

Course Outline

Health Science and Medical Technology

REVISED: January/2023

Job Title

Radiologic Technologist

77-20-70

Career Pathway:

Patient Care

Radiologic Technologist

Industry Sector:

Health Science and Medical Technology

Credits: 40

Hours: 1100

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

CBEDS No.:

4257

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.**

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
Division of Adult and Career Education
Instructional and Counseling Services Unit
Adult Curriculum Office
www.wearelace.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. 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. 7-28

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

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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 VERONICA AGUILAR, JENNIFER AYONN, 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"> 1. Participate in student introductions. 2. Identify local school administrators. 3. Demonstrate an understanding of classroom policies and procedures. 4. Locate and describe program policies and Department of Health Services-Radiological Health Branch (DHS-RHB) policies pertaining to the radiologic technologist program. 5. Examine the impact of thinking on learning and the practice of radiography. 6. Create a framework for developing the critical thinking skills required of a radiographer. 7. Describe and practice each step of this framework in given decision-making situations. 8. Develop strategies/skills that help make information more understandable. 9. Develop strategies to discover, retain, and utilize information from the text/lecture. 10. Identify methods to improve listening skills and reading effectiveness. 11. Describe the use of rhymes, mnemonics, associations, and other techniques for learning. 12. Describe the importance of self-care for the student 13. Describe the employment outlook, career advancements, and opportunities for graduates. 14. Explain the relationship between clinical education and the theory component of the x-ray technology curriculum. 15. Identify the responsibilities of the student during internship. 16. Describe the importance of the following personal skills in the health career’s environment: <ol style="list-style-type: none"> a. positive attitude b. self-confidence c. honesty d. perseverance e. work ethic f. pride in work g. dependability 17. Appropriately identify patient for exam. 18. Observe patient physical/emotional responses to radiographic exam. 19. Describe four essentials for patient/radiographer interaction. 20. Describe quality care from the patient’s perspective. 	<p>Career Ready Practice: 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12</p> <p>CTE Anchor: 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
	<ol style="list-style-type: none"> 21. Describe what is meant by optimum patient care as it relates to a radiographer. 22. Describe methods to enhance verbal and written communications including effective and non-effective communication techniques. 23. Compare and contrast the role of the x-ray technician with that of the radiologic technologist. 24. Determine the legal requirements for the practice of radiography in California. 25. Describe a typical radiology department. 26. Describe departmental administrative and office procedures. 27. Describe relationships and interdependencies of departments within the clinical facility. 28. Describe the role and the function of the policy and procedure manual in the radiology department. 29. Explain what is involved in developing skills and maintaining competency in radiographers. 30. Prepare the radiographic facility for procedure following established protocol. 31. Appropriately identify patient for exam. 32. Observe patient physical/emotional responses to radiographic exam. 33. Identify steps you can take to economize in the radiology department. 34. Explain the significance of a quality assurance program from the standpoint of patient care, economics, and staff development. 35. Explain the primary mission of the American Society of Radiologic Technologists (ASRT). 36. Explain how membership in a professional organization benefits the personal practice of radiographers. 37. Describe upward mobility career routes for radiographers. 38. Understand the required number of credits needed to renew California certification. 39. Establish goals for self-improvement and further education/training. 40. Understand the importance of initiative and leadership. 41. Understand the importance of lifelong learning. 42. Understand the implications of noncompliance with continuing education requirements. 43. Describe the role of the radiologic technologist in patient education. 44. Explain the role of ethical behavior in health care delivery. 45. Describe the Code of Ethics for Imaging Health Care Professionals. 46. List and explain at least six viewpoints of the radiologic technologist's code of ethics. 47. Describe the typical work environment and the duties of a radiologic technologist. 48. Explain the importance of having a thorough understanding of the technical aspects of x-ray technology. 	<p>CTE Pathway: 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
(10 hours Theory)	<ol style="list-style-type: none"> 49. Describe and demonstrate professional, civil, and considerate interactions with patients and peers. 50. Explain what professional confidentiality means. 51. Explain the importance of complying with the Health Insurance Portability and Accountability Act (HIPAA). 52. List three suggestions for improving relationships with coworkers, doctors, and supervisors. 53. Given sample patient questions, concerns, and statements; use paraphrasing techniques to form a written response. 54. Describe procedures for protecting patient modesty and self-esteem. 55. Describe personal obligations that radiologic technologists have to their patients and to their profession. 56. Describe how to prevent injury to the patient during a radiographic examination. 57. List and explain methods for protecting the patient, yourself, and others from contagious diseases. 58. List and explain methods that will reassure and comfort, within the limits of your training, the anxious and fearful patient. 59. Describe and demonstrate proper body mechanics in moving and transferring patients. 60. Describe the significance of requiring clinical information when radiographic service is requested. 61. Describe the impact of medical malpractice on society. 62. Identify and describe the Patient's Bill of Rights and the radiographer's role in assuring these rights. 63. List legal/professional standards and their relationship to practice in health professions. 64. Explain specific legal terms, principles, and laws. 65. Describe steps a radiographer may take to prevent a lawsuit against a health provider. 66. Demonstrate competency in cardiopulmonary resuscitation (CPR). 67. Demonstrate first aid techniques. 68. Explain the importance of anatomical side markers and proper film identification. 	
<p>B. RADIOBIOLOGY AND 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>	<ol style="list-style-type: none"> 1. Describe the characteristics of a molecule. 2. Describe the principles of cellular biology. 3. Identify sources of radiation exposure. 4. Identify principal source of ionizing radiation. 5. Identify ionizing radiation sources from natural and man-made sources. 6. Describe the nature of ionizing radiation. 7. Describe the devices used to detect and measure radiation. 8. State the units used to measure radiation intensity, radiation dose, and dose equivalents in both the conventional and the (International Standards) SI system. 9. List the events that occur when radiation passes through the human body. 	<p>Career Ready Practice: 1, 2, 5, 6, 7, 8, 10</p> <p>CTE Anchor: 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</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> 10. Explain the difference between Compton scattering, photoelectric effect, and pair production, and coherent scattering. 11. Describe the biology of the human cell. 12. List and explain four possible results when photons of radiation strike human cells. 13. Explain factors influencing radiosensitivity. 14. Differentiate between cells that are highly radiosensitive vs. those that have low radiosensitivity. 15. Differentiate between direct and indirect effect of radiation. 16. Describe radiolysis of water. 17. Describe irradiation of macromolecules. 18. Identify the characteristics of radiation dose-response relationships and draw diagrams demonstrating them. 19. Examine effects of limited vs. total body exposure. 20. List and explain short and long term effects of exposure to radiation. 21. Differentiate between somatic and genetic radiation effects as well as describe specific diseases or syndromes associated with them. 22. Describe risk estimates for radiation-induced malignancies. 23. Describe life span shortening. 24. Differentiate between genetic and biological damage due to irradiation. 25. Compare the radiation effects on an embryo-fetus to those on children and adults. 26. Identify the time periods of greatest radiosensitivity. 27. Explain the concept of lethal dose (LD) 50/60 and indicate the LD 50/60 for humans. 28. Describe the Law of Bergonie and Tribondeau. 29. Describe the relationship between x-ray interactions and technical factor selections. 30. Identify types of potential biological effects of ionizing radiation. 31. List and explain the significance of radiation effects on the total body. 32. Define and compare radiation risks according to type: somatic v. genetic; stochastic v. un stochastic; short term v. long term. 33. Describe the risks of exposure of low doses of ionizing radiation and compare these to other similar health risks. 34. Explain the significance of the As Low as Reasonably Achievable (ALARA) concept. 35. List, explain, and demonstrate ten methods for minimizing patient dose during radiography. 36. Differentiate between inherent, added, and total filtration. 37. Describe added and inherent filtration in terms of the effect on patient dosage. 38. State the reasons for using gonad shielding during radiographic exams and recognize the varieties of shields employed. 39. Describe the need for using correct exposure factors for all radiographic exams. 	<p>Ethics and Legal Responsibilities: 8.2, 8.3</p> <p>Technical Knowledge and Skills: 10.1, 10.2, 10.3</p> <p>Demonstration and Application: 11.1</p> <p>CTE Pathway: B1.2, B3.1, B3.2, B10.4, B12.1, B12.2, B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours Theory)	<ol style="list-style-type: none"> 40. Explain the relationship of exposure factors to patient dosage. 41. Explain the rationale for decreasing the number of repeat radiographs. 42. Differentiate between high dose techniques and low dose techniques. 43. List, explain, and demonstrate radiation-safety precautions for the radiographers. 44. List possible risks of radiation exposure during pregnancy and explain ways to reduce these risks. 45. Explain the need for radiation protection efforts by radiographers. 46. Define radiation units of measurement such as roentgen, rad, rem, gray, and sievert. 47. List, explain, and demonstrate the radiation protection methods expected of all radiographers on each radiograph exam. 48. List, describe, and compare instruments for monitoring personnel exposures to radiation. 49. Interpret dosimetry reports. 50. Define and calculate the dose-limiting recommendations for radiology personnel. 51. Explain the structural shielding construction and list items that influence this construction. 52. Describe the relationship between Half Value Layer (HVL) and shielding design. 53. Demonstrate how time, distance, and shielding can be manipulated to decrease the radiation exposure. 54. Illustrate the inverse square law. 55. Identify garments that can be worn to reduce radiation exposure and explain when such garments should be used. 56. List the people and the methods that can help with patient immobilization during an x-ray exposure. 57. Identify dose limits for occupational and non-occupational exposure. 58. Distinguish between controlled and non-controlled areas. 59. List acceptable exposure levels. 60. Describe "Radiation Area" signs and identify appropriate placement sites. 61. Describe procedures used to verify performance standards for equipment and indicate potential consequences of performance standards failure. 62. Comply with legal and ethical radiation protection responsibilities of radiation workers. 63. Identify State Regulations-Title 17. 64. Describe the latest National Council on Radiation Protection and Measurements (NCRP) reports regarding radiation safety. 65. Pass the safety test with 100% accuracy. 	
C. RADIOLOGIC IMAGE FORMATION	<ol style="list-style-type: none"> 1. Name the fundamental particles of the atom and the characteristics of each. 	Career Ready Practice: 1, 2, 5, 6

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>Understand the parts, along with the proper use and care of radiographic equipment (fluoroscopic and mobile). Understand the principles involved in the operation of the radiographic equipment and radiographic exposure parameters.</p>	<ol style="list-style-type: none"> 2. Given the chemical symbol of an element and a periodic table of elements, state the number of protons, neutrons, and electrons. 3. Identify various forms of energy. 4. Explain the processes of ionization and excitation. 5. Compare and contrast the characteristics of x-rays with short wavelengths vs. long wavelengths. 6. Explain the relationship between electromotive force, current, and resistance in an electric circuit and state the units used to measure them. 7. Draw and describe the difference in waveform between a direct current and an alternating current. 8. Identify the general components and function of the primary, secondary, and filament circuits. 9. List essential features of a typical x-ray room. 10. Explain the purposes of the control booth and the transformer cabinet. 11. Safely change the positions of the radiographic table and the x-ray tube. 12. Locate and identify each part of the radiographic machine. 13. List the primary features of the x-ray machine's control panel. 14. Describe the construction of the glass envelope and the protective tube housing. 15. Define and display the radiation field and the central ray. 16. Compare and contrast the following types of radiation: primary radiations, Scatter Radiation, and remnant radiation, leakage radiation, useful radiation and non-useful radiation. 17. Explain the purpose of the collimator. 18. Differentiate between inherent filtration, added filtration, total filtration, half-value layer, and compensating filter. 19. Describe precautions to be taken to ensure personnel safety from radiation exposure. 20. Describe the principles involved in the operation of the x-ray machine. 21. Demonstrate inspection procedures for testing equipment. 22. Demonstrate the care and maintenance of radiographic equipment. 23. Describe quality assurance relative to the radiographic equipment. 24. Draw a basic x-ray tube diagram and label its parts. 25. Describe the requirements for the production of x-rays. 26. Describe the process of thermionic emission. 27. Describe the production of <i>bremstrahlung</i> ("braking" or "slowing down") and characteristic radiation, and explain what determines the wavelength of each. 28. Describe the x-ray emission spectra. 29. Identify the factors affecting the x-ray emission spectra 30. Describe the conversion of electron energy to x-ray energy in the x-ray tube. 31. Describe the classification and identify properties of x-rays. 32. Explain what is meant by dual focus tube and describe its advantages. 	<p>CTE Anchor: 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>CTE Pathway: B3.1, B3.2, B8.4, B9.3, B12.1, B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(60 hours Theory) (15 hours Laboratory)	<ol style="list-style-type: none"> 33. Define effective focal spot and state its significance with respect to the radiographic image. 34. Explain the function of a rotating anode and state its purpose. 35. State the effect of changes in milliamperage (mA) and kilovoltage peak (kVp) on the resulting x-ray beam. 36. Describe the production of the anode heel effect and how it can assist radiographers. 37. Draw the current waveform for each of the following: unrectified, half-wave rectification, full-wave rectification, three-phase rectified, and high frequency. 38. Identify possible causes of tube failure and describe methods to prevent each. 39. State and be able to apply the formula for measurement of heat units. 40. Describe the development of fluoroscopy, functions, and components. 41. Describe the effects of magnification and flux gain on total brightness gain. 42. Describe the factors that affect fluoroscopy image contrast, resolution, distortion, and quantum mottle. 43. Describe fluoroscopy regulations and radiation safety. 44. Describe eye anatomy and physiology and their relationship to fluoroscopy. 45. Differentiate between fluoroscopic exams and typical radiographic exams. 	
<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 Theory)</p>	<ol style="list-style-type: none"> 1. Define digital imaging, dynamic range, post-processing image enhancement, matrix, pixel, imaging plate (IP), histogram, algorithms, window level, and window width. 2. Compare the process of digital radiography with conventional radiography. 3. Explain the imaging process in digital radiography. 4. Describe the primary factors controlling image quality in digital radiography. 	<p>Career Ready Practice: 1, 2, 5, 11</p> <p>CTE Anchor: Academics: 1.0 Technology: 4.5 Problem Solving and Critical Thinking: 5.4 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: B12.1</p>
<p>E. PRINCIPLES OF EXPOSURE AND IMAGE QUALITY</p>	<ol style="list-style-type: none"> 1. List the prime factors of exposure. 2. Calculate and understand mAs and the reciprocity law and its quantity of x-rays produced. 	<p>Career Ready Practice:</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<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"> 3. Explain the radiographic effect caused by changes in each of the four prime factors of exposure. 4. Recognize changes in radiographic density and state the exposure factors used to control radiographic density. 5. Assess radiographic density on radiographic images. 6. Identify high, low, and optimum contrast on a radiograph and state the exposure factor that primarily controls radiographic contrast. 7. Differentiate between short-scale contrast and long-scale contrast. 8. Utilizing radiographs, distinguish between acceptable and unacceptable levels of density and contrast. 9. Explain the effects of kVp and the primary beam. 10. Explain and demonstrate application of the 15% rule. 11. Explain and demonstrate application of the inverse square law. 12. Calculate milliroentgen (mR) when the source-to-image receptor distance (SID) is changed. 13. Calculate mAs needed to maintain density when changes are made in SID. 14. Define radiographic distortion and explain the difference between magnification and shape distortion. 15. Define radiographic definition and list factors that influence definition. 16. List and explain the geometric factors that affect radiographic definition and explain why magnification affects definition. 17. List, describe, and demonstrate methods for minimizing motion blur on radiographs. 18. Describe the effect of patient size on the attenuation of the x-ray beam. 19. Describe the relationship of the patient to the density, contrast, detail, and distortion of the recorded image. 20. Describe the effect of pathology on radiation absorption. 21. Identify pathologic conditions that result in increased and decreased attenuation of the x-ray beam. 22. Read and use an x-ray technique chart. 23. List methods for creating an x-ray technique chart. 24. Compare a fixed kVp technique chart with a variable kVp technique chart. 25. Explain what is meant by optimum kVp and how this value is determined. 26. Select an appropriate mA, time, and kVp for a given set of circumstances. 27. Take appropriate steps when technique charts fail to provide an appropriate exposure. 28. Calculate exposure adjustments for changes in patient/part size. 29. Estimate the technique change required when radiographs are too dark or too light. 30. Suggest appropriate technique changes for lengthening or shortening the scale of contrast. 31. Calculate technique changes for: <ol style="list-style-type: none"> a. variations in SID 	<p>1, 2, 4, 5, 6, 7, 8, 10, 12</p> <p>CTE Anchor: 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>CTE Pathway: B3.1, B3.2, B12.1, B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(30 hours Theory)	<ul style="list-style-type: none"> b. grid/s c. speeds of image receptors 32. Develop a technique chart for personal use during internship. 33. Describe x-ray interaction with matter. 34. Define attenuation. 35. Define, explain, and identify Scatter Radiation on a radiograph. 36. List and demonstrate measures that can be taken to reduce the quantity of Scatter Radiation. 37. Explain the construction of a grid, including grid ratio, grid frequency, and grid radius. 38. List common grid ratios and state the appropriate application for each. 39. Define grid cutoff. 40. Compare and contrast a Bucky and a stationary grid. 41. State the criteria for determining whether a grid is to be used. 42. Describe the purpose of the grid. 43. Analyze the relationships between grid selection, patient dose, radiographic density, and absorption of scatter. 44. Calculate changes in technical factors to compensate in grid selection. 	
<p>F. NURSING PROCEDURES</p> <p>Perform the basic nursing procedures necessary to assist in the healthcare facility and to maintain patient safety.</p>	<ol style="list-style-type: none"> 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. Describe what is meant by chain of command and describe how it promotes effective communication and team efforts. 6. Given sample patient questions, concerns, and statements; use paraphrasing techniques to form a written response. 7. Review personal obligations that radiologic technologists have to their patients and to their profession. 8. Explain the legal implications of professional liability, malpractice, professional negligence/carelessness, and other legal doctrines applicable to professional practice. 9. List the information to be collected prior to patient examination. 10. List common departmental procedures for infection control. 11. List and explain three methods that will reassure and comfort, within the limits of your training, the anxious and fearful patient. 12. Describe the significance of requiring clinical information when radiographic service is requested. 13. Identify common safety measures that the radiologic technologist can practice. 14. Identify normal vital signs ranges for adults and children to include temperature, pulse, respiration, and blood pressure. 15. Discriminate between appropriate and inappropriate procedures and techniques related to taking and recording vital signs, responding to emergencies, and handling trauma patients. 	<p>Career Ready Practice: 1, 2, 5, 6, 7, 10</p> <p>CTE Anchor: 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</p> <p>CTE Pathway: B4.4, B6.2, B8.3, B8.4, B8.5, B10.4, B10.5, B12.1, B12.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours Theory)	16. Demonstrate competence in each task listed: <ol style="list-style-type: none"> a. hand washing b. assisting the falling patient c. assisting the patient with a walker and/or cane d. transporting the patient in a wheelchair e. transferring the patient between radiographic table and wheelchair f. preparing the patient for the radiographic exam g. taking temperature h. counting radial pulse and respiration rate i. taking blood pressure j. applying correct principles of medical asepsis in linen handling, disposal of contaminated items, and disinfections of radiographic tables and equipment k. applying correct technique for establishing a sterile field, donning sterile gloves, removing contaminated gloves, and changing dressings 	
G. MEDICAL AND RADIOLOGICAL METHODS AND PROCEDURES Understand medical terminology, perform pediatric radiography, describe and define disease and pathology and compare and describe pharmacology and drug administration.	<ol style="list-style-type: none"> 1. Interpret abbreviations and symbols commonly used in radiography: Lt., r/o, fx., P/3, pt., c/o, etc. 2. 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. 3. Define and use basic positioning terminology: supine, prone, lateral, oblique, etc. 4. Define and use relationship terms: anterior vs. posterior; inferior vs. superior; distal vs. proximal, etc. 5. Define and use terminology related to movement: flexion vs. extension; supination vs. pronation; adduction vs. abduction, etc. 6. Define and use terms and phrases in general usage in radiography. 7. Explain similarities and differences for these terms: position, projection, and view. 8. Identify the following common pediatric examinations: <ol style="list-style-type: none"> a. chest radiography b. torsoskeletal radiography c. skull radiography d. extremity radiography e. abdominal radiography f. gastrointestinal & genitourinary procedures 9. Identify the following examination conditions unique to pediatric patients: <ol style="list-style-type: none"> a. bone age b. foreign bodies c. scoliosis 10. Compare and contrast necessary considerations when performing radiographic exams on a geriatric patient vs. a child or infant. 	Career Ready Practice: 1, 2, 4, 5, 6, 7, 8, 9, 10, 12 CTE Anchor: 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 Technical Knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(30 hours Theory)	<ol style="list-style-type: none"> 11. Compare and contrast the characteristics of the developing skeleton with that of a mature adult. 12. Demonstrate appropriate levels of communication with children of any age. 13. Demonstrate introduction of radiographer to child and parent(s). 14. Demonstrate positive attitude toward the child. 15. Assess the extent of parental involvement. 16. Report suspected child abuse to the appropriate radiologists, attending physician, radiology supervisor, or nurse. 17. Determine the following types of immobilization procedures to be used for the exam: <ol style="list-style-type: none"> a. demonstration of good communication strategies as a method of immobilization b. demonstration of immobilization of an infant or toddler for a radiographic exam, utilizing the following immobilization tools: <ol style="list-style-type: none"> i. sandbags ii. tape iii. compression bands iv. sheets and towels 18. Practice the ALARA principle with the following conditions: <ol style="list-style-type: none"> a. gonadal shielding b. collimation c. low mAs techniques d. lead strips as contact shields e. no repeat radiographs 19. Define common terms used to describe or classify disease processes. 20. Explain the differences between acute and chronic conditions and between benign and malignant conditions. 21. Define inflammation and describe its possible consequences. 22. List and explain factors involved in the cycle of infection. 23. State the best method of break the cycle of infection. 24. Describe the disease processes involved with HIV, hepatitis, and TB; and explain how to limit the transmission of these diseases. 25. Define medical asepsis, disinfections, and sterilization and give example of the correct application of each. 26. Identify selected diseases on radiographs. 27. Identify radiographic procedures and diseases common to each body system. 28. Explain the professional, ethical, and legal role of a radiographer with respect to medication administration. 29. List and describe common routes of medication administration. 30. Describe the symptoms and medical interventions for a patient having a reaction to contrast media. 	<p>CTE Pathway: 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>
<p>H. IMAGE CRITIQUE</p> <p>Understand the factors affecting radiographic quality</p>	<ol style="list-style-type: none"> 1. Define radiographic density/brightness and radiographic contrast and identify the controlling factors. 2. Recognize and identify short scale contrast and long scale contrast images. 	<p>Career Ready Practice: 1, 2, 5, 10</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>and the inter-relationships between them; develop a “problem-solving technique” for analyzing radiographic images.</p> <p>(50 hours Theory)</p>	<ol style="list-style-type: none"> 3. Define radiographic detail. 4. List the three geometric factors that influence image sharpness. 5. Identify the best ways of controlling involuntary and voluntary motion. 6. Define radiographic distortion and identify its controlling factor. 7. Identify the criteria for evaluating radiographs of the chest, extremities, torsoskeleton, and skull for positioning accuracy and overall image quality. 8. Identify the importance of collimation, anatomic side markers, and proper radiograph identification. 9. State the general criteria for repeating a radiograph. 10. List and describe the elements of a diagnostic image as they relate to image critique. 11. Describe modifications of procedures for atypical or impaired patients to better demonstrate the anatomic area of interest. 12. Based on the evaluation criteria, critique specific radiographs within the following categories and indicate modifications for improvement: <ol style="list-style-type: none"> a. chest and upper airway b. upper limb and shoulder girdle c. lower limb and pelvic girdle d. vertebral column e. skull and facial bones f. gastrointestinal tract g. biliary tract h. urinary system i. vascular system j. surgical and portable procedures 13. Discriminate between radiographs that are acceptable and those that are unacceptable because of exposure factors, motion, collimation, or positioning errors. 	<p>CTE Anchor: 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>CTE Pathway: B12.1</p>
<p>I. 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"> 1. Differentiate between anatomy and physiology. 2. Identify and define cell components. 3. Describe the role of the cell. 4. Explain the relationship between cells, tissues, organs, and systems. 5. Label a diagram of the main body cavities. 6. Identify main organs located in each body cavity. 7. List the functions of the skeletal system. 8. Describe the composition of bone. 9. Label the parts of a bone on a diagram of a long bone. 10. Differentiate between red and yellow marrow. 11. Describe the ossification process and the primary and secondary bone formation centers. 12. Define facet, tuberosity, process, spine, crest, foramen, meatus, sinus, fossa, and suture in relation to bone markings. 13. Name the two divisions of the skeletal system 14. Identify the classification of bones of the skeleton. 	<p>Career Ready Practice: 1, 2, 5, 10</p> <p>CTE Anchor: 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</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> 15. Compare the three classifications of joints by describing the type of motion allowed by each. 16. List and describe the location, size, and shape of each carpal bone in the wrist. 17. Compare the female and male pelvis. 18. Describe the location of the major landmarks of the pelvis and hip, and the two methods of locating the femoral head and neck. 19. Describe the structural and functional differences of the greater and lesser pelvis. 20. Identify the classification and movement type for the joints of the pelvis. 21. Identify those features of the cervical and thoracic spines that distinguish them from other aspects of the vertebral column. 22. Describe the location, classification, and type of movement for specific joints of the cervical and thoracic spine. 23. List additional terms for the first, second, and seventh cervical vertebra. 24. Describe topographical landmarks that can be palpated to locate specific thoracic and cervical vertebra. 25. Describe which anatomic structures are best demonstrated with each position of the cervical and thoracic spine. 26. Describe the structures and functions of the lumbar spine, sacrum, and coccyx. 27. Identify and describe the anatomy that is seen with the “Scotty Dog” of the lumbar spine. 28. Describe the classification of the joints found in the lumbar spine. 29. Describe topographical landmarks that can be palpated to locate specific aspects of the lumbar spine, sacrum, and coccyx. 30. Classify ribs as true, false, or floating. 31. Describe which anatomical structures are best seen with specific projections of the ribs and sternum. 32. Describe the eight cranial bones in regards to features, related structures, location, and function. 33. List and describe specific radiographic and topographical landmarks of the cranium. 34. Describe the locations, joint classification, and related terminology for the sutures and joints of the cranium and facial bones. 35. Describe the 14 facial bones in regards to features, related structures, location, and function. 36. List and describe the number and the names of cranial/facial bones with which each cranial and facial bone articulate. 37. List and describe the cranial and facial bones that make up the bony orbits. 38. Describe the causes and radiographic implications of a blowout and tripod fractures of the facial bones. 39. Describe the differences among the three shape and size classifications of the skull and their implications to radiography of the cranium. 40. Describe the location, function, and characteristics of the four groups of paranasal sinuses. 	<p>Demonstration and Application: 11.1</p> <p>CTE Pathway: B2.1, B2.3, B2.4, B5.1, B5.2, B12.1, B12.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ol style="list-style-type: none"> 41. Describe the three main portions of the temporal bone. 42. List and describe the structures of the external, middle, and internal ear. 43. Define specific terminology, reference points, positioning lines, and topographical landmarks as they relate to the cranium and the facial bones. 44. Label major parts on a diagram of the ear. 45. Trace pathway of sound waves as they travel through the ear. 46. Explain how the ear maintains balance and equilibrium. 47. Label the layers, chambers, valves, and major blood vessels on a diagram of the heart. 48. Differentiate between systole and diastole by explaining what happens in the heart during each phase. 49. 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. 50. List the types of blood vessels and the action of each. 51. Compare the three main types of blood cells by describing the function of each. 52. Describe diseases of the circulatory system. 53. Label a diagram of the respiratory system. 54. 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. 55. List functions of the nasal cavity. 56. List skeletal landmarks associated with organs of the respiratory system. 57. Identify the three sections of the pharynx. 58. Describe the function and structure of the following: <ol style="list-style-type: none"> a. bony thorax b. larynx c. pharynx d. trachea e. bronchi/bronchioles f. alveolar sacs g. hilum h. lungs i. mediastinum 59. Describe the exchange of oxygen and carbon dioxide in the alveoli. 60. Describe the epiglottis and describe how it prevents food from entering the trachea. 61. Compare the processes of inspiration and expiration, including muscle action that occurs during each phase. 62. Describe diseases of the respiratory system. 63. Describe how the circulatory and respiratory systems perform a joint function. 64. Describe how the pituitary gland influences various body functions. 65. Differentiate between voluntary muscle and involuntary muscle. 66. Describe the main ways muscles attach to bones. 	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(75 hours Theory)	<p>67. Describe diseases of the muscular system.</p> <p>68. Explain functions of the spinal cord.</p> <p>69. Contrast the action of the sympathetic and parasympathetic nervous system.</p> <p>70. Describe diseases of the nervous system.</p> <p>71. Label on a diagram the major parts of the eye.</p> <p>72. Trace the pathway of light as it passes through the eye.</p> <p>73. Describe diseases of the ear and eye.</p> <p>74. Explain the function of the lymphatic system.</p> <p>75. List functions of the spleen.</p> <p>76. Describe the function of the thymus.</p> <p>77. Label major organs on a diagram of the digestive system.</p> <p>78. Identify organs of the digestive system that aid in the initial breakdown of food.</p> <p>79. Give two functions of the salivary glands.</p> <p>80. Describe how gastric juices act on food in the stomach.</p> <p>81. Explain how food is absorbed into the body.</p> <p>82. List functions of the large intestine.</p> <p>83. List functions of the liver.</p> <p>84. Explain the function of the pancreas.</p> <p>85. Describe diseases of the digestive system.</p> <p>86. Name all parts of the alimentary canal in correct order.</p> <p>87. Label a diagram of the urinary system.</p> <p>88. Explain the action of the following:</p> <ol style="list-style-type: none"> a. nephron b. glomerulus c. Bowman’s capsule d. convoluted tubule e. collecting tubule f. ureter g. bladder h. urethra <p>89. Describe diseases of the urinary system.</p> <p>90. Label a diagram of the main endocrine glands.</p> <p>91. Describe how hormones influence various body functions.</p> <p>92. Describe diseases of the endocrine system.</p> <p>93. Label a diagram of the male and female reproductive system.</p> <p>94. List functions of the skin.</p> <p>95. Describe diseases of the integumentary system.</p> <p>96. Describe examples of interrelationships between body systems.</p>	
<p>J. RADIOGRAPHIC POSITIONING</p> <p>Demonstrate basic and special radiographic positioning, including procedures involving contrast media.</p>	<ol style="list-style-type: none"> 1. List and describe patient care considerations relevant to positioning. 2. List the technical factors relevant to positioning. 3. List methods of reducing patient radiation exposure. 4. Explain the ten-day rule. 5. List the three primary principles of radiation protection. 6. Define and demonstrate the anatomic positions. 7. Define terms related to general positioning. 8. List general principles of positioning. 	<p>Career Ready Practice: 1, 2, 4, 5, 6, 7, 10, 12</p> <p>CTE Anchor: Academics: 1.0</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<p>9. Given the names of a number of contrast studies, indicate the following:</p> <ul style="list-style-type: none"> a. their purpose b. the anatomic structures/function being demonstrated c. the contrast media normally used d. the usual dose e. route of administration <p>10. Explain the patient preparation required for each radiographic exam within each of the following categories:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures <p>11. Describe the basic and special positioning used to visualize the anatomic structures of the following:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures <p>12. 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:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures <p>13. Explain the protective measures that should be taken for each of the following exams:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures h. surgical and portable procedures <p>14. Recommend the technical factors for producing an acceptable radiograph for each of the following projections:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton 	<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>CTE Pathway: 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"> d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures <p>15. State the patient instructions for each of the following projections:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures <p>16. Describe technical and positional qualities that should be seen on erect PA and lateral chest radiographs.</p> <p>17. Describe reasons for taking chest radiographs in the erect position whenever possible.</p> <p>18. Properly position on a human model all basic and special projections for each body part of the upper limb, lower limb and the shoulder girdle.</p> <p>19. 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> <p>20. List and describe the basic projections taken for an extremity in a cast and the approximate exposure conversions guidelines.</p> <p>21. Properly position on a human model all basic and special projections of the cervical and thoracic spine.</p> <p>22. Properly position on a human model all basic and special projections of the lumbar spine, sacrum, and coccyx.</p> <p>23. Identify differences in patient dose on alternative frontal (AP) vs. posteroanterior (PA) projections of the vertebral column and the skull/facial bones.</p> <p>24. Properly position on a human model all basic and special projections of the ribs and sternum.</p> <p>25. Properly position on a human model and phantom all basic and special projections of the cranium and facial bones and paranasal sinuses.</p> <p>26. Properly position on a human model/phantom basic procedure involving contrast media-gastrointestinal, genitourinary.</p> <p>27. Evaluate positioning and technical factors, given radiographs of the following:</p> <ul style="list-style-type: none"> a. chest b. extremities c. torsoskeleton d. skull/facial e. gastrointestinal/genitourinary procedures f. contrast studies pertaining to IVP's/IVU's g. surgical and portable procedures h. surgical and portable procedures 	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(120 hours Theory)	28. Describe modifications of procedures for atypical or impaired patients to better demonstrate the anatomic area of interest involving radiographs of the following: <ol style="list-style-type: none"> chest extremities torsoskeleton skull/facial gastrointestinal/genitourinary procedures contrast studies pertaining to IVP's/IVU's surgical and portable procedures surgical and portable procedures 29. Compare and contrast necessary considerations/modifications when performing radiographic exams on a geriatric patient vs. a child or infant.	
K. CLINICAL EDUCATION Demonstrate basic clinical procedures and radiographic skills in a health care facility.	<ol style="list-style-type: none"> Independently perform all state-required radiographic exam totals: <ol style="list-style-type: none"> Chest exams Bony skeleton exams Gastrointestinal and genitourinary exams Vascular and contrast studies Special studies and x-ray imaging modalities Surgical and portable (emergency) procedures Combine basic clinical procedures skills and radiographic skills in a health care facility. Meet competency standards in all areas outlined above while demonstrating: <ol style="list-style-type: none"> proper and accurate positioning of the patient proper and accurate central ray location for imaging time management and critical thinking optimum radiation protection for the patient, clinical personnel, and self recognizing and correcting the factors that affect the quality of diagnostic imaging Demonstrate proper usage of selected medical and radiological terminology. Demonstrate the ability to provide patient care and comfort by: <ol style="list-style-type: none"> preparing radiographic room for procedure following established policies establishing and maintaining effective communication with patient, patient's family, and facility personnel appropriately identifying patient for examination utilizing proper body mechanics to assist patients on and off radiographic equipment to avoid patient/personnel injury utilizing established sterile/aseptic techniques for the prevention of infections observing and assessing patient physical and emotional response during radiographic procedures assisting other health facility staff, when directed 	Career Ready Practice: 1, 2, 4, 5, 6, 7, 8, 10, 12 CTE Anchor: Academics; 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 Technical knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.1 CTE Pathway: B2.1, B3.1, B4.4, B4.5, B5.1, B5.2, B5.6, B6.1, B6.2, B6.3, B6.4, B7.1,

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> h. demonstrating professional and ethical responsibility for safe practice as a radiologic technologist i. recognizing potential genetic and somatic effects from ionizing radiation in relation to patient and personnel protection j. operating within the concept of maximum permissible dose and ALARA k. demonstrating appropriate utilization of personnel monitoring devices l. employing basic principles of time, shielding, and distance through: <ul style="list-style-type: none"> i. utilization of lead aprons, gloves, and ancillary shielding devices as appropriate ii. assessment of need for and use of gonad shielding, as related to sex, age, and anatomical region iii. restriction of primary beam to area of clinical interest m. Follow departmental policy for alerting appropriate personnel of potentially pregnant female patient before proceeding with radiographic exam. n. Demonstrate knowledge of the effects of filtration on patient exposure and be aware of filtration required by federal/local regulations. <p>6. Demonstrate care in emergency situations by performing the following procedures:</p> <ul style="list-style-type: none"> a. protection of patients from injury during a disaster b. functioning in student role, while assisting clinical staff during disaster c. locating emergency cart d. recognizing emergency patient conditions and initiate lifesaving first aid and basic life support procedures e. attainment of current certification in CPR techniques f. administration of basic life support procedures and first aid, until appropriate help arrives g. demonstration of knowledge of patient monitoring equipment by recognizing deviations from established norms <p>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:</p> <ul style="list-style-type: none"> a. utilization of appropriate warm-up procedure for radiographic tubes b. demonstration of ability to recognize and report any malfunctions of radiographic equipment 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 <p>8. Competently interpret radiographic calculations and exposure conditions affecting the quality of radiographs.</p> <p>9. Determine exposure factors to achieve optimum radiographic techniques with minimum radiation exposure.</p> <p>10. Calculate and select radiation exposure factors appropriate for part being radiographed.</p>	<p>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
	<ol style="list-style-type: none"> 11. Modify the radiation exposure factors according to the following unusual patient requirements: <ol style="list-style-type: none"> a. pathology conditions b. voluntary and involuntary motion c. plaster/fiber casts d. body habitus 12. Interpret technique charts and tube rating charts for guidance in selecting exposure factors by: <ol style="list-style-type: none"> a. selecting correct image receptor and grid combination appropriate for the anatomical part under examination b. effectively performing the steps necessary to develop radiographs 13. Apply knowledge of anatomy, physiology, positioning, and radiographic techniques to accurately demonstrate radiographically required anatomical structures by: <ol style="list-style-type: none"> a. reviewing the clinical data on the requisition form for information pertinent to performing the exam 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 c. recognizing the legality of required identification information on the radiograph 14. Perform the basic clinical procedures necessary to assist in the health care facility and to maintain patient care/safety by: <ol style="list-style-type: none"> a. demonstrating a clear understanding of medical and radiologic terminology when documenting a patient's chart b. obtaining radial pulse, counting respirations, obtain temperature, and blood pressure c. documenting vital signs on patient records according to clinic's policy 15. Evaluate the diagnostic and radiographic quality of the following radiographs while making modifications as needed: <ol style="list-style-type: none"> a. radiographs for appropriate positioning and overall image quality b. radiographs for evaluation of technique, positioning, and other pertinent technical qualities c. radiographs that call for a repeat exam based on requests to modify exposure and/or positioning factors 16. Demonstrate proper care for a patient with a musculoskeletal system disorder including: <ol style="list-style-type: none"> a. traumatic disorder b. inflammatory disorder c. arthroplasty d. amputation e. scoliosis f. arthritic conditions g. osteoporosis h. plaster/fiberglass cast i. with orthopedic aids: j. crutch/cane 	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(673 hours Clinical Externship)	<ul style="list-style-type: none"> k. walker l. sling/immobilizer m. brace <p>17. Demonstrate proper care for the patient with a cardiovascular disorder including:</p> <ul style="list-style-type: none"> a. chronic obstructive pulmonary disease (COPD) b. infectious disease c. allergic reactions d. traumatic injuries <p>18. Demonstrate valuable personal skills development, including positive attitude, honesty, and self-confidence, time management, and other positive traits that affect employment.</p> <p>19. Demonstrate effective interpersonal skills, including group dynamics, conflict resolution and negotiation.</p> <p>20. 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"> a. understanding the restrictions applicable to practice according to permit categories b. demonstrating the ability to work within the policies of the employer <p>21. Applies good critical thinking and problem-solving skills.</p> <p>22. Clearly and effectively communicates when speaking and in writing.</p>	
<p>L. EMPLOYABILITY SKILLS & RESUME PREPARATION</p> <p>Understand the processes involved in seeking, gaining, and maintaining employment.</p>	<ul style="list-style-type: none"> 1. Understand employer requirements for soft skills such as: <ul style="list-style-type: none"> a. punctuality and attendance b. time management c. flexibility and adaptability d. interpersonal skills e. work ethic f. communication and collaboration g. teamwork h. critical thinking and problem solving i. leadership and responsibility j. ethical behavior k. cultural and diversity differences 2. Create/revise a resume, cover letter and/or portfolio. 3. Review the role of online job searching platforms and career websites. 4. Complete and/or review an on-line job application. 5. Discuss interview skills to get the job: <ul style="list-style-type: none"> a. do's and don'ts for job interviews b. how to dress for the job 6. Create sample follow-up letters. 	<p>Career Ready Practice: 1, 2, 3, 5, 10, 11</p> <p>CTE Anchor: Academics: 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>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours Theory)	7. Understand the importance of the continuous upgrading of job skills as it relates to: <ol style="list-style-type: none"> a. certification, licensure, and/or renewal b. professional organizations/events c. industry associations and/or organized labor 	CTE Pathway: B12.1, B12.3, B12.4

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Bontrager, Kenneth L. Radiographic Positioning and Related Anatomy, Latest Edition, El Sevier, 2020

Bushong, Stewart. Radiologic Science for Technologists, Latest Edition, Elsevier, 2020

Ehrlich, Ruth A., Coakes, Dawn. Patient Care in Radiography, Latest Edition, El Sevier, 2020

RESOURCES

Employer Advisory Board members

California Career Technical Education Model Curriculum Standards

<https://www.cde.ca.gov/ci/ct/sf/documents/healthmedical.pdf>

American Registry of Radiologic Technologists (ARRT): <https://www.arrt.org/>

Joint Review Committee on Education in Radiologic Technology (JRCERT): <https://www.jrcert.org/>

Radiologic Health Branch: <https://www.cdph.ca.gov/Programs/CEH/DRSEM/Pages/RHB.aspx>

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

- A. Lecture and discussion
- 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 with a minimum score of 75% or higher.

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

SECTION C – Radiologic Image Formation – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION D – Introduction to Digital Imaging – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION E – Principles of Exposure and Image Quality – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION F – Nursing Procedures – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION G – Medical and Radiological Methods and Procedures – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION H – Image Critique – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION I – Anatomy and Physiology – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION J – Radiographic Positioning – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION K – Clinical Education – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION L – Employability Skills & Resume Preparation – Pass all assignments and exams on with a minimum score of 75% or higher.

Standards for Career Ready Practice

1. Apply appropriate technical skills and academic knowledge.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and performing other work-related practices.

2. Communicate clearly, effectively, and with reason.

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others: they are active listeners who speak clearly and with purpose, and they are comfortable with terminology that is common to workplace environments. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.

3. Develop an education and career plan aligned with personal goals.

Career-ready individuals take personal ownership of their educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process, and they understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.

4. Apply technology to enhance productivity.

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks.

5. Utilize critical thinking to make sense of problems and persevere in solving them

Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve a problem and, once agreed upon, follow through to ensure the problem is resolved.

6. Practice personal health and understand financial literacy.

Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.

7. Act as a responsible citizen in the workplace and the community.

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them, and they think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.

8. Model integrity, ethical leadership, and effective management.

Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

9. Work productively in teams while integrating cultural and global competence.

Career-ready individuals contribute positively to every team, as both team leaders and team members. To avoid barriers to productive and positive interaction, they apply an awareness of cultural differences. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.

10. Demonstrate creativity and innovation.

Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.

11. Employ valid and reliable research strategies.

Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.

12. Understand the environmental, societal, and economic impacts of decisions.

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.

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