8.3 Technical Knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> B3.1, B3.2, B12.1, B12.3, B12.4</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 30 hours)	<ol style="list-style-type: none"> <li>29. Accurately measure a body part using x-ray calipers and calculate the kVp, based on measurements.</li> <li>30. Compare a fixed kVp technique chart with a variable kVp technique chart.</li> <li>31. Explain what is meant by optimum kVp and how this value is determined.</li> <li>32. Select an appropriate mA, time, and kVp for a given set of circumstances.</li> <li>33. Take appropriate steps when technique charts fail to provide an appropriate exposure.</li> <li>34. Calculate exposure adjustments for changes in patient/part size.</li> <li>35. Estimate the technique change required when radiographs are too dark or too light.</li> <li>36. Suggest appropriate technique changes for lengthening or shortening the scale of contrast.</li> <li>37. Calculate technique changes for variations in SID.</li> <li>38. Calculate technique changes required when using a grid or changing grid ratio.</li> <li>39. Calculate technique changes required for changes in the speed of the image receptor system.</li> <li>40. Develop a technique chart for personal use during internship.</li> <li>41. Perform State required experiments to illustrate effects of kVp, mA, SID, Heel Effect, and Scatter Radiation.</li> <li>42. Describe x-ray interaction with matter.</li> <li>43. Define attenuation.</li> <li>44. List and explain three types of interactions between radiation and matter that produce Scatter Radiation.</li> <li>45. Analyze the relationships between x-ray interactions and technical factor selections.</li> <li>46. Explain the problems caused by Scatter Radiation in radiography.</li> <li>47. List factors that affect the amount of Scatter Radiation reaching a radiograph.</li> <li>48. Identify Scatter Radiation on a radiograph.</li> <li>49. List and demonstrate measures that can be taken to reduce the quantity of Scatter Radiation.</li> <li>50. Explain the construction of a grid, including grid ratio, grid frequency, and grid radius.</li> <li>51. List common grid ratios and state the appropriate application for each.</li> <li>52. Define grid cutoff.</li> <li>53. List four causes of grid cutoff.</li> <li>54. Identify grid cutoff on a radiograph.</li> <li>55. Compare and contrast a Bucky and a stationary grid.</li> <li>56. State the criteria for determining whether a grid is to be used.</li> <li>57. Describe the purpose of the grid.</li> <li>58. Analyze the relationships between grid selection, patient dose, radiographic density, and absorption of scatter.</li> <li>59. Calculate changes in technical factors to compensate in grid selection.</li> </ol>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>F. IMAGE RECEPTOR SYSTEM</p> <p>Understand the factors that control and influence the production and recording of radiographic images; perform the steps necessary to process films.</p>	<ol style="list-style-type: none"> <li>1. List the components of the image receptor system.</li> <li>2. Identify the components of a typical radiographic cassette and explain the purpose of each.</li> <li>3. State the purpose of intensifying screens and explain how this purpose is accomplished.</li> <li>4. Identify screen characteristics that affect screen speed and resolution.</li> <li>5. Compare and contrast the relationships between phosphor size, technical factors, patient dose and radiographic detail.</li> <li>6. State the types of phosphor commonly used for intensifying screens and describe their spectral emission characteristics.</li> <li>7. Explain the classifications of intensifying screens and the applications of each.</li> <li>8. Employ a quality control program for intensifying screens.</li> <li>9. Describe safelight illumination appropriate for specific image receptor systems.</li> <li>10. Demonstrate proper handling and cleaning of cassettes and screens.</li> <li>11. Explain the importance of good film/screen contact.</li> <li>12. List three causes of poor film/screen contact.</li> <li>13. Assess the quality of film/screen contact in three samples.</li> <li>14. List or draw the layers of radiographic film and explain the content and purpose of each.</li> <li>15. List the factors that may cause the accidental exposure of radiographic film.</li> <li>16. State optimum conditions for film storage and handling.</li> <li>17. List three inherent characteristics of film response.</li> <li>18. Describe the production of the latent image.</li> <li>19. Explain proper radiographic identification.</li> <li>20. List essential features and equipment found in an x-ray darkroom and state the purpose of each.</li> <li>21. List possible causes of darkroom fog.</li> <li>22. Demonstrate the procedure for testing the safety of safelights.</li> <li>23. Demonstrate correct methods for film handling.</li> <li>24. Describe the layout of a darkroom</li> <li>25. Name chemical components of processing solutions for both the manual and automatic processing and state the function of each.</li> <li>26. Describe and demonstrate the order, purpose, and time required for each of the manual film processing steps.</li> <li>27. State the two purposes of replenishment in any film processing system.</li> <li>28. Demonstrate the procedure for processing a film with an automatic processor.</li> <li>29. List the steps taken daily for processor startup and shutdown.</li> <li>30. Demonstrate correct use of equipment for processor quality control evaluations and plot the results of an evaluation on a typical graph.</li> <li>31. Identify common radiographic artifacts, state their causes, and explain how to avoid them.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 6, 7, 10</p> <p><b>CTE Anchor:</b> Academics: 1.0 Problem Solving and Critical Thinking: 5.2, 5.4, 5.6 Health and Safety: 6.2, 6.3, 6.6, 6.8 Responsibility and Flexibility: 7.5 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> B3.2, B12.1, B12.3, B12.4, B13.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 10 hours)	32. List the possible causes and health implications of “darkroom chemical sensitivity.” 33. Describe Q. A. relative to darkroom and processing. 34. Describe sensitometry as it applies to radiography. 35. Explain the function and demonstrate proper use of the densitometer.	
<b>G. NURSING PROCEDURES</b>  Perform the basic nursing procedures necessary to assist in the healthcare facility and to maintain patient safety.	1. Differentiate between quality improvement/ management, quality assurance and quality control. 2. List the benefits of a quality management program to the patient and to the department. 3. Describe the importance of positive interpersonal relationships in the healthcare settings. 4. Suggest ways to avoid miscommunication. 5. List three suggestions for creating positive interactions with patients. 6. List and explain five negative barriers to establishing positive relationships. 7. List three suggestions for improving relationships with coworkers, doctors, and supervisors. 8. Describe what is meant by chain of command and describe how it promotes effective communication and team efforts. 9. Given sample patient questions, concerns, and statements; use paraphrasing techniques to form a written response. 10. Describe procedures for protecting patient modesty and self-esteem. 11. Explain how to project a professional image in attire and conduct. 12. Describe personal obligations that radiologic technologists have to their patients and to their profession. 13. Explain the legal implications of professional liability, malpractice, professional negligence/carelessness, and other legal doctrines applicable to professional practice. 14. List the information to be collected prior to patient examination. 15. Describe how to prevent injury to the patient during a radiographic examination. 16. List and explain two methods for protecting the patient, yourself, and others from contagious diseases. 17. List common departmental procedures for infection control. 18. List and explain three methods that will reassure and comfort, within the limits of your training, the anxious and fearful patient. 19. Describe and demonstrate proper body mechanics in moving and transferring patients. 20. Describe the significance of requiring clinical information when radiographic service is requested. 21. Identify common safety measures that the radiologic technologist can practice. 22. Identify principles of body mechanics and relate these to radiographer and patient safety and comfort.	<b>Career Ready Practice:</b> 1, 2, 5, 6, 7, 10  <b>CTE Anchor:</b> Academics: 1.0 Communications: 2.1, 2.2, 2.5 Problem Solving and Critical Thinking: 5.2, 5.4 Health and Safety: 6.4, 6.6 Responsibility and Flexibility: 7.7 Technical Knowledge and Skills: 10.1, 10.2 Demonstration and Application: 11.1  <b>CTE Pathway:</b> B4.4, B6.2, B8.3, B8.4, B8.5, B10.4, B10.5, B12.1, B12.2

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 10 hours)	<ol style="list-style-type: none"> <li>23. Identify the common vital signs and describe their importance in assessment of patient condition.</li> <li>24. Identify normal vital signs ranges for adults and children to include temperature, pulse, respiration, and blood pressure.</li> <li>25. Discriminate between appropriate and inappropriate procedures and techniques related to taking and recording vital signs, responding to emergencies, and handling trauma patients.</li> <li>26. Demonstrate competence in each task listed:               <ol style="list-style-type: none"> <li>a. hand washing</li> <li>b. assisting the falling patient</li> <li>c. assisting the patient with a walker and/or cane</li> <li>d. transporting the patient in a wheelchair</li> <li>e. transferring the patient between radiographic table and wheelchair</li> <li>f. preparing the patient for the radiographic exam</li> <li>g. taking temperature</li> <li>h. counting radial pulse and respiration rate</li> <li>i. taking blood pressure</li> <li>j. applying correct principles of medical asepsis in linen handling, disposal of contaminated items, and disinfections of radiographic tables and equipment</li> <li>k. applying correct technique for establishing a sterile field, donning sterile gloves, removing contaminated gloves, and changing dressings</li> </ol> </li> </ol>	
<p>H. MEDICAL AND RADIOLOGICAL METHODS AND PROCEDURES</p> <p>Understand medical terminology, perform pediatric radiography, describe and define disease and pathology and compare and describe pharmacology and drug administration.</p>	<ol style="list-style-type: none"> <li>1. Define prefixes, roots, and suffixes selected from a list of words.</li> <li>2. Interpret abbreviations and symbols commonly used in radiography: Lt., r/o, fx., P/3, pt., c/o, etc.</li> <li>3. Name titles and organizations pertaining to radiography, when given their abbreviations: Department of Health Services (DHS), Radiologic Health Branch (RHB), American Registry of Radiologic Technologists (ARRT), Radiologic Technologist (RT), Certified Radiologic Technologist (CRT), X-ray Technologist (XT), etc.</li> <li>4. Define and use basic positioning terminology: supine, prone, lateral, oblique, etc.</li> <li>5. Define and use terminology related to specific body positions: right anterior oblique (RAO), left anterior oblique (LAO), right posterior oblique (RPO), left posterior oblique (LPO), left lower extremity (LLE), right lower extremity (RLE), etc.</li> <li>6. Define and use relationship terms: anterior vs. posterior; inferior vs. superior; distal vs. proximal, etc.</li> <li>7. Define and use terminology related to movement: flexion vs. extension; supination vs. pronation; adduction vs. abduction, etc.</li> <li>8. Define and use terms and phrases in general usage in radiography.</li> <li>9. Explain similarities and differences for these terms: position, projection, and view.</li> <li>10. Identify the following common pediatric examinations:         <ol style="list-style-type: none"> <li>a. chest radiography</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 6, 7, 8, 9, 10, 12</p> <p><b>CTE Anchor:</b> Academics: 1.0 Communications: 2.4, 2.5, 2.7, 2.8 Problem Solving and Critical Thinking: 5.2, 5.3, 5.4, 5.6 Health and Safety: 6.6 Responsibility and Flexibility: 7.7 Ethics and Legal Responsibilities: 8.2, 8.3, 8.4, 8.5 Leadership and Teamwork: 9.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> <li>b. hip radiography</li> <li>c. skull radiography</li> <li>d. limb radiography</li> <li>e. abdominal radiography</li> <li>f. gastrointestinal &amp; genitourinary procedures</li> </ul> <ol style="list-style-type: none"> <li>11. Identify the following examination conditions unique to pediatric patients: <ul style="list-style-type: none"> <li>a. bone age</li> <li>b. foreign bodies</li> <li>c. scoliosis</li> </ul> </li> <li>12. Compare and contrast necessary considerations when performing radiographic exams on a geriatric patient vs. a child or infant.</li> <li>13. Compare and contrast the characteristics of the developing skeleton with that of a mature adult.</li> <li>14. Demonstrate appropriate levels of communication with children of any age.</li> <li>15. Demonstrate introduction of radiographer to child and parent(s).</li> <li>16. Demonstrate positive attitude toward the child.</li> <li>17. Assess the extent of parental involvement.</li> <li>18. Report suspected child abuse to the appropriate radiologists, attending physician, radiology supervisor, or nurse.</li> <li>19. Determine the following types of immobilization procedures to be used for the exam: <ul style="list-style-type: none"> <li>a. demonstration of good communication strategies as a method of immobilization</li> <li>b. demonstration of immobilization of an infant or toddler for a radiographic exam, utilizing the following immobilization tools: <ul style="list-style-type: none"> <li>i. immobilization board</li> <li>ii. Pigg-O-Stat</li> <li>iii. sandbags</li> <li>iv. tape</li> <li>v. compression bands</li> <li>vi. sheets and towels</li> </ul> </li> </ul> </li> <li>20. Practice the ALARA principle with the following conditions: <ul style="list-style-type: none"> <li>a. gonadal shielding</li> <li>b. tight collimation</li> <li>c. low mAs techniques</li> <li>d. lead strips as contact shields</li> <li>e. no repeat radiographs</li> <li>f. high speed film-screen combinations</li> </ul> </li> <li>21. Define common terms used to describe or classify disease processes.</li> <li>22. Explain the differences between acute and chronic conditions and between benign and malignant conditions.</li> <li>23. Define inflammation and describe its possible consequences.</li> <li>24. List and explain factors involved in the cycle of infection.</li> <li>25. State the best method of break the cycle of infection.</li> </ol>	<p>Technical Knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> B2.1, B2.3, B2.4, B5.1, B5.3, B5.4, B5.5, B6.1, B6.3, B7.3, B8.2, B9.1, B12.1, B12.2, B12.3, B12.4, B13.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 30 hours)	<ol style="list-style-type: none"> <li>26. Describe the disease processes involved with HIV, hepatitis, and TB; and explain how to limit the transmission of these diseases.</li> <li>27. Define medical asepsis, disinfections, and sterilization and give example of the correct application of each.</li> <li>28. Identify selected diseases on radiographs.</li> <li>29. Identify radiographic procedures and diseases common to each body system.</li> <li>30. Explain the professional, ethical, and legal role of a radiographer with respect to medication administration.</li> <li>31. Look up medication information in standard references and on medication package inserts.</li> <li>32. Distinguish between chemical, generic, and trade names for selected drugs.</li> <li>33. Classify drugs according to specific categories.</li> <li>34. List and describe common routes of medication administration.</li> <li>35. Explain the use and the side effects for selected drugs.</li> <li>36. Describe the symptoms and medical interventions for a patient having a reaction to contrast media.</li> <li>37. Name medications commonly needed in emergencies and describe their effects.</li> <li>38. Describe the precautions required to ensure safety when injecting medications.</li> <li>39. Describe several aspects in starting and stopping intravenous drug therapy.</li> <li>40. Compare and contrast dose calculations for adult and pediatric patients.</li> <li>41. Chart medications accurately.</li> </ol>	
<p>I. FILM CRITIQUE</p> <p>Understand the factors affecting radiographic quality and the inter-relationships between them; develop a “problem-solving technique” for analyzing radiographic images.</p>	<ol style="list-style-type: none"> <li>1. List at least two conditions that must be present in a radiographic image that would indicate acceptable visibility of image details.</li> <li>2. List the four image quality factors of a radiograph.</li> <li>3. Define radiographic density and radiographic contrast and identify the controlling factors.</li> <li>4. Recognize and identify short scale contrast and long scale contrast images.</li> <li>5. Define radiographic detail.</li> <li>6. List the three geometric factors that influence image sharpness.</li> <li>7. Identify the best ways of controlling involuntary and voluntary motion.</li> <li>8. Define radiographic distortion and identify its controlling factor.</li> <li>9. List three important conditions for properly viewing radiographs.</li> <li>10. List three areas from which objective radiographic film evaluation criteria may be developed.</li> <li>11. Identify the criteria for evaluating radiographs of the chest, extremities, torsoskeleton, and skull for positioning accuracy and overall image quality.</li> <li>12. Identify the importance of collimation, anatomic side markers, and proper radiograph identification.</li> <li>13. State the general criteria for repeating a radiograph.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 10</p> <p><b>CTE Anchor:</b> Problem Solving and Critical Thinking: 5.2, 5.3, 5.4, 5.6 Ethics and Legal Responsibilities: 8.1 Technical Knowledge and Skills: 10.1</p> <p><b>CTE Pathway:</b> B12.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 50 hours)	<ol style="list-style-type: none"> <li>14. List and describe the elements of a diagnostic image as they relate to film critique.</li> <li>15. Identify the three steps of the decision making process in the proper critique of radiographs.</li> <li>16. Explain the differences between technical factor problems, procedural problems, and equipment malfunctions.</li> <li>17. Describe modifications of procedures for atypical or impaired patients to better demonstrate the anatomic area of interest.</li> <li>18. Based on the evaluation criteria, critique specific radiographs within the following categories and indicate modifications for improvement:               <ol style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> <li>i. reproductive system</li> <li>j. vascular system</li> <li>k. surgical and portable procedures</li> </ol> </li> <li>19. Discriminate between radiographs that are acceptable and those that are unacceptable because of exposure factors, motion, collimation, or positioning errors.</li> </ol>	
<p>J. ANATOMY AND PHYSIOLOGY</p> <p>Apply the appropriate terms for major organs and systems of the human body. Identify the major functions of these organs and systems. Compare the interrelationships amongst the systems. Describe diseases affecting each system.</p>	<ol style="list-style-type: none"> <li>1. Differentiate between anatomy and physiology.</li> <li>2. Identify and define cell components.</li> <li>3. Describe the role of the cell.</li> <li>4. Explain the relationship between cells, tissues, organs, and systems.</li> <li>5. Label the names of the planes and the directional terms related to these planes on a diagram of the three planes of the body.</li> <li>6. Label a diagram of the main body cavities.</li> <li>7. Identify main organs located in each body cavity.</li> <li>8. Identify at least seven major systems of the human body and name associated organs for each system.</li> <li>9. List the five functions of the skeletal system.</li> <li>10. Describe the composition of bone.</li> <li>11. Label the parts of a bone on a diagram of a long bone.</li> <li>12. Differentiate between red and yellow marrow.</li> <li>13. Describe the ossification process and the primary and secondary bone formation centers.</li> <li>14. Define facet, tuberosity, process, spine, crest, foramen, meatus, sinus, fossa, and suture in relation to bone markings.</li> <li>15. Name the two divisions of the skeletal system and name the main groups of bones in each division.</li> <li>16. Identify the classification of bones of the skeleton and name at least three bones within each classification.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 10</p> <p><b>CTE Anchor:</b> Academics: 1.0 Communications: 2.7, 2.8 Problem Solving and Critical Thinking: 5.4, 5.6 Technical Knowledge and Skills: 10.1, 10.3 Demonstration and Application: 11.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> <li>17. Compare the three classifications of joints by describing the type of motion allowed by each.</li> <li>18. Give one example of each joint classification.</li> <li>19. List and describe the location, size, and shape of each carpal bone in the wrist.</li> <li>20. Compare the female and male pelvis.</li> <li>21. Describe the location of the major landmarks of the pelvis and hip, and the two methods of locating the femoral head and neck.</li> <li>22. Describe the structural and functional differences of the greater and lesser pelvis.</li> <li>23. Identify the classification and movement type for the joints of the pelvis.</li> <li>24. Determine the gender of the patient from radiographs of the pelvis.</li> <li>25. Identify those features of the cervical and thoracic spines that distinguish them from other aspects of the vertebral column.</li> <li>26. Describe the location, classification, and type of movement for specific joints of the cervical and thoracic spine.</li> <li>27. List additional terms for the first, second, and seventh cervical vertebra.</li> <li>28. Describe topographical landmarks that can be palpated to locate specific thoracic and cervical vertebra.</li> <li>29. Describe which anatomic structures are best demonstrated with each position of the cervical and thoracic spine.</li> <li>30. Describe the structures and functions of the lumbar spine, sacrum, and coccyx.</li> <li>31. Identify and describe the anatomy that is seen with the “Scotty Dog” of the lumbar spine.</li> <li>32. Describe the classification of the joints found in the lumbar spine.</li> <li>33. Describe topographical landmarks that can be palpated to locate specific aspects of the lumbar spine, sacrum, and coccyx.</li> <li>34. Describe at least four diseases involved with the vertebral column.</li> <li>35. Classify ribs as true, false, or floating.</li> <li>36. Describe which anatomical structures are best seen with specific projections of the ribs and sternum.</li> <li>37. Describe the eight cranial bones in regards to features, related structures, location, and function.</li> <li>38. List and describe specific radiographic and topographical landmarks of the cranium.</li> <li>39. Describe the locations, joint classification, and related terminology for the sutures and joints of the cranium and facial bones.</li> <li>40. Describe the 14 facial bones in regards to features, related structures, location, and function.</li> <li>41. List and describe the number and the names of cranial/facial bones with which each cranial and facial bone articulate.</li> <li>42. List and describe the cranial and facial bones that make up the bony orbits.</li> </ol>	<p><b>CTE Pathway:</b>  B2.1, B2.3, B2.4,  B5.1, B5.2, B12.1,  B12.3</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<p>43. Describe the causes and radiographic implications of a blowout and tripod fractures of the facial bones.</p> <p>44. Describe the differences among the three shape and size classifications of the skull and their implications to radiography of the cranium.</p> <p>45. Describe the location, function, and characteristics of the four groups of paranasal sinuses.</p> <p>46. Describe the three main portions of the temporal bone.</p> <p>47. List and describe the structures of the external, middle, and internal ear.</p> <p>48. Define specific terminology, reference points, positioning lines, and topographical landmarks as they relate to the cranium and the facial bones.</p> <p>49. Label major parts on a diagram of the ear.</p> <p>50. Trace the pathway of sound waves as they travel through the ear.</p> <p>51. Explain how the ear maintains balance and equilibrium.</p> <p>52. Label the layers, chambers, valves, and major blood vessels on a diagram of the heart.</p> <p>53. Differentiate between systole and diastole by explaining what happens in the heart during each phase.</p> <p>54. Trace the flow of blood as it enters the heart and goes to the body cells, naming each blood vessel, chamber, and valve in the heart.</p> <p>55. List the three types of blood vessels and the action of each.</p> <p>56. Compare the three main types of blood cells by describing the function of each.</p> <p>57. Describe at least three diseases of the circulatory system.</p> <p>58. Label a diagram of the respiratory system.</p> <p>59. On drawings, list and describe the structures making up the airway through which oxygen will pass as it travels from the nose and mouth to the terminal aspects of the lungs.</p> <p>60. List five functions of the nasal cavity.</p> <p>61. List skeletal landmarks associated with organs of the respiratory system.</p> <p>62. Identify the three sections of the pharynx.</p> <p>63. Describe the function and structure of the following:</p> <ul style="list-style-type: none"> <li>a. bony thorax</li> <li>b. larynx</li> <li>c. pharynx</li> <li>d. trachea</li> <li>e. bronchi/bronchioles</li> <li>f. alveolar sacs</li> <li>g. hilum</li> <li>h. lungs</li> <li>i. mediastinum</li> </ul> <p>64. Describe the exchange of oxygen and carbon dioxide in the alveoli.</p> <p>65. Trace a molecule of oxygen entering the nasal/oral cavity through the respiratory system into a tissue cell.</p>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<p>66. Describe the epiglottis and describe how it prevents food from entering the trachea.</p> <p>67. Compare the processes of inspiration and expiration, including muscle action that occurs during each phase.</p> <p>68. Differentiate between internal and external respiration.</p> <p>69. Describe five diseases of the respiratory system.</p> <p>70. Describe how the circulatory and respiratory systems perform a joint function.</p> <p>71. Describe how the pituitary gland influences various body functions.</p> <p>72. Given drawings, dry skeleton, and radiographs, locate the anatomic structures and landmarks pertaining to the following:</p> <ol style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> </ol> <p>73. Compare the three main kinds of muscle.</p> <p>74. List at least three functions of muscles.</p> <p>75. Differentiate between voluntary muscle and involuntary muscle.</p> <p>76. List at least three functions of muscles.</p> <p>77. Describe two main ways muscles attach to bones.</p> <p>78. Define flexion, extension, abduction, adduction, rotation, supination, pronation, inversion, and eversion.</p> <p>79. Demonstrate five major movements performed by muscles.</p> <p>80. Name and locate four major muscles found on the axial skeleton.</p> <p>81. Name and locate four major muscles found on the appendicular skeleton.</p> <p>82. Describe at least three diseases of the muscular system.</p> <p>83. Name the two main divisions of the nervous system.</p> <p>84. Describe the function of each of the five parts of the brain.</p> <p>85. Explain at least two functions of the spinal cord.</p> <p>86. Name the three meninges.</p> <p>87. Describe the circulation and function of cerebrospinal fluid.</p> <p>88. Contrast the action of the sympathetic and parasympathetic nervous system.</p> <p>89. Describe at least five diseases of the nervous system.</p> <p>90. Identify five special senses.</p> <p>91. Label on a diagram the major parts of the eye.</p> <p>92. Trace the pathway of light as it passes through the eye.</p> <p>93. Describe at least five diseases of the ear and eye.</p> <p>94. Explain the function of the lymphatic system.</p> <p>95. List at least two functions of lymph nodes.</p> <p>96. Identify the two lymphatic ducts and the areas of the body that each drains.</p> <p>97. List at least three functions of the spleen.</p> <p>98. Describe the function of the thymus.</p> <p>99. Describe at least two diseases of the lymphatic system.</p> <p>100. Label major organs on a diagram of the digestive system.</p>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 75 hours)	<p>101. Identify at least three organs of the digestive system that aid in the initial breakdown of food.</p> <p>102. Give two functions of the salivary glands.</p> <p>103. Describe how gastric juices act on food in the stomach.</p> <p>104. Explain how food is absorbed into the body.</p> <p>105. List three functions of the large intestine.</p> <p>106. List four functions of the liver.</p> <p>107. Explain the function of the pancreas.</p> <p>108. Describe five diseases of the digestive system.</p> <p>109. Name all parts of the alimentary canal in correct order.</p> <p>110. Label a diagram of the urinary system.</p> <p>111. Explain the action of the following:</p> <ol style="list-style-type: none"> <li>a. nephron</li> <li>b. glomerulus</li> <li>c. Bowman’s capsule</li> <li>d. convoluted tubule</li> <li>e. collecting tubule</li> <li>f. ureter</li> <li>g. bladder</li> <li>h. urethra</li> </ol> <p>112. Describe three diseases of the urinary system.</p> <p>113. Label a diagram of the main endocrine glands.</p> <p>114. Describe how hormones influence various body functions.</p> <p>115. Describe four diseases of the endocrine system.</p> <p>116. Label a diagram of the male and female reproductive system.</p> <p>117. Trace the pathway of sperm from where they are produced to where they are expelled from the body.</p> <p>118. Describe how an ovum is released from an ovary.</p> <p>119. Describe four diseases of the reproductive system.</p> <p>120. Evaluate three sexually transmitted diseases and describe how symptoms are the same/different in males vs. females.</p> <p>121. Label a diagram of a cross section of the skin.</p> <p>122. Differentiate between two types of skin glands.</p> <p>123. List five functions of the skin.</p> <p>124. Provide name for three abnormal colors of the skin and identify the cause of each.</p> <p>125. Describe at least three skin eruptions.</p> <p>126. Describe three diseases of the integumentary.</p> <p>127. Describe five examples of interrelationships between body systems.</p>	
<p>K. RADIOGRAPHIC POSITIONING</p> <p>Demonstrate basic and special radiographic positioning, including procedures involving contrast media.</p>	<ol style="list-style-type: none"> <li>1. List and describe patient care considerations relevant to positioning.</li> <li>2. List the three technical factors relevant to positioning.</li> <li>3. List four methods of reducing patient radiation exposure.</li> <li>4. Explain the ten-day rule.</li> <li>5. List the three primary principles of radiation protection.</li> <li>6. Define and demonstrate the anatomic positions.</li> <li>7. Define terms related to body planes.</li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5, 6, 7, 10, 12</p> <p><b>CTE Anchor:</b> Academics: 1.0</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> <li>8. Given diagrams, identify body planes.</li> <li>9. Give five topographical landmarks and identify the corresponding vertebrae.</li> <li>10. List and describe characteristics of each of the four major body types.</li> <li>11. Define and demonstrate given terms related to relative body positions, body position, and body movement.</li> <li>12. Define terms related to general positioning.</li> <li>13. List three general principles of positioning.</li> <li>14. List and describe five primary elements in radiographic positioning.</li> <li>15. Given the names of a number of contrast studies, indicate the following: <ol style="list-style-type: none"> <li>a. their purpose</li> <li>b. the anatomic structures/function being demonstrated</li> <li>c. the contrast media normally used</li> <li>d. the usual dose</li> <li>e. route of administration</li> </ol> </li> <li>16. Explain the patient preparation required for each radiographic exam within each of the following categories: <ol style="list-style-type: none"> <li>a. chest</li> <li>b. extremities</li> <li>c. torsoskeleton</li> <li>d. skull/facial</li> <li>e. gastrointestinal/genitourinary procedures</li> <li>f. special procedures such as vascular studies, mammography, tomography, contrast studies, etc.</li> <li>g. surgical and portable procedures</li> </ol> </li> <li>17. Describe the basic and special positioning used to visualize the anatomic structures of the following: <ol style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> <li>i. reproductive system</li> <li>j. vascular system</li> <li>k. surgical and portable procedures</li> </ol> </li> <li>18. List and identify the central ray location of the following with angulation specifics, cassette size and orientation, and the extent of collimation necessary for both the basic and special projections: <ol style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> </ol> </li> </ol>	<p>Problem Solving and Critical Thinking: 5.2, 5.3, 5.4, 5.6</p> <p>Health and Safety: 6.6</p> <p>Technical Knowledge and Skills: 10.1, 10.2, 10.3</p> <p>Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> B2.1, B4.5, B8.3, B8.5, B12.1, B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> </ul> <p>19. Explain the protective measures that should be taken for each of the following exams:</p> <ul style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> <li>i. reproductive system</li> <li>j. vascular system</li> <li>k. surgical and portable procedures</li> </ul> <p>20. Recommend the technical factors for producing an acceptable radiograph for each of the following projections:</p> <ul style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> </ul> <p>21. State the patient instructions for each of the following projections:</p> <ul style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> </ul> <p>22. Describe technical and positional qualities that should be seen on erect PA and lateral chest radiographs.</p> <p>23. Describe three reasons for taking chest radiographs in the erect position whenever possible.</p> <p>24. On a model, properly position for the chest projections/positions.</p> <p>25. Properly position on a human model all basic and special projections for each body part of the upper limb and the shoulder girdle.</p> <p>26. Properly position on a model all basic and special projections for each body part of the lower limb and the pelvic girdle.</p> <p>27. Describe and list the projections of the female pelvis and/or hips for which gonad shielding should be used and how such shields should be placed.</p>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 120 hours)	<p>28. List and describe the basic projections taken for an extremity in a cast and the approximate exposure conversions guidelines.</p> <p>29. Compare the technical adjustments needed for a fiberglass cast vs. plaster.</p> <p>30. Properly position on a human model all basic and special projections of the cervical and thoracic spine.</p> <p>31. Properly position on a human model all basic and special projections of the lumbar spine, sacrum, and coccyx.</p> <p>32. Identify differences in patient dose on alternative frontal (AP) vs. posteroanterior (PA) projections of the vertebral column and the skull/facial bones.</p> <p>33. Properly position on a human model all basic and special projections of the ribs and sternum.</p> <p>34. Properly position on a human model and phantom all basic and special projections of the cranium and facial bones and paranasal sinuses.</p> <p>35. Properly position on a human model/phantom basic procedure involving contrast media-gastrointestinal, genitourinary.</p> <p>36. Evaluate positioning and technical factors, given radiographs of the following:</p> <ul style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> <li>i. surgical and portable procedures</li> </ul> <p>37. Describe modifications of procedures for atypical or impaired patients to better demonstrate the anatomic area of interest involving radiographs of the following:</p> <ul style="list-style-type: none"> <li>a. chest and upper airway</li> <li>b. upper limb and shoulder girdle</li> <li>c. lower limb and pelvic girdle</li> <li>d. vertebral column</li> <li>e. skull and facial bones</li> <li>f. gastrointestinal tract</li> <li>g. biliary tract</li> <li>h. urinary system</li> <li>i. surgical and portable procedures</li> </ul> <p>38. Compare and contrast necessary considerations/modifications when performing radiographic exams on a geriatric patient vs. a child or infant.</p>	
<p>L. EMPLOYABILITY SKILLS</p> <p>Understand the processes involved in seeking, gaining, and maintaining employment.</p>	<p>1. Identify five job seeking skills and explain why employers consider them to be essential skills.</p> <p>2. Write a cover letter containing all required information and using correct form for letters.</p>	<p><b>Career Ready Practice:</b> 1, 2, 3, 5, 10, 11</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(25 hours)	<ol style="list-style-type: none"> <li>3. Prepare a résumé containing all necessary information and meeting standards for neatness and correctness.</li> <li>4. Complete a job application form that meets standards of neatness and correctness.</li> <li>5. Demonstrate how to participate in a job interview.</li> <li>6. Demonstrate effective ways to anticipate and respond to an interviewer's questions.</li> <li>7. Describe appropriate overall appearance and dress for an interview.</li> <li>8. Identify the benefits of writing a follow-up letter.</li> <li>9. List and describe four methods in locating a job.</li> <li>10. Locate at least three potential job opportunities.</li> <li>11. Participate in a mock interview while being videoed.</li> <li>12. Conduct a self-evaluation of the video mock interview.</li> <li>13. Describe your professional responsibility towards the expectations of the following: <ol style="list-style-type: none"> <li>a. administrators</li> <li>b. physicians</li> <li>c. radiology manager</li> </ol> </li> <li>14. Demonstrate and understand how personal skills development, including positive attitude, honesty, and self-confidence, time management, and other positive traits affect employment.</li> <li>15. Demonstrate how good academic skills, critical thinking, and problem solving skills are beneficial in the workplace.</li> </ol>	<p><b>CTE Anchor:</b>  <b>Academics:</b>  1.0  Career Planning and Management:  3.1, 3.2, 3.3, 3.4, 3.5, 3.9  Problem Solving and Critical Thinking:  5.4  Responsibility and Flexibility:  7.7  Technical Knowledge and Skills:  10.1, 10.3  Demonstration and Skills:  11.1</p> <p><b>CTE Pathway:</b>  B12.1, B12.3, B12.4</p>
<p>M. CLINICAL EDUCATION</p> <p>Demonstrate basic clinical procedures and radiographic skills in a health care facility.</p>	<ol style="list-style-type: none"> <li>1. Independently perform all state-required radiographic exam totals: <ol style="list-style-type: none"> <li>a. 200 Chest exams</li> <li>b. 400 Bony skeleton</li> <li>c. 200 Gastrointestinal and genitourinary exams</li> <li>d. 50 Vascular and contrast studies</li> <li>e. 50 Special studies and x-ray imaging modalities</li> <li>f. 50 Surgical and portable (emergency) procedures</li> </ol> </li> <li>2. Combine basic clinical procedures skills and radiographic skills in a health care facility.</li> <li>3. Meet competency standards in all areas outlined above while demonstrating: <ol style="list-style-type: none"> <li>a. proper and accurate positioning of the patient</li> <li>b. proper and accurate central ray location</li> <li>c. familiarity with the examination, so that it is completed in a timely manner</li> <li>d. optimum radiographic diagnostic quality</li> <li>e. optimum radiation protection for the patient, clinical personnel, and self</li> <li>f. well-organized critical analytic skills</li> <li>g. attention to the factors that affect radiographic quality</li> <li>h. proper interpretation of radiographic calculations and exposure conditions affecting the quality of radiographs</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b>  1, 2, 4, 5, 6, 7, 8, 10, 12</p> <p><b>CTE Anchor:</b>  <b>Academics;</b>  1.0  Communications:  2.2, 2.3, 2.4, 2.5  Technology:  4.5  Problem Solving and Critical Thinking:  5.2, 5.3, 5.4, 5.5, 5.6  Health and Safety:  6.3, 6.4, 6.5, 6.6  Responsibility and Flexibility:  7.5, 7.7  Ethics and Legal Responsibility:  8.1, 8.3, 8.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> <li>4. Demonstrate proper usage of selected medical and radiological terminology; the effects of and regulations for radiation exposure.</li> <li>5. Demonstrate the ability to provide patient care and comfort by:               <ol style="list-style-type: none"> <li>a. preparing radiographic room for procedure following established policies</li> <li>b. utilizing communication skills</li> <li>c. establishing and maintaining effective communication with patient, patient's family, and facility personnel</li> <li>d. appropriately identifying patient for examination</li> <li>e. utilizing proper body mechanics to assist patients on and off x-ray table, stool, wheel chair, or gurney to avoid patient/personnel injury</li> <li>f. utilizing established sterile/aseptic techniques for the prevention of infections</li> <li>g. observing and record patient physical and emotional response during radiographic procedures</li> <li>h. assisting other health facility staff, when directed</li> <li>i. demonstrating occupational safety, including usage of correct body mechanics and avoidance of physical hazards</li> <li>j. demonstrating professional and ethical responsibility for safe practice as a radiologic technologist</li> <li>k. applying the principles of radiation protection for the patient, self, and others</li> <li>l. recognizing potential genetic and somatic effects from ionizing radiation in relation to patient and personnel protection</li> <li>m. operating within the concept of maximum permissible dose and ALARA</li> <li>n. demonstrating appropriate utilization of personnel monitoring devices</li> <li>o. employing basic principles of time, shielding, and distance through:                   <ol style="list-style-type: none"> <li>i. utilization of lead aprons, gloves, and ancillary shielding devices as appropriate</li> <li>ii. assessment of need for and use of gonad shielding, as related to sex, age, and anatomical region</li> <li>iii. restriction of primary beam to area of clinical interest</li> </ol> </li> <li>p. Follow departmental policy for alerting appropriate personnel of potentially pregnant female patient before proceeding with radiographic exam.</li> <li>q. Demonstrate knowledge of the effects of filtration on patient exposure and be aware of filtration required by federal/local regulations.</li> </ol> </li> <li>6. Demonstrate care in emergency situations by performing the following procedures:               <ol style="list-style-type: none"> <li>a. protection of patients from injury during a disaster</li> <li>b. functioning in student role, while assisting clinical staff during disaster</li> <li>c. locating emergency cart</li> </ol> </li> </ol>	<p>Technical knowledge and Skills: 10.1, 10.2, 10.3</p> <p>Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> B2.1, B3.1, B4.4, B4.5, B5.1, B5.2, B5.6, B6.1, B6.2, B6.3, B6.4, B7.1, B7.3, B8.2, B8.3, B8.5, B10.2, B10.3, B11.4, B12.1, B12.3, B12.4</p>



COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> <li>d. recognizing emergency patient conditions and initiate lifesaving first aid and basic life support procedures</li> <li>e. attainment of current certification in CPR techniques</li> <li>f. administration of basic life support procedures and first aid, until appropriate help arrives</li> <li>g. demonstration of knowledge of patient monitoring equipment by recognizing deviations from established norms</li> </ul> <ol style="list-style-type: none"> <li>7. Demonstrate clear understanding of the parts, appropriate use, and care of the radiographic machine; and the following principles involved in the function of the radiographic machine. <ul style="list-style-type: none"> <li>a. utilization of appropriate warm-up procedure for radiographic tubes</li> <li>b. demonstration of ability to recognize and report any malfunctions of radiographic equipment</li> <li>c. inspection of screens and cassettes on a regular basis to assess condition and for the removal of artifacts via appropriate procedure for cleaning screens</li> <li>d. practice of appropriate procedure for the safe storage of radiographic film</li> </ul> </li> <li>8. Competently interpret radiographic calculations and exposure conditions affecting the quality of radiographs.</li> <li>9. Determine exposure factors to achieve optimum radiographic techniques with minimum radiation exposure.</li> <li>10. Calculate and select radiation exposure factors appropriate for part being radiographed.</li> <li>11. Modify the radiation exposure factors according to the following unusual patient requirements: <ul style="list-style-type: none"> <li>a. pathology conditions</li> <li>b. voluntary and involuntary motion</li> <li>c. plaster/fiber casts</li> <li>d. body habitus</li> </ul> </li> <li>12. Understand the utilization of calipers to measure body thickness and establishing appropriate kvp.</li> <li>13. Interpret technique charts and tube rating charts for guidance in selecting exposure factors by: <ul style="list-style-type: none"> <li>a. selecting correct image receptor and grid combination appropriate for the anatomical part under examination</li> <li>b. effectively performing the steps necessary to develop radiographs</li> </ul> </li> <li>14. Apply knowledge of anatomy, physiology, positioning, and radiographic techniques to accurately demonstrate radiographically required anatomical structures by: <ul style="list-style-type: none"> <li>a. reviewing the clinical data on the requisition form for information pertinent to performing the exam</li> <li>b. positioning patient utilizing body landmarks to achieve optimal demonstration of the affected body part using knowledge of anatomy, radiographic positioning criteria, and facility protocol</li> <li>c. recognizing the legality of required identification information on the radiograph</li> </ul> </li> </ol>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<p>15. Perform the basic clinical procedures necessary to assist in the health care facility and to maintain patient care/safety by:</p> <ol style="list-style-type: none"> <li>a. demonstrating a clear understanding of medical and radiologic terminology when documenting a patient's chart</li> <li>b. obtaining radial pulse, counting respirations, obtain temperature, and blood pressure</li> <li>c. documenting vital signs on patient records according to clinic's policy</li> </ol> <p>16. Evaluate the diagnostic and radiographic quality of the following radiographs while making modifications as needed:</p> <ol style="list-style-type: none"> <li>a. radiographs for appropriate positioning and overall image quality</li> <li>b. radiographs for evaluation of technique, positioning, and other pertinent technical qualities</li> <li>c. radiographs that call for a repeat exam based on requests to modify exposure and/or positioning factors</li> </ol> <p>17. Demonstrate proper care for a patient with a musculoskeletal system disorder including:</p> <ol style="list-style-type: none"> <li>a. traumatic disorder</li> <li>b. inflammatory disorder</li> <li>c. arthroplasty</li> <li>d. amputation</li> <li>e. scoliosis</li> <li>f. arthritic conditions</li> <li>g. osteoporosis</li> <li>h. plaster/fiberglass cast</li> <li>i. with orthopedic aids:</li> <li>j. crutch/cane</li> <li>k. walker</li> <li>l. sling/immobilizer</li> <li>m. brace</li> </ol> <p>18. Demonstrate proper care for the patient with a cardiovascular disorder including:</p> <ol style="list-style-type: none"> <li>a. chronic obstructive pulmonary disease (COPD)</li> <li>b. infectious disease</li> <li>c. allergic reactions</li> <li>d. traumatic injuries</li> </ol> <p>19. Demonstrate valuable personal skills development, including positive attitude, honesty, and self-confidence, time management, and other positive traits that affect employment.</p> <p>20. Demonstrate effective interpersonal skills, including group dynamics, conflict resolution and negotiation.</p>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Lab: 1088 hours)	<p>21. Demonstrate the ability to practice within the profession’s ethical and legal framework and within the scope of the graduate’s ability by:</p> <ul style="list-style-type: none"> <li>a. understanding the restrictions applicable to practice according to permit categories</li> <li>b. demonstrating the ability to work within the policies of the employer</li> </ul> <p>22. Applies good critical thinking and problem solving skills.</p> <p>23. Clearly and effectively communicates when speaking and in writing.</p>	

## ***SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES***

### **TEXTBOOKS**

Bontrager, Kenneth L. Textbook of Radiographic Positioning and Related Anatomy: Workbook and Lab Manual (Vol. 1 & Vol. 2), 6<sup>th</sup> Edition. Mosby, 2005.

California Department of Health Services-Radiologic Health Branch. Syllabus on Fluoroscopy Radiation Protection. 6<sup>th</sup> Revision.

Carlton, Richard R. and Arlene M. Adler. Principles of Radiographic Imaging: Workbook with Lab Exercises. 3<sup>rd</sup> Edition. Delmar Publishers, 2001 .

Radiologic Technology – Journal of the American Society of Radiologic Technologists. Bi-Monthly Journal.

### **REFERENCE BOOKS/PERIODICALS**

Advance. Monthly news magazine for imaging and oncology professionals.

Bushong, Stewart C. Radiologic Science For Technologists, 7<sup>th</sup> Edition. C.V. Mosby, 2001 .

California Department of Health Services-Radiologic Health Branch. Syllabus on Radiography. 1995

Carter, Pamela J. and Susan Lewsen. Textbook for Nursing Assistants. Lippincott Williams & Wilkins, 2005

Durand, Kathryn S. Critical Thinking: Developing Skills in Radiography. F.A. Davis Company, 1999.

Edge, Raymond S. and John R. Groves. The Ethics of Health Care. Delmar Publishers, 1994.

Eisenberg, Ronald L. and Cynthia A. Dennis. Radiographic Pathology, 2<sup>nd</sup> Edition. C.V. Mosby, 1995 .

Forshier, Steve. Essentials of Radiation Biology and Protection. Delmar Publishers, 2002.

Kowalczyk, Nina and Kathleen Donnett. Integrated Patient Care for the Imaging Professional. Mosby.1996.

Scanner ASRT. Monthly news magazine of American Society of Radiologic Technologists.

Statkiewicz/Ritenous. Radiation Protection for Student Radiographers. C.V. Mosby, 1993.

Thibodeau, Gary A. and Kevin T. Patton. Anatomy and Physiology, 16<sup>th</sup> Edition. Mosby.1999.

Wallace, Jerry E. Radiographic Exposure: Principles and Practice. F.A. Davis Company, 1996.

## **RESOURCES**

Teacher prepared slides, films, transparencies, and instructional packages.

Employer Advisory Board members

Foundation Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/ctstandards.pdf>

<http://www.cde.ca.gov/be/st/ss/documents/ctstandards.doc>

[American Registry of Radiologic Technologists \(ARRT\)](#), 1255 Northland Dr., St. Paul, MN 55120-1155. Phone: (651) 687-0048.

[American Society of Radiologic Technologists \(ASRT\)](#), 15000 Central Ave. SE, Albuquerque, NM 87123-3917. Phone: (800) 444-2778. Fax: (505) 298-5063.

[Joint Review Committee on Education in Radiologic Technology \(JRCERT\)](#), 20 N. Wacker Dr., Suite 900, Chicago, IL 60606-2901. Phone: (312) 704-5300. Fax: (312) 704-5304.

## **COMPETENCY CHECKLIST**

## ***TEACHING STRATEGIES and EVALUATION***

### **METHODS AND PROCEDURES**

- A. Lecture and describeion
- B. Demonstration/ participation
- C. Multi-sensory presentation
- D. Individualized instruction
- E. Laboratory practice
- F. Community classroom experience
- G. Guest lecturers

### **EVALUATION**

SECTION A – Introduction to Radiologic Technology – Pass all assignments and exams on introduction to radiologic technology with a minimum score of 80% or higher.

SECTION B – Radiobiology and Radiation Safety – Pass the radiation safety test with 100% accuracy.

SECTION C –Radiologic Image Formation – Pass all assignments and exams on radiologic image formation with a minimum score of 80% or higher.

SECTION D –Introduction to Digital Imaging – Pass all assignments and exams on introduction to digital imaging with a minimum score of 80% or higher.

SECTION E – Principles of Exposure and Image Quality – Pass all assignments and exams on principles of exposure and image quality with a minimum score of 80% or higher.

SECTION F – Image Receptor System – Pass all assignments and exams on image receptor system with a minimum score of 80% or higher.

SECTION G – Nursing Procedures – Pass all assignments and exams on nursing procedures with a minimum score of 80% or higher.

SECTION H –Medical and Radiological Methods and Procedures – Pass all assignments and exams on medical and radiological methods and procedures with a minimum score of 80% or higher.

SECTION I – Film Critique – Pass all assignments and exams on film critique with a minimum score of 80% or higher.

SECTION J – Anatomy and Physiology – Pass all assignments and exams on anatomy and physiology with a minimum score of 80% or higher.

SECTION K– Radiographic Positioning – Pass all assignments and exams on radiographic positioning with a minimum score of 80% or higher.

SECTION L – Employability Skills – Pass all assignments and exams on employability skills with a minimum score of 80% or higher.

SECTION M – Clinical Education – Pass all assignments and exams on clinical education with a minimum score of 80% or higher.

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### Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.

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