

Course Outline

Health Science and Medical Technology

REVISED: January/2023

Job Title

X-Ray Technician

76-45-83

Career Pathway:

Patient Care

X-Ray Technology/1

Industry Sector:

Health Science and Medical Technology

Credits: 15

Hours: 200

O*NET-SOC CODE:

29-2034.00

Course Description:

This competency-based course is the first in a sequence of three designed for x-ray technology. It provides students with project-based experiences according to the California State certification examination requirements for the limited category of extremities and torsoskeleton. Didactic instruction includes an orientation, general safety principles, communication skills, critical thinking skills, and resource management. Emphasis is placed on medical ethics, medical terminology, anatomy and physiology, image critique, radiographic positioning, clinical assistant procedures, and the principles of exposure and image quality. Students are also provided with clinical training in health care facilities supervised by the instructor and staff personnel to perform as safe, competent, and professional X-Ray Technicians. The passing of the state examination allows graduates to work as XRay Technicians 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 at least 18 years of age, a high school diploma or high school equivalency certificate, employment-level competency in reading and math, and participation in a qualifying interview; upon acceptance present a satisfactory physical examination and current American Heart Association (AHA) or Basic Life Support (BLS) for Healthcare Providers Cardiopulmonary Resuscitation Certificate and First Aid certificate **PRIOR TO CLINICAL ROTATION.**

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

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.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

pp. 7-18

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	p. 20
<p>Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.</p> <p>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.</p>	
UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT	Cover
<p>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.</p> <p>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.</p>	
EVALUATION PROCEDURES	p. 20
<p>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.</p> <p>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.</p>	
REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT	Cover
<p>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.</p>	

ACKNOWLEDGMENTS

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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 X-Ray Technology/1 Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. ORIENTATION AND GENERAL SAFETY PRINCIPLES</p> <p>Understand, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p>	<ol style="list-style-type: none"> 1. Describe the scope and purpose of the course. 2. Describe the overall course content as a part of the Multiple Pathways program. 3. Describe classroom, office, and laboratory policies and procedures. 4. Describe the different occupations in the Health Science and Medical Technology Industry Sector, which have an impact on the role of X-Ray Technician. 5. Describe the opportunities available for promoting gender equity and the representation of non-traditional populations in the x-ray technology field. 6. Describe the differences in job descriptions between an X-Ray Technician and a Radiologic Technologist. 7. Describe the California Department of Public Health-Radiologic Health Branch (CDPH-RHB) policies pertaining to the following: <ol style="list-style-type: none"> a. x-ray technology training/educational programs b. certification requirements c. certification renewal requirements d. entry into specialty programs 8. Describe the primary mission of the American Society of Radiologic Technologists (ASRT). 9. Identify and describe the role of the following in radiography: <ol style="list-style-type: none"> a. Radiologic Technologist (RT) b. Certified Radiologic Technologist (CRT) c. X-Ray Technician (XT) 10. Describe the purpose of the California Occupational Safety and Health Administration (Cal/OSHA) and its laws governing X-Ray Technicians. 11. Describe classroom and workplace first aid procedures, CPR, and emergency procedures according to American Red Cross (ARC) standards. 12. Describe how each of the following ensures a safe workplace: <ol style="list-style-type: none"> a. employees’ rights as they apply to job safety b. employers’ obligations as they apply to safety c. adherence to Universal Precautions and isolation procedures e. following hand washing techniques f. donning and removing clean gloves g. dress requirements for X-Ray Technicians h. following safe radiography practices 	<p>Career Ready Practice: 1, 2, 3, 5, 6, 7, 8, 9</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8 Career Planning and Management: 3.1, 3.2, 3.4, 3.6 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.6 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.6, 6.8 Responsibility and Flexibility: 7.2, 7.3, 7.7, 7.8 Ethics and Legal Responsibilities: 8.3, 8.4, 8.5 Leadership and Teamwork: 9.5, 9.6</p> <p>CTE Pathway: B1.1, B1.2, B1.3, B1.4, B4.1, B4.2, B4.3, B4.4, B4.5, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7,</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 5 hours)	<ul style="list-style-type: none"> i. knowledge of post-exposure incident management <p>13. Identify and describe the following:</p> <ul style="list-style-type: none"> a. patient care considerations relevant to positioning b. primary principles of radiation protection, including the “ten-day rule” c. methods of reducing patient radiation exposure utilizing “As low as reasonable achievable” (ALARA) d. special considerations necessary when performing radiographic procedures on an infant or a child e. special considerations necessary when performing radiographic procedures on a geriatric patient f. types of upper and lower extremity fractures g. immobilization devices for upper and lower extremity fractures h. positioning for upper and lower extremity fractures <p>14. Pass the safety test with 100% accuracy.</p>	<p>B6.1, B6.2, B6.3, B6.4, B6.5, B6.6, B8.1, B8.2, B8.3, B8.4, B8.5, B9.1, B9.2, B9.3, B9.4, B9.5, B9.6, B9.7, B10.1, B10.2, B10.3, B10.4, B10.5, B10.6, B10.7, B11.3, B12.1, B12.2, B12.3, B12.4, B13.1, B13.2, B13.3, B13.4, B13.5, B13.6</p>
<p>B. COMMUNICATION SKILLS</p> <p>Understand and apply communication techniques required in clinical setting offices.</p>	<ul style="list-style-type: none"> 1. Understand different methods of communication: <ul style="list-style-type: none"> a. verbal and von-verbal through body language b. written c. effective communication using medical terminology 2. Utilizing listening skills: <ul style="list-style-type: none"> a. open-ended questions b. check for understanding using paraphrasing techniques 3. Describe the following stages of the communication process: <ul style="list-style-type: none"> a. sending/source: <ul style="list-style-type: none"> i. reason for sending the message ii. content of the message b. message c. encoding: <ul style="list-style-type: none"> i. avoid cultural issues ii. eliminate mistaken assumptions iii. fill in missing information d. channel: <ul style="list-style-type: none"> i. face-to-face meetings ii. telephone and videoconferencing iii. written channels including letters, emails, memos and reports e. decoding - the time to read a message carefully or listen actively to it f. receiving g. feedback - verbal and nonverbal reactions to the communicated message h. context: <ul style="list-style-type: none"> i. surrounding environment ii. broader culture (corporate culture, international cultures, etc.) 	<p>Career Ready Practice: 1, 2, 7</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8 Responsibility and Flexibility: 7.3, 7.4, 7.7, 7.8</p> <p>CTE Pathway: B6.1, B6.2, B6.3, B6.4, B6.5, B6.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 5 hours)	<ol style="list-style-type: none"> 4. Describe and demonstrate the following techniques to remove barriers in communication: <ol style="list-style-type: none"> a. using clear verbal and body language to avoid confusion b. being mindful of the demands on other people’s time c. conversing and delivering the message to people of different backgrounds and cultures 5. Demonstrate the following: <ol style="list-style-type: none"> a. medical history interview, using positive communication techniques b. patient greetings c. effective communication with peers and patients 	
<p>C. CRITICAL THINKING SKILLS</p> <p>Understand, apply, and evaluate principles and practices used to promote critical thinking skills for students.</p>	<ol style="list-style-type: none"> 1. Identify and describe the steps and procedures involved in defining and clarifying issues or problems. 2. Describe the importance of the following attributes in judging information related to problem-solving: <ol style="list-style-type: none"> a. consistency b. logic c. unbiased d. unemotional e. credibility 3. Describe the importance of determining the adequacy of information to justify a conclusion and to predict probable consequences. 4. Describe and demonstrate the following affective techniques used to sharpen student critical thinking skills: <ol style="list-style-type: none"> a. thinking independently b. developing insight into egocentricity or socio-centricity c. exercising fair mindedness d. exploring thoughts underlying feelings and feelings underlying thoughts e. developing intellectual humility and suspending judgment f. developing intellectual courage g. developing intellectual good faith or integrity h. developing intellectual perseverance i. developing confidence in reason 5. Describe the following macro-cognitive techniques used to sharpen student critical thinking skills: <ol style="list-style-type: none"> a. comparing analogous situations: transferring insights to new contexts b. developing one's perspective: creating or exploring beliefs, arguments, or theories c. clarifying issues, conclusions, or beliefs d. clarifying and analyzing the meanings of words or phrases e. developing criteria for evaluation: clarifying values and standards f. evaluating the credibility of sources of information 	<p>Career Ready Practice: 2, 5, 7, 8</p> <p>CTE Anchor: Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.6 Responsibility and Flexibility: 7.2, 7.3, 7.4, 7.7, 7.8 Ethics and Legal Responsibilities: 8.1, 8.3, 8.4, 8.5, 8.7</p> <p>CTE Pathway: B5.1, B5.2, B5.3, B5.4, B5.5, B6.1, B6.2, B6.3, B6.4, B6.5, B6.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 3 hours)	<ul style="list-style-type: none"> g. questioning deeply: raising and pursuing root or significant questions h. analyzing or evaluating arguments, interpretations, beliefs, or theories i. generating or assessing solutions j. analyzing or evaluating actions or policies k. making interdisciplinary connections l. clarifying and questioning beliefs, theories, or perspectives m. reasoning dialogically: comparing perspectives, interpretations, or theories n. reasoning dialectically: evaluating perspectives, interpretations, or theories <p>6. Describe and demonstrate how to document patient history:</p> <ul style="list-style-type: none"> a. thinking precisely using critical vocabulary b. noting significant similarities and differences c. examining or evaluating assumptions d. distinguishing relevant from irrelevant facts e. making plausible inferences, predictions, or interpretations f. evaluating evidence and alleged facts g. recognizing contradictions h. exploring implications and consequences 	
<p>D. RESOURCE MANAGEMENT</p> <p>Understand the basic principles and procedures of resource management in x-ray facilities.</p> <p>(Theory: 1 hour)</p>	<ul style="list-style-type: none"> 1. Define the following: <ul style="list-style-type: none"> a. resources b. management c. sustainability d. direct supervision e. indirect supervision 2. List specific examples of effective management of the following resources during clinical internship: <ul style="list-style-type: none"> a. time b. materials c. personnel 3. Manage resources in a responsible way. 	<p>Career Ready Practice: 2, 5, 6, 7</p> <p>CTE Anchor: Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8 Problem Solving and Critical Thinking: 5.1, 5.3, 5.4, 5.6 Health and Safety: 6.2, 6.3, 6.7, 6.8 Responsibility and Flexibility: 7.2</p> <p>CTE Pathway: B1.1, B6.6, B7.1, B11.2, B11.3, B12.1, B12.2, B12.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>E. MEDICAL ETHICS</p> <p>Understand, apply, and evaluate the policies and procedures used to ensure professional ethics, patient confidentiality, and compliance to radiologic laws and regulations.</p> <p>(Theory: 6 hours)</p>	<ol style="list-style-type: none"> 1. Define the following: <ol style="list-style-type: none"> a. ethics b. compliance c. Health Information Portability and Accountability Act of 1996 (HIPAA) d. Patient’s Bill of Rights e. medical necessity f. professional confidentiality g. professional liability h. professional negligence/carelessness i. malpractice 2. Describe the following: <ol style="list-style-type: none"> a. HIPAA confidentiality requirements b. Patient’s Bill of Rights provisions c. role of federal, state and private healthcare carriers and agencies in assuring compliance d. code of ethics for X-Ray Technicians e. quality care and compliance from the patient’s perspective f. optimum patient care and compliance from an X-Ray technician’s perspective g. legal implications of professional liability, malpractice, professional negligence/ carelessness and other legal doctrines applicable to professional practice h. economic impact of malpractice on the society 	<p>Career Ready Practice: 1, 2, 7, 8</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.8 Responsibility and Flexibility: 7.2, 7.3, 7.7 Ethics and Legal Responsibilities: 8.1, 8.3, 8.4, 8.5, 8.7</p> <p>CTE Pathway: B4.4, B4.5, B5.1, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7, B6.1, B6.2, B6.3, B6.4, B6.5, B6.6, B7.3, B7.4, B9.6, B12.1, B12.2, B12.3, B12.4</p>
<p>F. MEDICAL TERMINOLOGY</p> <p>Understand, apply, and evaluate medical and radiologic terms.</p>	<ol style="list-style-type: none"> 1. Define and demonstrate the following body/part positioning terms: <ol style="list-style-type: none"> a. supine b. prone c. lateral d. oblique 2. Define and demonstrate radiographic positioning terms, including: <ol style="list-style-type: none"> a. right anterior oblique (RAO) b. left anterior oblique (LAO) c. right posterior oblique (RPO) d. left posterior oblique (LPO) 3. Define and locate body/part relationship terms, including: <ol style="list-style-type: none"> a. anterior vs. posterior b. inferior vs. superior c. distal vs. proximal 4. Define and demonstrate the body/part movement terms, including: <ol style="list-style-type: none"> a. flexion vs. extension 	<p>Career Ready Practice: 1, 2</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8</p> <p>CTE Pathway: B4.4, B4.5, B5.1, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 5 hours)	<ul style="list-style-type: none"> b. supination v. pronation c. adduction vs. abduction 5. Describe the similarities and differences between the following terms: <ul style="list-style-type: none"> a. position b. projection c. view 6. Critique orders, requests, and diagnostic reports. 7. Translate medical terms, abbreviations, and symbols into common language from a medical report.	
G. ANATOMY AND PHYSIOLOGY I Understand, apply, and evaluate the organs of the body systems and the extremities and torsoskeleton from a radiologic perspective and function.	1. Define the following: <ul style="list-style-type: none"> a. cell b. tissue c. organs d. systems e. planes of the body f. anatomy g. physiology h. pathology 2. Identify and describe the following: <ul style="list-style-type: none"> a. role and parts of a basic cell b. relationship between cells, tissues, organs, and systems c. differences between anatomy, physiology, and pathology d. three planes and directions of the body e. identify the major systems of the human body 3. Define the following: <ul style="list-style-type: none"> a. bone marrow b. ossification c. facet d. tuberosity e. process f. spine g. crest h. foramen i. meatus j. sinus k. fossa l. suture 4. Identify and describe the following: <ul style="list-style-type: none"> a. functions of the skeletal system b. composition of the bone c. differences between red and yellow marrow d. ossification process e. primary and secondary bone formation centers f. divisions of the skeletal system g. main groups of bones in each division h. classification of bones i. examples of bones in each classification 	Career Ready Practice: 1, 2 CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8 CTE Pathway: B2.1, B2.2, B2.3, B2.4, B5.1, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 50 hours)	<ul style="list-style-type: none"> j. location of the major landmarks of the pelvis and hip k. structural and functional differences of the greater and lesser pelvis l. differentiating the female pelvis from the male pelvis m. classifications of joints based on the type of motion allowed n. examples of joint classification o. identifying the classification and movement type for the joints of the pelvis p. pathologies associated with the extremities and torsoskeleton q. location & classification of the bones that make up the shoulder girdle and the upper extremities r. location & classification of the bones that make up the pelvic girdle and the lower extremities <p>5. Identify and describe the following:</p> <ul style="list-style-type: none"> a. flexion b. extension c. abduction d. adduction e. rotation f. supination g. pronation h. inversion i. eversion <p>6. Describe and demonstrate the following:</p> <ul style="list-style-type: none"> a. labeling the parts of a bone on a diagram of a long bone b. labeling the primary and secondary bone formation centers c. differentiating the structural and functional features of the greater and lesser pelvis d. differentiating the female pelvis from the male pelvis e. determining the age of the patient from wrist, knee, and or pelvic radiographs f. locating the following anatomic structures and landmarks on drawings, dry skeleton, and radiographs: <ul style="list-style-type: none"> i. upper limb and shoulder girdle ii. lower limb and pelvic girdle 	
<p>H. IMAGE CRITIQUE I</p> <p>Understand, apply, and evaluate the factors that affect radiographic quality, and the inter-relationship between them.</p>	<p>1. Define the following:</p> <ul style="list-style-type: none"> a. radiographic detail b. image sharpness c. radiographic density d. contrast e. short-scale contrast image f. long-scale contrast image g. radiographic distortion h. collimation 	<p>Career Ready Practice: 1, 2, 5, 7</p> <p>CTE Anchor: Academics: 1.0</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 15 hours)	<ol style="list-style-type: none"> 2. Identify and describe: <ol style="list-style-type: none"> a. role of the radiographer in image analysis b. elements of a diagnostic image c. conditions that must be present in a radiographic image that would indicate acceptable visibility of image details d. controlling factors for radiographic density and contrast e. image quality factors of a radiograph f. geometric factors that influence image sharpness g. ways of controlling involuntary and voluntary motion h. parameters for evaluating visibility of detail on the image i. controlling factors for radiographic distortions j. criteria for evaluating radiographic distortions 3. Describe and demonstrate: <ol style="list-style-type: none"> a. determining that the adequate level of penetration has been applied to produce the desired level of contrast b. techniques for adequate density, contrast, recorded detail and acceptable limits of distortion of a radiographic image c. identifying short scale contrast and long scale contrast images d. evaluating image distortion 4. Identify and describe the following: <ol style="list-style-type: none"> a. criteria for evaluating radiographs of the extremities for positioning accuracy and overall image quality b. importance of collimation, anatomic side markers, and proper radiograph identification c. general criteria for repeating a radiograph d. elements of a diagnostic image as they relate to film critique e. differences between technical factor problems, procedural problems, and equipment malfunctions f. common equipment malfunctions that affect image quality g. impact of patient preparation on the resulting radiographic image h. modifications of procedures for atypical or impaired patients to better demonstrate the anatomic area of interest 5. Describe and demonstrate the following: <ol style="list-style-type: none"> a. analyzing samples of the upper extremity & shoulder girdle radiographs b. analyzing samples of the lower extremity & pelvic girdle radiographs c. recommending modifications for improvement: d. discriminating acceptable radiographs from the unacceptable ones based on the following criteria: <ol style="list-style-type: none"> i. exposure factors ii. motion iii. collimation iv. positioning errors 	<p>Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8</p> <p>Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6</p> <p>Responsibility and Flexibility: 7.2, 7.3, 7.4, 7.5, 7.7</p> <p>Technical Knowledge and Skills: 10.1, 10.2</p> <p>CTE Pathway: B2.1, B3.1, B4.5, B5.1, B5.6, B6.1, B6.2, B6.3, B6.4, B6.5, B6.6, B7.1, B8.4, B9.1, B9.3, B9.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>I. RADIOGRAPHIC POSITIONING I</p> <p>Understand, apply, and evaluate the principles of positioning image receptor and central ray.</p> <p>(Theory: 40 hours) (Laboratory: 20 hours)</p>	<ol style="list-style-type: none"> 1. Identify and describe the general principles of positioning 2. Define and describe the following: <ol style="list-style-type: none"> a. upper and lower extremities b. torsoskeleton c. shoulder girdle d. pelvic girdle 3. List and identify the central ray location with angulation specifics, cassette size and orientation, and the extent of the field necessary for both the basic and special projections of the following: <ol style="list-style-type: none"> a. upper and lower extremities b. torsoskeleton c. shoulder girdle d. pelvic girdle 4. Identify and describe the technical factors required to produce an acceptable radiograph for basic and special projections involving the: <ol style="list-style-type: none"> a. upper and lower extremities b. torsoskeleton c. shoulder girdle d. pelvic girdle 5. Identify and describe the patient instructions for basic and special projections involving the: <ol style="list-style-type: none"> a. upper and lower extremities b. torsoskeleton c. shoulder girdle d. pelvic girdle e. upper limb and shoulder girdle f. lower limb and pelvic girdle 6. Describe and demonstrate the following: <ol style="list-style-type: none"> a. positioning the basic and special projections for each part of the upper limb and the shoulder girdle on phantom and human models b. positioning the basic and special projections for each part of the lower limb and the pelvic girdle on phantom and human models c. identifying and using the appropriate-lead shielding d. taking the basic projections for an extremity in a fiberglass cast and identifying the approximate exposure conversion guidelines e. evaluating positioning and technical factors based on given radiographs f. making procedural modifications for atypical or impaired patients to better demonstrate the anatomic area of interest 	<p>Career Ready Practice: 1, 2, 5</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.6</p> <p>CTE Pathway: B2.1, B3.1, B5.1, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7, B8.2, B8.3, B9.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>J. CLINICAL ASSISTANT PROCEDURES I</p> <p>Understand, apply, and evaluate the basic clinical procedures necessary to assist in the health care facility and to maintain patient safety.</p> <p>(Theory: 15 hours)</p>	<ol style="list-style-type: none"> 1. Define and demonstrate the following: <ol style="list-style-type: none"> a. common vital signs and their role in assessing patient condition <ol style="list-style-type: none"> i. temperature ii. pulse iii. respiration iv. blood pressure b. normal vital signs for adults and children c. taking and recording vital signs techniques d. responding to emergencies e. handling trauma patients 2. Describe and demonstrate the following techniques: <ol style="list-style-type: none"> a. assessing and assisting patients b. completing an intake of medical history and documentation c. provide back office support with assisting patients d. administering emergency first aid for nosebleed, shock, and seizure e. managing medical emergencies f. handling and disposal of hazardous materials g. hand washing h. minimize the risk of potential pathogens following disinfecting and sanitizing protocols 	<p>Career Ready Practice: 1, 2, 6, 9, 10</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 Health and Safety: 6.2, 6.3, 6.4, 6.6, 6.8 Leadership and Teamwork: 9.2 Technical Knowledge and Skills: 10.5</p> <p>CTE Pathway: B2.1, B2.4, B5.1, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7, B6.1, B6.2, B6.3, B6.4, B6.5, B6.6, B8.2, B10.1, B10.2, B10.3, B10.4, B10.5, B10.6, B10.7</p>
<p>K. PRINCIPLES OF EXPOSURE AND IMAGE QUALITY I</p> <p>Understand, apply, and evaluate the techniques for radiographic calculations and exposure to produce quality radiographs.</p>	<ol style="list-style-type: none"> 1. Define the following: <ol style="list-style-type: none"> a. milliamperage (mA) b. source to image distance (SID) c. milliamperage second (mAs) d. exposure time e. reciprocity law f. contrast <ol style="list-style-type: none"> i. high ii. low iii. optimum iv. short-scale vs. long-scale 2. Identify and describe radiographic density: <ol style="list-style-type: none"> a. prime factors of exposure b. reciprocity law 	<p>Career Ready Practice: 1, 2, 4, 5, 7, 10</p> <p>CTE Anchor: Academics: 1.0 Communications: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 Technology: 4.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<p>c. radiographic effect caused by changes in each of the four prime factors of exposure</p> <p>3. Describe and demonstrate the following:</p> <ul style="list-style-type: none"> a. calculating mAs when given mA and exposure time b. calculating mA when given mAs and exposure time c. calculating exposure time when given mAs and mA d. application of the reciprocity law e. evaluating the relationships between mA, exposure time, mAs and quantity of x-rays produced f. assessing radiographic density on radiographic images g. recognizing changes in radiographic density and determining the exposure factors used to control radiographic density h. identifying high, low, and optimum contrast on a radiograph and determining the exposure factor that primarily controls radiographic contrast i. differentiating between short-scale contrast and long-scale contrast j. distinguishing between acceptable and unacceptable levels of density and contrast based on given radiographs <p>4. Define the following:</p> <ul style="list-style-type: none"> a. peak kilovoltage (kVp) b. primary beam c. 15% rule d. inverse square law e. Roentgen f. Roentgen Equivalent in Man/Mammal (REM) g. Radiation Absorbed Dose (RAD) <p>5. Identify and describe the following:</p> <ul style="list-style-type: none"> a. effect of kVp b. effects of the primary beam <p>6. Describe and demonstrate the following:</p> <ul style="list-style-type: none"> a. application of the 15% rule b. calculation of the new kVp needed to maintain density when changes are made in mAs, using the 15% rule c. calculation of an optimum kVp d. application of the inverse square law e. calculation of mR when the SID is changed f. calculation of needed mAs to maintain density when changes are made in SID <p>7. Define and describe-radiographic detail:</p> <ul style="list-style-type: none"> a. radiographic distortion b. magnification c. shape distortion d. motion blur e. attenuation f. radiation absorption g. heel effect h. scattered radiation 	<p>Problem Solving & Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, Responsibility & Flexibility: 7.3 Demonstration & Application: 11.1</p> <p>CTE Pathway: B3.1, B3.2, B5.1, B5.2, B5.3, B5.4, B5.5, B5.6, B5.7, B12.2, B12.3, B12.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>(Theory: 30 hours) (Laboratory: 5 hours)</p>	<ul style="list-style-type: none"> i. effect of pathology on radiation absorption j. pathologic conditions that result in increased or decreased attenuation of the x-ray beam 8. Describe the following: <ul style="list-style-type: none"> a. methods for minimizing motion blur on radiographs b. assessing radiographs for optimum quality c. reading and using an x-ray technique chart d. creating an x-ray technique chart e. distinguishing fixed kVp technique charts from variable kVp technique charts f. determining the value of an optimum kVp g. selecting an appropriate mA, time, and kVp for a given set of circumstances h. taking appropriate steps when technique charts fail to provide an appropriate exposure i. calculating exposure adjustments for changes in patient/part size j. estimating the technique change required when radiographs are too dark or too light k. suggesting appropriate technique changes for lengthening or shortening the scale of contrast l. calculating technique changes for variations in SID m. calculating technique changes required when using a grid or changing grid ratio n. developing a technique chart for personal use during internship 	

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Kendrick, Leslie E. and Lampignano, John. Bontrager's Textbook of Radiographic Positioning and Related Anatomy, 10th Edition. Elsevier Health Science, 2021.

Kendrick, Leslie E. and Lampignano, John. Workbook for Bontrager's Textbook of Radiographic Positioning and Related Anatomy, 10th Edition. Elsevier Health Science, 2021.

Mason, Starla. Essentials of Radiologic Science Second Edition. Wolters Kluwer. 2018

Mason, Starla. Essentials of Radiologic Science Work Book Second Edition. Wolters Kluwer. 2018

Coakes, Dawn M. and Ehrlich, Ruth Ann. Patient Care in Radiography: With an Introduction to Medical Imaging 10th Edition. Elsevier Health Science, 2020.

ASRT Scanner. Monthly News Magazine of American Society of Radiologic Technologists.

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. Teacher and student guided:
 - 1. Lecture
 - 2. Discussion
 - 3. Role play
 - 4. Problem-solving
 - 5. Demonstration/practice/return demonstration
 - 6. Home assignment, patient case studies
- B. Field trips
- C. Multi-sensory presentations
 - 1. Videos, audio-visuals, CD-ROMS
 - 2. PowerPoint presentations
 - 3. Mock-ups
 - 4. Radiographs
- D. Clinical activities

EVALUATION

SECTION A – Orientation and General Safety Principles – Pass the safety test with a score of 100% accuracy.

SECTION B – Communication Skills – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION C – Critical Thinking Skills – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION D – Resource Management – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION E – Medical Ethics – Pass all assignments and exams with a minimum score of 75% or higher.

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

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

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

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

SECTION J – Clinical Assistant Procedures I – Pass all assignments and exams with a minimum score of 75% or higher.

SECTION K – Principles of Exposure and Image Quality I – Pass all assignments and exams 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.

Statement for Civil Rights

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