

# Course Outline

Health Science and Medical Technology

REVISED: August/2017

**Job Title:**

X-Ray Technician

**76-45-89**

**Career Pathway:**

Patient Care

## X-Ray Technology/3

**Industry Sector:**

Health Science and Medical  
Technology

**Credits:** 40

**Hours:** 510

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

29-2099.06

**Course Description:**

This competency-based course is the last 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 in the limited category of skull. Didactic and clinical instruction includes parts three of anatomy and physiology (including cranial and facial bone pathologies), radiographic positioning, and film critique. Emphasis is also placed on digital radiography, employability skills, and the evaluation process. Students are given maximum hours available for clinical experience in health care facilities supervised by the instructor and staff personnel in order to perform as safe, competent, and professional X-Ray Technicians. The passing of the state examination allows graduates to work as X-Ray 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

**Prerequisites:**

Enrollment requires successful completion of the X-Ray Technology/2 (76-45-86) course.

**CBEDS No.:**

4257

**NOTE:** For Perkins purposes this course has been designated as a **capstone** course.

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



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

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

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

### **COURSE OUTLINE COMPONENTS**

### **LOCATION**

#### **GOALS AND PURPOSES**

Cover

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

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

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

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

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

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

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

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

**COURSE OUTLINE COMPONENTS**

**LOCATION**

**INSTRUCTIONAL STRATEGIES**

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

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

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

Cover

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

pp. 7-15

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 and LUZ GRANADOS for developing and editing this curriculum. 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 X-Ray Technology/3 Course**

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. ANATOMY AND PHYSIOLOGY III</p> <p>Understand, apply, and evaluate the organs of the body systems from a radiologic perspective and function.</p>	<ol style="list-style-type: none"> <li>1. Review and demonstrate the following:               <ol style="list-style-type: none"> <li>a. labeling on a diagram of the main body cavities</li> <li>b. identifying the main organs located in each body cavity</li> <li>c. identifying the major systems of the human body and naming associated organs for each system</li> </ol> </li> <li>2. Review the definitions of the following:               <ol style="list-style-type: none"> <li>a. bone marrow</li> <li>b. ossification</li> <li>c. facet</li> <li>d. tuberosity</li> <li>e. process</li> <li>f. spine</li> <li>g. crest</li> <li>h. foramen</li> <li>i. meatus</li> <li>j. sinus</li> <li>k. fossa</li> <li>l. suture</li> </ol> </li> <li>3. Review the following:               <ol style="list-style-type: none"> <li>a. functions of the skeletal system</li> <li>b. composition of the bone</li> <li>c. differences between red and yellow marrow</li> <li>d. ossification process</li> <li>e. two divisions of the skeletal system</li> <li>f. primary and secondary bone formation centers</li> <li>g. main groups of bones in each division</li> <li>h. classification of bones</li> <li>i. examples of bones in each classification</li> <li>j. classifications of joints based on the type of motion allowed</li> <li>k. examples of joint classification</li> </ol> </li> <li>4. Identify and describe the following:               <ol style="list-style-type: none"> <li>a. eight cranial bones and their features, related structures, location, and function</li> <li>b. specific radiographic and topographical landmarks of the cranium</li> <li>c. identifying the locations and joint classification of sutures and joints of the cranium and facial bones</li> <li>d. 14 facial bones and their features, structures, location, and function</li> <li>e. number and names of cranial/facial bones with which each cranial and facial bone articulate</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 2</p> <p><b>CTE Anchor:</b> Communications: 2.4, 2.7, 2.8 Problem Solving and Critical Thinking: 5.4</p> <p><b>CTE Pathway:</b> B2.1, B2.2, B2.3, B2.4, B5.1, B5.2, B5.3, B5.4, B5.5, B5.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> <li>f. cranial and facial bones that make up the bony orbits</li> <li>g. three main portions of the temporal bone</li> <li>h. five special senses</li> <li>i. causes and radiographic implications of a blowout and tripod fractures of the facial bones</li> <li>j. differences among the three shape and size classifications of the cranium and their implications to radiography of the cranium</li> <li>k. reference points, positioning lines, and topographical landmarks as they relate to the cranium and the facial bones</li> <li>l. five cranial and facial bone pathologies</li> </ul> <p>5. Identify and describe the following:</p> <ul style="list-style-type: none"> <li>a. structures of the external, middle, and internal ear</li> <li>b. major parts of the ear</li> </ul> <p>6. Identify and describe the following:</p> <ul style="list-style-type: none"> <li>a. pathway of sound waves as they travel through the ear</li> <li>b. how the ear maintains balance and equilibrium</li> <li>c. functions of the nasal cavity</li> <li>d. four groups of paranasal sinuses and their features, location, and function</li> </ul> <p>7. Identify and describe the following:</p> <ul style="list-style-type: none"> <li>a. labeling on a diagram the external, middle, and internal ear</li> <li>b. labeling on a diagram major parts of the ear</li> </ul> <p>8. Identify and describe the following:</p> <ul style="list-style-type: none"> <li>a. cranium</li> <li>b. facial bones</li> <li>c. classification of the joints found in the lumbar spine</li> <li>d. topographical landmarks that can be palpated to locate specific aspects of the lumbar spine, sacrum, and coccyx</li> <li>e. diseases affecting the vertebral column</li> <li>f. classification of ribs: true, false, or floating</li> <li>g. structures that are best seen with specific projections of the ribs and sternum</li> <li>h. functions of the spinal cord</li> <li>i. layers, chambers, valves, and major blood vessels</li> <li>j. differences between systole and diastole by explaining what happen in the heart during each phase</li> <li>k. types of blood vessels and the action of each</li> <li>l. types of blood cells by describing the function of each</li> <li>m. three diseases of the circulatory system</li> <li>n. five pathologies associated with the chest</li> </ul> <p>9. Identify and describe the role of the following in radiography:</p> <ul style="list-style-type: none"> <li>a. labeling the layers, chambers, valves, and major blood vessels on a diagram of the heart</li> <li>b. flow of blood as it enters the heart and goes to the body cells, naming each chamber and valve in the heart</li> </ul> <p>10. Define and describe the functions and structures of the following:</p> <ul style="list-style-type: none"> <li>a. bony thorax</li> <li>b. larynx</li> <li>c. pharynx</li> <li>d. trachea</li> </ul>	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 30 hours)	<ul style="list-style-type: none"> <li>e. bronchi/bronchioles</li> <li>f. alveolar sacs</li> <li>g. hilum</li> <li>h. lungs</li> <li>i. mediastinum</li> </ul> <p>11. Describe the following:</p> <ul style="list-style-type: none"> <li>a. functions of the nasal cavity</li> <li>b. skeletal landmarks associated with organs of the respiratory system</li> <li>c. three sections of the pharynx</li> <li>d. exchange of oxygen and carbon dioxide in the alveoli</li> <li>e. path of an oxygen molecule entering the nasal/oral cavity through the respiratory system into a tissue cell</li> <li>f. function of the epiglottis and how it prevents food from entering the trachea</li> <li>g. processes of inspiration and expiration, including muscle action that occurs during each phase</li> <li>h. differences between internal and external respiration</li> <li>i. diseases of the respiratory system</li> <li>j. joint function of the circulatory and respiratory systems</li> <li>k. influence of the pituitary gland on various body functions</li> </ul> <p>12. Describe and demonstrate the following:</p> <ul style="list-style-type: none"> <li>a. labeling a diagram of the respiratory system</li> <li>b. tracing on a drawing the path through which oxygen travels and labeling the structures it passes through from the nose and mouth to the terminal aspects of the lungs</li> <li>c. locating the following anatomic structures and landmarks on drawings, dry skeleton, and radiographs: <ul style="list-style-type: none"> <li>i. chest and upper airway</li> <li>ii. vertebral column</li> </ul> </li> </ul>	
<p>B. RADIOGRAPHIC POSITIONING III</p> <p>Understand, apply, and evaluate the basic radiographic positioning for exams involving the cranium.</p>	<ul style="list-style-type: none"> <li>1. Review the definitions of the following: <ul style="list-style-type: none"> <li>a. radiologic positioning</li> <li>b. anatomic position</li> <li>c. body planes</li> <li>d. radiographic view</li> </ul> </li> <li>2. Review and describe the following: <ul style="list-style-type: none"> <li>a. general principles of positioning</li> <li>b. patient care considerations relevant to positioning</li> <li>c. primary principles of radiation protection, including the ten day rule</li> <li>d. methods of reducing patient radiation exposure</li> <li>e. special considerations necessary when performing radiographic procedures on an infant or a child</li> <li>f. special considerations necessary when performing radiographic procedures on a geriatric patient</li> <li>g. symptoms and precautions taken for a patient with a spinal injury</li> <li>h. body planes based on given diagrams</li> </ul> </li> </ul>	<p><b>Career Ready Practice:</b> 1, 2</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.4, 2.7, 2.8 Problem Solving and Critical Thinking: 5.1, 5.4, 5.5, 5.6 Responsibility and Flexibility: 7.2, 7.3, 7.4, 7.7 Ethics and Legal Responsibilities: 8.3, 8.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 30 hours)	<ul style="list-style-type: none"> <li>i. examples of topographical landmarks and their corresponding vertebrae</li> <li>j. characteristics of each of the four major body types</li> </ul> <ol style="list-style-type: none"> <li>3. Describe and demonstrate patient preparation techniques required for a cranium’s radiographic exam.</li> <li>4. Describe and demonstrate the basic and special positioning used to visualize anatomic structures of the cranium and facial bones.</li> <li>5. 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: <ul style="list-style-type: none"> <li>a. cranium</li> <li>b. facial bones</li> </ul> </li> <li>6. Identify and describe the technical factors required to produce an acceptable radiograph for basic and special projections of the: <ul style="list-style-type: none"> <li>a. cranium</li> <li>b. facial bones</li> </ul> </li> <li>7. Identify and describe the patient instructions for basic and special projections of the: <ul style="list-style-type: none"> <li>a. cranium</li> <li>b. facial bones</li> </ul> </li> <li>8. Describe and demonstrate the following: <ul style="list-style-type: none"> <li>a. identifying the differences in patient dose on alternative frontal (AP) vs. posteroanterior (PA) projections of the cranium and facial bones</li> <li>b. positioning the basic and special projections of the cranium, facial bones, and paranasal sinuses on phantom and human models</li> <li>c. making accurate evaluations of positioning and technical factors based on given radiographs</li> <li>d. making procedural modifications for atypical or impaired patients to better demonstrate the anatomic area of interest</li> </ul> </li> </ol>	<p>Leadership and Teamwork: 9.6</p> <p>Technical Knowledge and Skills: 10.1, 10.2</p> <p>Demonstration and Application:11.2</p> <p><b>CTE Pathway:</b> B2.1, B2.3, B3.1, B5.1, B5.2, B5.3, B5.4, B5.6, B5.7, B6.1, B6.2, B6.3, B6.4, B8.5, B12.1, B12.2, B12.3, B12.4</p>
<p><b>C. FILM CRITIQUE III</b></p> <p>Review, apply, and evaluate the procedures used to produce quality radiographic products.</p>	<ol style="list-style-type: none"> <li>1. Review the definitions of the following: <ul style="list-style-type: none"> <li>a. radiographic detail</li> <li>b. image sharpness</li> <li>c. radiographic density</li> <li>d. contrast</li> <li>e. short-scale contrast image</li> <li>f. long-scale contrast image</li> <li>g. radiographic distortion</li> <li>h. collimation</li> </ul> </li> <li>2. Review and describe: <ul style="list-style-type: none"> <li>a. role of the radiographer in image analysis</li> <li>b. elements of a diagnostic image</li> <li>c. conditions that must be present in a radiographic image that would indicate acceptable visibility of image details</li> <li>d. controlling factors for radiographic density and contrast</li> <li>e. image quality factors of a radiograph</li> <li>f. geometric factors that influence image sharpness</li> <li>g. ways of controlling involuntary and voluntary motion</li> </ul> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5</p> <p><b>CTE Anchor:</b> Communications: 2.4</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</p> <p>Ethics and Legal Responsibilities: 8.1, 8.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 5 hours)	<ul style="list-style-type: none"> <li>h. parameters for evaluating visibility of detail on the image</li> <li>i. controlling factors for radiographic distortions</li> <li>j. criteria for evaluating radiographic distortions</li> </ul> <p>3. Review and demonstrate:</p> <ul style="list-style-type: none"> <li>a. determining that the adequate level of penetration has been applied to produce the desired level of contrast</li> <li>b. techniques for adequate density, contrast, recorded detail and acceptable limits of distortion of a radiographic image</li> <li>c. identifying short scale contrast and long scale contrast images</li> <li>d. evaluating image distortion</li> </ul> <p>4. Review and describe the following:</p> <ul style="list-style-type: none"> <li>a. criteria for evaluating radiographs of the extremities for positioning accuracy and overall image quality</li> <li>b. importance of collimation, anatomic side markers, and proper radiograph identification</li> <li>c. general criteria for repeating a radiograph</li> <li>d. elements of a diagnostic image as they relate to film critique</li> <li>e. differences between technical factor problems, procedural problems, and equipment malfunctions</li> <li>f. common equipment malfunctions that affect image quality</li> <li>g. impact of patient preparation on the resulting radiographic image</li> <li>h. modifications of procedures for atypical or impaired patients to better demonstrate the anatomic area of interest</li> </ul> <p>5. Describe/review and demonstrate the following:</p> <ul style="list-style-type: none"> <li>a. analyzing samples of the cranial radiographs</li> <li>b. recommending modifications for improvement:</li> <li>c. discriminating acceptable radiographs from the unacceptable ones based on the following criteria: <ul style="list-style-type: none"> <li>i. exposure factors</li> <li>ii. motion</li> <li>iii. collimation</li> <li>iv. positioning errors</li> </ul> </li> </ul>	<p>Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> B3.1, B3.2, B5.2, B6.1, B6.2, B6.3, B6.4, B7.4, B12.1, B12.2, B12.3, B12.4</p>
<p>D. DIGITAL RADIOGRAPHY</p> <p>Understand, apply, and evaluate the basic radiation protection principles and procedures used in digital radiography.</p>	<ul style="list-style-type: none"> <li>1. Define the following: <ul style="list-style-type: none"> <li>a. radiologic positioning</li> <li>b. anatomic position</li> <li>c. body planes</li> <li>d. radiographic view</li> </ul> </li> <li>2. Identify and describe the following: <ul style="list-style-type: none"> <li>a. modalities that use digital radiography</li> <li>b. differences between digital radiography and conventional radiography</li> <li>c. imaging process in digital radiography</li> <li>d. primary factors controlling image quality in digital radiography</li> <li>e. criteria for evaluating digital radiographs</li> <li>f. differences between technical factor problems, procedural problems, and equipment malfunctions</li> <li>g. common equipment malfunctions that affect image quality</li> </ul> </li> </ul>	<p><b>Career Ready Practice:</b> 1, 2, 4, 5</p> <p><b>CTE Anchor:</b> Communications: 2.4, 2.7, 2.8 Technology: 4.5 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 Health and Safety: 6.2</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>(Theory: 20 hours) (Laboratory: 10 hours)</p>	<ul style="list-style-type: none"> <li>h. impact of patient preparation on the resulting digital image</li> <li>i. importance of matching the body part being examined to the examination menu</li> <li>j. importance of preprocessing collimation</li> <li>k. extraction of the image in a cassette-less system</li> <li>l. extraction of the image in a cassette-based system</li> <li>m. effects of incorrect histogram model selection</li> <li>n. exposure indicator in a cassette-less system (DAP) and the need for routine calibration</li> <li>o. differences in exposure indicators from various vendors</li> <li>p. advantages and limitations of digital imaging over film-screen radiography</li> <li>q. differences between image latitude in digital imaging with film-screen radiography</li> <li>r. automatic rescaling of pixels in digital radiography and how it increases the range of exposures</li> <li>s. effective beam-part-receptor alignment latitude</li> <li>t. effects of the beam-part-receptor alignment on the histogram analysis</li> </ul> <p>3. Describe and demonstrate the following:</p> <ul style="list-style-type: none"> <li>a. analyzing digital images of the extremities (two), torsoskeleton (three), chest (four), and cranium (five)</li> <li>b. discriminating acceptable digital images from the unacceptable ones based on the following criteria: <ul style="list-style-type: none"> <li>i. technical factors</li> <li>ii. patient preparation</li> </ul> </li> <li>c. digital imaging techniques by: <ul style="list-style-type: none"> <li>i. appropriate menu selection</li> <li>ii. patient preparation</li> </ul> </li> <li>d. perform labs to illustrate the use of appropriate menu selection, part placement, pre- &amp; post-processing, and receptor erasure &amp; cleaning</li> </ul>	<p>Responsibility and Flexibility: 7.2, 7.4</p> <p>Ethics and Responsibilities: 8.1, 8.2, 8.3, 8.4</p> <p>Technical Knowledge and Skills: 10.1, 10.2</p> <p>Demonstration and Application: 11.2</p> <p><b>CTE Pathway:</b> B2.1, B2.3, B3.1, B3.2, B5.2, B6.2, B7.4, B9.3</p>
<p>E. EMPLOYABILITY SKILLS</p> <p>Understand, apply, and evaluate the employability skills required in dental assisting.</p>	<ul style="list-style-type: none"> <li>1. Describe employer requirements for the following: <ul style="list-style-type: none"> <li>a. punctuality</li> <li>b. attendance</li> <li>c. attitude toward work</li> <li>d. quality of work</li> <li>e. teamwork</li> <li>f. timeliness</li> <li>g. communication skills</li> <li>h. computer skills and software applications in: <ul style="list-style-type: none"> <li>i. radiologic information systems (RIS)</li> <li>ii. hospital information systems (HIS)</li> <li>iii. picture archiving communication systems (PACS)</li> </ul> </li> </ul> </li> <li>2. Identify potential employers through traditional and internet sources.</li> <li>3. Describe the role of electronic social networking in job search.</li> <li>4. Design sample résumés and cover letters.</li> </ul>	<p><b>Career Ready Practice:</b> 1, 2, 3, 4</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7</p> <p>Career Planning and Management: 3.1, 3.2, 3.3, 3.4, 3.5</p> <p>Technology: 4.1</p> <p>Responsibility and Flexibility: 7.2, 7.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 10 hours)	<ol style="list-style-type: none"> <li>5. Describe the importance of filling out a job application legibly, with accurate and complete information.</li> <li>6. Complete sample job application forms correctly.</li> <li>7. Describe the importance of enthusiasm on a job.</li> <li>8. Describe the importance of appropriate appearance on a job.</li> <li>9. Describe the importance of the continuous upgrading of job skills.</li> <li>10. Describe customer service as a method of building permanent relationships between the organization and the dental patient.</li> <li>11. Describe and demonstrate appropriate interviewing techniques.</li> <li>12. Identify the informational materials and resources needed to be successful in an interview.</li> <li>13. Design sample follow-up letters.</li> <li>14. Describe and demonstrate appropriate follow-up procedures.</li> </ol>	<p>Ethics and Legal Responsibilities: 8.4</p> <p>Leadership and Teamwork: 9.2</p> <p><b>CTE Pathway:</b> B3.3, B5.2, B5.6, B6.2, B6.6, B12.1, B12.2, B12.3, B12.4</p>
<p>F. REVIEW AND EVALUATION</p> <p>Complete state required number of exams within the mandated time period and pass final exams with at least 70%.</p>	<ol style="list-style-type: none"> <li>1. Pass each of the following final exams with at least 70%: <ol style="list-style-type: none"> <li>a. chest</li> <li>b. extremity</li> <li>c. torsoskeleton</li> <li>d. cranium</li> <li>e. core section <ol style="list-style-type: none"> <li>i. radiation protection</li> <li>ii. equipment operation and maintenance</li> <li>iii. image production and evaluation</li> <li>iv. patient care and management</li> </ol> </li> </ol> </li> <li>2. Demonstrate competency standards for chest, extremity, torsoskeletal, and cranial categories by: <ol style="list-style-type: none"> <li>a. calculating mAs when given mA and exposure time</li> <li>b. calculating mA when given mAs and exposure time</li> <li>c. positioning the patient effectively and accurately</li> <li>d. determining the central ray location effectively and accurately</li> <li>e. completing the examination in a timely manner</li> <li>f. producing optimum radiographic diagnostic quality</li> <li>g. producing optimum radiographic diagnostic quality</li> <li>h. optimizing functional critique skills</li> </ol> </li> <li>3. Demonstrate minimal competencies in the following sections of the X-Ray Technician course sequence: <ol style="list-style-type: none"> <li>a. orientation and general safety principles</li> <li>b. radiobiology and radiation safety</li> <li>c. radiologic physics</li> <li>d. principles of exposure and image quality</li> <li>e. image receptor system</li> <li>f. medical and radiologic terminology</li> <li>g. clinical assistant procedures</li> <li>h. film critique</li> </ol> </li> </ol>	<p><b>Career Ready Practice:</b> 1, 2, 5, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4, 2.7, 2.8</p> <p>Technology: 4.1</p> <p>Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6</p> <p>Health and Safety: 6.2</p> <p>Responsibility and Flexibility: 7.2</p> <p>Ethics and Legal Responsibilities: 8.1, 8.2, 8.3</p> <p><b>CTE Pathway:</b> B2.1, B2.2, B2.3, B2.4, B3.1, B3.2, B5.2, B5.6, B7.1, B12.1, B12.2, B12.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Theory: 15 hours)	<ul style="list-style-type: none"> <li>i. anatomy and physiology</li> <li>j. radiographic positioning</li> <li>k. employability skills</li> <li>l. digital radiography</li> <li>m. clinical experience</li> </ul> <p>4. Pass a final comprehensive exam with at least 80% accuracy.</p>	
<p>G. CLINICAL EXPERIENCE</p> <p>Demonstrate proficiency in clinical skills and radiographic procedures in a health care facility.</p>	<ul style="list-style-type: none"> <li>1. Review and demonstrate the following: <ul style="list-style-type: none"> <li>a. knowledge of selected medical and radiological terminology; the effects of and regulations for radiation exposure</li> <li>b. understanding of the parts, appropriate use, and care of the radiographic machine; the principles involved in the function of the radiographic machine</li> <li>c. professional and ethical standards for safe practice as an x-ray technician</li> <li>d. occupational safety standards, including usage of effective body mechanics and avoidance of physical hazards</li> <li>e. effective hand washing techniques</li> <li>f. effective patient transfer and ambulation techniques</li> <li>g. accurate interpretation of radiographic calculations and exposure conditions affecting the quality of radiographs</li> <li>h. steps necessary to develop radiographs</li> <li>i. knowledge of medical and radiologic terminology when documenting on a patient's chart</li> <li>j. obtaining radial pulse, counting respirations, obtaining temperature and blood pressure</li> <li>k. documenting vital signs on patient records according to clinics' policy</li> <li>l. evaluating the diagnostic and radiographic quality of radiographs, making modifications as needed</li> <li>m. combining basic clinical procedures skills and radiographic skills in a health care facility</li> </ul> </li> <li>2. Describe and demonstrate the following radiographic standards for the chest category: <ul style="list-style-type: none"> <li>a. effective and accurate positioning of the patient</li> <li>b. effective and accurate central ray location</li> <li>c. familiarity with the examination, so that it is completed in a timely manner</li> <li>d. optimum radiographic diagnostic quality</li> <li>e. optimum radiation protection for the patient, clinical personnel, and self</li> <li>f. well-organized critique skills</li> <li>g. attentiveness to the factors that affect radiographic quality</li> <li>h. effective interpretation of radiographic calculations and exposure conditions affecting the quality of radiographs</li> <li>i. responding appropriately to patient emergencies, as well as clinical emergencies</li> </ul> </li> </ul>	<p><b>Career Ready Practice:</b> 1, 2, 5, 6, 8, 10, 11</p> <p><b>CTE Anchor:</b> Communications: 2.1, 2.2, 2.3, 2.4, 2.6, 2.7 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 Health and Safety: 6.2 Responsibility and Flexibility: 7.4 Ethics and Legal Responsibilities: 8.2 Demonstration and Application: 11.1</p> <p><b>CTE Pathway:</b> B2.1, B2.2, B2.3, B2.4, B5.1, B5.2, B5.3, B5.6, B8.1, B8.2, B8.3, B8.4, B8.5, B9.1, B10.1, B10.2, B10.3, B10.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(Clinical 390 hours)	3. Describe and demonstrate: <ol style="list-style-type: none"> <li>a. proper imaging procedures under the appropriate level of supervision</li> <li>b. completion of 40 actual patient cranial exams (plus 60 phantoms) required by the State within the mandated time period of 12 consecutive months</li> </ol>	

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

### **TEXTBOOKS**

Bontrager, Kenneth L. and John Lampignano. Textbook of Radiographic Positioning and Related Anatomy, 7<sup>th</sup> Edition. Elsevier Health Science, 2009.

Bushong, Stewart C. Radiologic Science for Technologists: Physics, Biology, and Protection, 9<sup>th</sup> Edition. Elsevier Health Sciences, 2008.

Campeau, Frances E. and Jeana Fleitz. Limited Radiography, 2<sup>nd</sup> Edition. Cengage Learning, 1999.

Carlton, Richard R. and Arlene M. Adler. Principles of Radiographic Imaging: An Art and a Science, 4<sup>th</sup> Edition. Cengage Learning, 2005.

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

Edge, Raymond S. and John R. Groves. The Ethics of Health Care: A Guide for Clinical Practice, 3<sup>rd</sup> Edition. Cengage Learning, 2005.

Forshier, Steve. Essentials of Radiation, Biology and Protection, 2<sup>nd</sup> Edition. Cengage Learning, 2008.

Gurley, Laverne T. and William J. Callaway. Introduction to Radiologic Technology, 6<sup>th</sup> Edition. Elsevier Health Science, 2006.

Kowalczyk, Nina and Kathleen Donnett. Integrated Patient Care For the Imaging Professional. Elsevier Health Sciences, 1996.

Statkiewicz-Sherer, Mary Alice, E. Russell Ritenour, and Paula j. Visconti. Radiation Protection in Medical Radiography, 6<sup>th</sup> Edition. Elsevier Health Sciences, 2010.

Thibodeau, Gary A. and Kevin T. Patton. Structure and Function of the Body, 13<sup>th</sup> Edition. Elsevier Health Sciences, 2007.

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

## **RESOURCES**

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

Employer Advisory Board members

Foundation Standards

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

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

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

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

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

## **COMPETENCY CHECKLIST**

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

### **METHODS AND PROCEDURES**

- A. 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. Films, videos
  - 2. PowerPoint presentations
  - 3. Mock-ups
  - 4. Audio-visuals, CD-ROMs
  - 5. Radiographs
- D. Clinical activities

### **EVALUATION**

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

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

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

SECTION D – Digital Radiography – Pass all assignments and exams on digital radiography with a minimum score of 80% or higher.

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

SECTION F – Review and Evaluation – Pass all assignments and exams on review and evaluation with a minimum score of 80% or higher.

SECTION G – Clinical Experience – Pass all assignments and exams on employability skills review with a minimum score of 80% or higher.

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### Statement for Civil Rights

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

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