Imaging Technology II Clinical

PEIMS Code: N1302131
Abbreviation: IMGTEC2
Grade Level(s): 11-12
Award of Credit: 2.0

Approved Innovative Course

- Districts must have local board approval to implement innovative courses.
- In accordance with Texas Administrative Code (TAC) §74.27, school districts must provide instruction in all essential knowledge and skills identified in this innovative course.
- Innovative courses may only satisfy elective credit toward graduation requirements.
- Please refer to TAC §74.13 for guidance on endorsements.

Course Description:

The Imaging Technology II Clinical course provides students with the opportunity to build upon the knowledge learned in Introduction to Imaging Technology and Imaging Technology I. The course prepares students to take the Limited Medical Radiologic Technician Licensing Exam (LMRT) by increasing their depth of knowledge in anatomy, radiology-based physics, positioning, radiation protection, radiation biology, patient care, ethics, imaging techniques, correcting imaging errors, image storage, and equipment while participating in clinical rotations. Additionally, students will identify errors within the radiographic image and describe how to correct the errors. Imaging Technology II Clinical incorporates a clinical component that allows students to gain hands-on experience. This course is recommended for students grades 11-12.

Essential Knowledge and Skills:

(a) General Requirements. This course is recommended for students in 11-12. Recommended prerequisite: Introduction to Imaging Technology. Required prerequisite: Imaging Technology I. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and Technical Education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

(3) The Imaging Technology II Clinical course provides students with the opportunity to further their education in radiographic imaging. Students will develop a better understanding of radiographic physics, anatomy, equipment, and obtaining and correcting radiographic images. Students are given the opportunity to learn hands-on by participating in the clinical portion of this course. Imaging Technology II Clinical helps prepare students for college, career, and military readiness by allowing the student the opportunity to obtain an industry-based certification, enter the workforce upon graduation from high school, or transition to a post-secondary institution with the prior knowledge to be successful in a radiology career field.

(4) To pursue a career in the health science industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(5) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to apply the knowledge and skills necessary to pursue a career in health science through further education and employment.

(6) Professional integrity in the health science industry is dependent on the acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities, recognize limitations, and understand the implication of their actions.

(7) Students are expected to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(8) Statements that contain the word “including reference content that must be mastered, while those containing the phrase “such as” are intended as possible illustrative examples.

(c) Knowledge and Skills.

(1) The student demonstrates professional standards and employability skills as required by the industry of medical imaging. The student is expected to:

(A) demonstrate written and verbal communication in a clear, concise, and effective manner;

(B) cooperate, contribute, and collaborate as a member of a team;

(C) model employer expectations such as punctuality, attendance, time management, personal hygiene, proper dress, communication, organizational skills, and productive work habits;

(D) deliver oral presentations;

(E) research the employment process for a chosen imaging career; and

(F) create a resume for employment in the imaging industry.

(2) The student applies mathematics, science, English language arts, and social studies in medical imaging. The student is expected to:

(A) solve mathematical calculations relating to medical imaging;

(B) convert International System of Units (SI) units;

(C) solve equations using the inverse square law;

(D) interpret data from tables, charts, and graphs to provide solutions to medical imaging problems;

(E) interpret complex technical material related to medical imaging; and

(F) apply critical thinking and problem solving to make informed decisions.

(3) The student explains proper interactions with patients. The student is expected to:

(A) communicate effectively with patients in a simulated setting, including using strategies to improve patient understanding of procedures and patient education;

(B) demonstrate proper physical assistance, including patient transfers, body mechanics, fall prevention, and assisting with medical equipment;

(C) report documentable information according to professional standards and facility policy;

(D) discuss the importance of infection control and how to prevent the spread of infections, including identifying the cycle of infection, modes of transmission, and standard precautions;

(E) demonstrate proper handwashing techniques;

(F) identify asepsis techniques and equipment;

(G) evaluate physical signs and symptoms for possible changes in radiographic procedure; and

(H) model cardiopulmonary resuscitation (CPR), first aid, and vital signs as applied to radiography in a simulated setting, including allergic reactions to contrast, physical injury, seizures, and diabetic reactions.

(4) The student explains the ethical and legal responsibilities of medical imaging professionals. The student is expected to:

(A) describe the legal terms and consequences associated with radiation and patient errors;

(B) differentiate between negligence, liability, and regulatory law;

(C) discuss the elements of a medical negligence lawsuit;

(D) compare personal and professional liability; and

(E) perform examinations within the designated medical imaging scope of practice in a simulated setting.

(5) The student recognizes the rights and choices of the individual. The student is expected to:

(A) model activities demonstrating patient choices within medical imaging;

(B) summarize the process of image and patient identification;

(C) analyze documentation related to patient rights and choices such as the patient's bill of rights;

(D) examine ethical issues related to patient rights, including Health Insurance Portability and Accountability Act (HIPAA), informed consent, and access to information;

(E) explain legal doctrines, including *respondeat superior* and *res ipsa loquitur*;

(F) compare the ethical use of restraints and immobilization devices as related to the medical imaging field; and

(G) research and describe how diversity and culture influence healthcare practices.

(6) The student investigates the structure of the human body as it pertains to imaging modalities. The student is expected to:

(A) explain medical terminology related to the anatomy and physiology of the chest, extremities, skull, sinuses, and spine;

(B) demonstrate knowledge of anatomical structures found in the chest, extremities, skull, sinuses, and spine;

(C) analyze the anatomical structures found in the chest, extremities, skull, sinuses, and spine;

(D) evaluate the physiology of the structures found in the chest, extremities, skull, sinuses, and spine; and

(E) research basic pathologies related to body systems found in the chest, extremities, skull, sinuses, and spine.

(7) The student uses proper terminology related to the health science and imaging technology industry. The student is expected to:

(A) differentiate between radiographic position, projection, and view;

(B) demonstrate the proper uses of anatomical positioning and directional terms relating to radiography such as anterior, posterior, superior, inferior, medial, lateral, proximal, and distal;

(C) apply proper medical terminology to critique radiographs; and

(D) analyze and articulate the use of medical abbreviations, acronyms, and symbols related to the imaging technology industry.

(8) The student demonstrates the concepts of positioning. The student is expected to:

(A) model appropriate equipment placement for routine examinations, including placement of source image receptor distance (SID), computed radiography (CR), bucky tray, imaging plate, collimator, x-ray tube, and x-ray field;

(B) model appropriate positioning for routine radiology examinations, including chest, extremities, spine, skull, and sinuses;

(C) modify basic positioning for common imaging procedures to accommodate patient needs; and

(D) create a protocol manual for basic radiographic procedures for the chest, extremities, skull, sinuses, and spine based on synthesized knowledge from clinical experience.

(9) The student applies and analyzes concepts of x-ray production. The student is expected to:

(A) identify the components of a step-up generator;

(B) describe the x-ray circuit;

(C) describe the path of electricity through a step-up generator;

(D) compare single-phase, three-phase, and high-frequency power;

(E) apply concepts of electrodynamics to radiation production; and

(F) apply the inverse square law to beam intensity, dosage, and image quality.

(10) The student identifies and defines the importance of equipment used in radiology exam rooms. The student is expected to:

(A) explain the purpose and function of the parts of the x-ray tube, including the cathode, anode, glass enclosure, focusing cup, filament, target, window, collimator, and rotating anode;

(B) explain quality control of imaging equipment and accessories, including reporting malfunctions, maintenance, quality control (QC) test, and testing shielding accessories;

(C) integrate the knowledge of basic imaging equipment to demonstrate proper usage in multiple situations;

(D) identify components of digital imaging, including CR components and digital radiography (DR) imaging receptors; and

(E) identify imaging informatics such as Digital Imaging and Communications in Medicine (DICOM), picture archiving and communication system (PACS), and electronic medical records (EMR).

(11) The student defines an x-ray beam and understands the factors that affect it. The student is expected to:

(A) identify the effects of the x-ray beam on sample x-rays;

(B) describe the factors affecting the quality of the x-ray beam;

(C) compare and contrast x-ray quantity and intensity;

(D) compare the effects of increasing or decreasing the intensity of the x-ray beam; and

(E) compare the Compton effect and photoelectric effect and how they affect the x-ray beam.

(12) The student simulates imaging techniques and interprets their effects on image quality. The student is expected to:

(A) describe how to correct image artifacts, including geometric factors,

(B) describe factors that improve radiographic image quality;

(C) identify National Council on Radiation Protection and Measurements (NCRP) recommendations for filtration;

(D) interpret image errors related to grid problems;

(E) compare exposure technique charts such as anatomically programmed technique, caliper measurement, and fixed versus variable kilovoltage peak (kVp); and

(F) demonstrate technique factor correction in a simulated setting.

(13) The student describes the process of image acquisition. The student is expected to:

(A) describe image processing and display techniques, including raw data, corrected data, and post-processing;

(B) explain automatic exposure controls;

(C) demonstrate proper image acquisition technique in a simulated setting;

(D) analyze digital imaging characteristics, including pixel characteristics, detector elements, and matrix size; and

(E) analyze image signal, including dynamic range, quantum noise, signal-to-noise ratio, and contrast to noise ratio.

(14) The student applies the concepts of radiation protection. The student is expected to:

(A) calculate and document radiographic dose;

(B) determine appropriate As Low As Reasonably Achievable (ALARA) equipment and technique to be used in a simulated setting;

(C) identify minimum lead equivalents required for radiography;

(D) compare the recommendations for occupational exposure, public exposure, and dose equivalent limits;

(E) research different types of dosimeters; and

(F) interpret dosimetry records for appropriate dosage limits.

(15) The student identifies and applies fundamental principles of radiobiology. The student is expected to:

(A) describe the Law of Bergonié and Tribondeau;

(B) identify somatic effects, including short-term effects, long-term effects, chronic effects, and carcinogenesis;

(C) summarize the physical factors that affect radiosensitivity, including linear energy transfer and relative biologic effectiveness;

(D) compare the linear and nonlinear dose-response relationships;

(E) describe factors related to radiosensitivity, including oxygen effect, relative tissue radiosensitivity, and cell survival and recovery;

(F) explain embryonic and fetal risks of radiation exposure;

(G) summarize the genetic impact of radiation; and

(H) analyze the effects of acute radiation syndromes.

Recommended Resources and Materials:

Campeau, Frances, and Jeana Fleitz. *Limited Radiography*, *4th ed*. CENGAGE Learning Custom Publishing, 2016.

Stewart C. Bushong. *Radiologic Science for Technologists: Physics, Biology, and Protection*, *11th ed*. Mosby, 2016.

Bushong, Stewart Clareyle. Workbook for Radiologic Science for Technologists: Physics, Biology, and Protection, 11th ed. Mosby, 2017.

Long, Bruce W., Jeannean Hall Rollins, Barbara Smith, and Tammy Curtis. *Merrill's Atlas of Radiographic Positioning and Procedures, 14th ed*. Mosby, 2019.

Long, Bruce W., Eugene Frank, and Ruth Ann Ehrlich. *Radiography Essentials for Limited Practice*. 2016.

Cochard, Larry, Loria Goduartz, Nancy Carlaarmath, and Srinivasan Mukundan Jr. *Netter's Introduction to Imaging: With Student Consult Access, 1st ed*. Saunders, 2011.

Recommended	TYPE OF RESOURCE	WHERE TO FIND
Anatomage Table	Classroom manipulative	https://www.anatomage.com/table
Anatomy AR+	Interactive 3D anatomy model that works with Merge Cube	https://www.hybridmedicalanimation.com
Anatomy.tv	Digital resource	https://www.anatomy.tv/
ASRT newsroom articles	Scholarly articles. Student resources to reinforce ELA and critical thinking	https://www.asrt.org/main/news-publications
Cassettes: 17" x 14", 14" x 14", 10" x 12" and 8" x 10"	Classroom resource	https://pixray.com/
Laptop/iPad	Digital resource	
Lead aprons/shields	Classroom manipulative	https://pixray.com/
Merge cube	Classroom manipulative	https://mergeedu.com/cube
Positioning sponges	Classroom manipulative	https://pixray.com/
Radiology phantoms transparent	Classroom manipulative	https://www.gtsimulators.com/X-Ray-Phantoms-Radiology-Training-Phantoms-and-Simulator-s/208.htm
radtechbootcamp.com	Digital resource	https://www.radtechbootcamp.com/

Treatment table (unupholstered)	For positioning labs. Upholstery can cause misalignment and when placing a cassette, it could damage the table.	https://www.tigermedical.com/Products/Portable-Taping-and-Treatment-Table HAU7645.aspx?invsrc=adwords tm&gclid=Cj0KCQiA04XxBRD5ARIsAGFygj-QkauPvSZa1RdouTtMJw81H_hiS5Mz-DDmn6zRHUzRgVjTPMuBogQaAvNvEALw_wcB
X-ray markers	Classroom manipulative	https://pixray.com/

Recommended Course Activities:

- Participate in clinical site shadowing
- Simulate positioning, patient safety, and patient care labs
- Research and prepare preparation of presentations using technology for oral presentations
- Anatomical landmark lab and presentation
- Image quality identification lab
- Vocabulary activities
- Labs related to radiation physics
- Read and interpret content-specific supplemental materials, such as dosage reports, technique charts, doctor's orders, etc.
- Gallery walks

Suggested methods for evaluating student outcomes:

Student outcomes may be evaluated through a variety of methods, including:

- Classroom assignments
- Individual and group projects
- Interviews
- Lab assessments for positioning of skull, sinuses, chest, and lower and upper extremities
- Quizzes
- Mock certification exams over limited content
- Tests
- Final exam
- Clinical site performance

Teacher qualifications:

An assignment for Imaging Technology II Clinical is allowed with one of the following certificates:

- Health Science: Grades 6 – 12
- Health Science Technology Education Certification 8 – 12 with a background in radiology
- Vocational Health Occupations
- Vocational Health Science Technology

The following licensures are also preferred:

- American Registry of Radiologic Technologists (ARRT) certification, and/or

- Limited Scope Medical Radiologic Technologist License.

Additional information:

Required training for the instructor:

- American Society of Radiologic Technologists: Clinical Instructor Academy ($110.00) https://www.asrt.org/main/continuing-education/earn-ce/featured-ce/clinical-instructor-acad-credit

List of optional trainings:

- THOA – Texas Health Occupations Associations
- CTE (Career and Technical Education) Training
- CTAT Career and Technical Association of Texas
- Clover Leaf Learning - www.RadTechBootcamp.com