# Introduction to Imaging Technology

PEIMS Code: N1302102
Abbreviation: IMGTECH
Grade Level(s): 9–10
Award of Credit: 1.0

## 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 *Introduction to Imaging Technology* course provides students an introduction to the basic principles, guidelines, and knowledge needed for members of the medical imaging field. This course will provide the student with an overview of radiography and its role within the health care system, including basic radiologic terminology, equipment, basic image production, patient positioning, and radiation safety. The student will study human anatomic structures and organs, as well as the standard positioning associated with the chest, abdomen, upper and lower extremities. This course is recommended for students grades 9-10 interested in the medical imaging field.

## Essential Knowledge and Skills:

(a) General Requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provide 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 Introduction to Imaging Technology course provides students an introduction to the basic principles, guidelines, and knowledge needed for members of the medical imaging field. This course will provide the student with an overview of radiography and its role within the health care system, including basic radiologic terminology, equipment, basic image production, patient positioning, and radiation safety. The student will study human anatomic structures and organs, as well as

the standard positioning associated with the chest, abdomen, upper and lower extremities.

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

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

(7) 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/employability skills as required by business and industry of medical imaging. The student is expected to:

(A) express ideas in a clear, concise, and effective manner;

(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team;

(C) identify and adhere to employer expectations such as punctuality, attendance, time management, communication, organizational skills, and productive work habits; and

(D) prepare and deliver effective oral presentations.

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

(A) convert units between systems of measurement;

(B) apply data from tables, charts, and graphs to provide solutions to health-related problems;

(C) interpret technical material related to the health science industry;

(D) organize and compose reports and summaries;

(E) formulate responses and communicate ideas using precise language;

(F) research the historical significance of radiology;

(G) use critical thinking and problem solving to make informed decisions; and

(H) evaluate models according to their limitations in representing biological objects or events.

(3) The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations;

(B) discuss the proper use and conservation of resources and the proper disposal or recycling of materials;

(C) obtain and analyze data with physical equipment or in a simulated environment;

(D) analyze data with physical equipment or in a simulated environment; and

(E) analyze observations that extend beyond the classroom.

(4) The student uses verbal and nonverbal communication skills necessary for medical imaging. The student is expected to:

(A) identify components of effective and ineffective communication;

(B) demonstrate effective communication skills including responding to the needs of individuals in a diverse society; and

(C) accurately interpret, transcribe, and communicate medical vocabulary appropriate to medical imaging.

(5) The student identifies academic preparation, career options, and the requirements for employment in the medical imaging industry. The student is expected to:

(A) evaluate career options and employment information;

(B) recognize the impact of career decisions, including the causes and effects of changing employment situations;

(C) identify academic requirements for professional advancement such as certifications, licensure, registration, continuing education, and advanced degrees; and

(D) explain the concept of teaming to provide quality health care.

(6) The student demonstrates knowledge of the modalities related to medical imaging. The student is expected to:

(A) identify different imaging modalities;

(B) identify the collaborative role of team members between imaging modalities;

(C) compare and contrast different imaging modalities; and

(D) investigate terminology related to additional imaging modalities such as: fluoroscopy, sonography, nuclear medicine, magnetic resonance imaging (MRI), computerized tomography (CT), mammography, bone densitometry, positron emission tomography (PET), and fusion studies.

(7) The student interprets ethical behavior standards and legal responsibilities as a radiographer. The student is expected to:

(A) compare published professional medical codes of ethics and imaging technology scope of practice within medical imaging;

(B) explain principles of ethical behavior and confidentiality, including the consequences of breach of confidentiality;

(C) discuss ethical issues related to radiology, including implications of technological advances;

(D) examine issues related to malpractice, negligence, and liability; and

(E) research laws governing the radiology industry.

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

(A) identify independent activities within medical imaging;

(B) review documentation related to patient rights and choices; and

(C) discuss diversity and cultural practices influencing contemporary aspects of radiology.

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

(A) identify anatomical landmarks and structures of various systems including integumentary, nervous, skeletal, muscular, cardiovascular, respiratory, digestive, urinary, immune, endocrine, and reproductive systems;

(B) identify and compare anatomical structures in sagittal, frontal/coronal, transverse, and oblique body planes including systems of the: integumentary, nervous, skeletal, muscular, cardiovascular, respiratory, digestive, urinary, immune, endocrine, and reproductive systems;

(C) analyze the relationships between the anatomical structures of the systems including integumentary, nervous, skeletal, muscular, cardiovascular, respiratory, digestive, urinary, immune, endocrine, and reproductive systems; and

(D) analyze the physical and biological properties of transport systems, including circulatory, respiratory, and excretory.

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

(A) locate and explain the anatomical contents of the quadrants of the human abdomen;

(B) identify the regions of the abdomen in reference to correct anatomical positions;

(C) discuss the importance of anatomical positioning and directional terms such as anterior, posterior, superior, inferior, medial, lateral, proximal, and distal;

(D) translate medical abbreviations, acronyms, and symbols related to the imaging technology industry; and

(E) interpret and describe basic radiography terminology such as x-ray, radiograph, source to image distance (SID), computed radiography (CR), landmarks, radiographic image, imaging plate, technique, density, contrast, kilovoltage peak (kVp), milliampere-seconds (mAs), and x-ray field.

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

(A) demonstrate proper positioning for common imaging procedures;

(B) explain the relationships between anatomy and positioning; and

(C) compare the concepts of position, projection, and view as related to radiography.

(12) The student identifies and applies concepts of radiologic physics. The student is expected to:

(A) describe the different types of energy;

(B) describe and apply radiologic units of measurement;

(C) describe the concepts of electricity measurements used in medical imaging;

(D) explain how Newton's laws of motion apply to radiology;

(E) identify and explain the different parts of an atom;

(F) explain the process of creating ionizing radiation;

(G) compare different types of ionizing radiation;

(H) describe and calculate wave frequency and how it relates to the electromagnetic spectrum; and

(I) explain the concepts of mass.

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

(A) identify the parts of an x-ray imaging room, such as the overhead tube, exam table, lead curtain, bucky slot cover, lead apron and gloves, protective viewing window, and upright bucky;

(B) identify the parts of an x-ray tube such as cathode, anode, glass enclosure, focusing cup, filament, target, window, collimator, and rotating anode;

(C) describe the uses of imaging equipment; and

(D) demonstrate proper use of basic equipment.

(14) The student demonstrates knowledge of an x-ray beam. The student is expected to:

(A) describe how x-rays interact with matter;

(B) describe how attenuation affects beam quality;

(C) explain the different types of radiation;

(D) analyze the factors affecting x-ray beam quantity and optical density;

(E) compare how changes to standard measurements, kVp and mAs, affect image production; and

(F) calculate and apply the inverse square law relating to medical imaging technique.

(15) The student compares imaging techniques and their effects on image quality. The student is expected to:

(A) explain radiographic exposure;

(B) demonstrate imaging techniques and how they affect image quality;

(C) compare and contrast radiographic images for image quality, artifacts, and processor malfunctions; and

(D) compare changes that affect radiologic technology.

(16) The student understands the significance of radiation protection principles and how to minimize radiation exposure for patients. The student is expected to:

(A) identify basic principles of radiobiology;

(B) identify radiation protection procedures such as the use of lead shielding, and explain when to use them;

(C) identify the cardinal principles of time, distance, and shielding;

(D) describe the concept of collimation and its importance to radiation protection and image quality;

(E) describe how risk management techniques are used in reference to radiation protection;

(F) describe the effects of radiation on human health;

(G) summarize the concept of as low as reasonably achievable (ALARA) and how it is used in the practice of radiation protection; and

(H) compare the concepts of risk management in medical imaging such as patient transport, equipment malfunctions, and test accuracy.

## Recommended Resources and Materials:

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

FACMP, Stewart C. Bushong ScD FACR. Radiologic Science for Technologists: Physics, Biology, and Protection. 11 edition, Mosby, 2016.

---. Workbook for Radiologic Science for Technologists: Physics, Biology, and Protection. 11 edition, Mosby, 2017.

FASRT, Bruce W. Long MS RT(CV), Jeannean Hall Rollins MRC BSRT(CV), et al. Merrill's Atlas of Radiographic Positioning and Procedures - 3-Volume Set. 14 edition, Mosby, 2019.

FASRT, Bruce W. Long MS RT(CV), Barbara J. Smith MS RT(QM) FASRT FAEIRS, et al. Workbook for Merrill's Atlas of Radiographic Positioning and Procedures. 14 edition, Mosby, 2018.

Long, Bruce W., et al. Radiography Essentials for Limited Practice. 2016.

PhD, Larry R. Cochard, et al. Netter's Introduction to Imaging: With Student Consult Access. 1 edition, Saunders, 2011.

Classroom resources and technology:

| Item | Type of resource | Where to find |
|---|---|---|
| Anatomage table | Classroom manipulative | https://www.anatomage.com/table/ |
| Anatomy AR+ | Interactive 3D anatomy model that works with | https://www.hybridmedicalanimation.com/ |

| | | |
|---|---|---|
| | Merge cube | |
| 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”x14”, 14”x14”, 10”x12”, and 8”x10” | Classroom resource | https://pjxray.com/ |
| laptop/ipad | Digital resource | |
| Lead aprons/shields | Classroom manipulative | https://pjxray.com/ |
| Merge cube | Classroom manipulative | https://mergeedu.com/cube |
| Positioning sponges | Classroom manipulative | https://pjxray.com/ |
| Radiology phantoms, transparent | Classroom manipulative | https://www.gtsimulators.com/X-Ray-Phantoms-Radiology-Training-Phantoms-and-Simulators-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://pjxray.com/ |

**Recommended Course Activities:**

- Simulation positioning lab
  - AP (anteroposterior), PA (poster-anterior), lateral, oblique, axial, etc.
- Simulation patient safety lab
- Research and preparation of presentations using compute technology
- Give oral presentations
- Anatomical landmark lab and presentation
  - Practice identifying for anterior, posterior, superior, inferior, medial, lateral proximal distal, etc.

- Image quality identification lab
- Vocabulary activities
    - Vocabulary includes: x-ray, radiograph, SID, CR, landmarks, radiographic image, imaging plate, technique, density, contrast, kVp, mAs, and x-ray field
- Simulation patient care labs
- Labs related to radiation physics
    - Include converting units, such as current, voltage, direct current, alternating current, resistance, and different types of circuits.
- Read test assignments and related supplemental materials
- Conduct simulation labs
- 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
- Surveys
- Labs assessments for positioning of chest and lower and upper extremities
- Quizzes
- Mock Certification Exams over limited content
- Tests
- Final exam

**Teacher qualifications:**

An assignment for Introduction to Imaging Technology 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 trainings for the instructor:

- American Society of Radiologic Technologist: Clinical Instructor Academy - $110