

STATE OF OREGON



Board of Medical Imaging

PHONE 971.673.0215

www.oregon.gov/obmi

				Instructor Manual					
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				Limited X-Ray Machine Operator Training Course					

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Table of Contents

INTRODUCTION	3
COURSE CONTENT	4
PROGRAM REQUIREMENTS	6
DIRECTOR	6
INSTRUCTORS	7
FACILITIES.....	8
STUDENT POSITIONING PRACTICE	8
COURSE OBJECTIVES	9
RADIOGRAPHIC PROCEDURES and POSITIONING	9
VIEW SELECTION	10
ANATOMY	10
TECHNIQUE	11
EQUIPMENT OPERATION and X-RAY PRODUCTION	12
RADIATION PROTECTION (CORE)	13
EXAMINATION.....	14
PROCESS TO OBTAIN A PERMANENT LIMITED PERMIT	14

INTRODUCTION

The purpose of the Limited X-ray Machine Operator (LXMO) course is to give students the opportunity to learn and be able to demonstrate basic principles of Radiation Protection, Quality Control, Equipment Operation, Image Production and Evaluation, Patient Care, and Radiographic Procedures. The course must be directed toward individuals working in radiography who are not and cannot be ARRT certified. The radiographic principles taught in this course should be designed for the LXMO who has a limited science and medical background. The course must cover the following:

- Basic radiographic principles
- Radiographic Procedures
- Digital -image production
- Radiographic techniques formulation
- Patient care
- Radiation protection

A signed and dated certificate must be issued to the student upon successful completion of the course.

I. COURSE CONTENT

The following is a topical outline containing **minimum** guidelines, which do not necessarily show the sequence in which the material should be presented. As an instructor, you shall submit to the board for approval your own course outline that includes the subjects listed on the following pages.

The course consists of three parts:

1. Core Module covering Radiation Protection Equipment Operation, Quality Control, Image Production and Evaluation, and Patient Care;
2. Radiographic Procedure Module(s) covering the Positioning and Techniques, for each specific body part, approved for LXMO permits;
3. Practical Experience

The Core Module portion of the course must contain a minimum of 52 hours of instruction approved by the Board and reflect the current Core Module of the “**Content Specifications for the Examination for the Limited Scope of Practice in Radiography**” published by the American Registry of Radiologic Technology. The curriculum shall include, but is not limited to:

- **SAFETY:**
 - Radiation physics
 - Radiation Protection, including Personnel Protection
 - Radiation exposure, monitoring, and radiation units
 - Biological effects of radiation
 - Low-dose technique and minimizing patient exposure
 - Applicable Federal and State radiation regulations
- **Image Production**
 - Principle of the radiographic equipment
 - Image Acquisition and Technical Evaluation
 - Equipment Operation and Quality Assurance
 - Developing and using technique charts
- **Patient Care**
 - Cultural Diversity

The Radiographic Procedures portion of the course must meet the minimum hourly requirements listed below; reflecting the current Radiographic Procedure Module for of the “**Content Specifications for the Examination for the Limited Scope of Practice in Radiography**” published by the American Registry of Radiologic Technology. Delivered by a Board approved instructor, the curriculum shall include, but is not limited to:

Skull/Sinus	18 hours
Spine	30 hours
Chest	12 hours
Extremities	60 hours
Podiatric	10 hours

The Practical Experience component of the graduate’s training must consist of experience with live patients during which images are acquired and the finished radiographic images are made available to the Practical Experience Evaluator for critique.

In order to practice on live patients, a student must first complete the coursework, pass the state ARRT examination and obtain graduate status.

Then, the graduate must obtain a temporary permit to successfully complete a practical experience program approved by the Board specific to each category for which the applicant seeks a LXMO Permanent permit. The graduate’s temporary limited permit can only include the anatomic areas that the applicant successfully completed during the course of instruction, as reflected on the course completion certificate.

The practical experience component must consist of experience with live patients personally supervised (present in the room during radiographic exposures) by a licensed radiographer, radiologist, or license physician, licensed nurse practitioner or licensed physician assistant with adequate training in radiography in accordance with RPS rules, or a person who has been actively taking x-rays under the authority of a permanent limited permit within the immediate previous twelve months in the same anatomic area that is being imaged. Processed images made by the graduates are evaluated and critiqued by an ARRT-registered, Oregon-licensed radiographer Practical Experience Evaluator. The graduate shall be evaluated for imaging by using either the On-Site or Peer Positioning Practical Experience Evaluation Form developed by the Board. The Practical Experience Evaluator must provide the graduate with a certificate of completion in the categories in which the graduate has successfully completed practical experience.

II. PROGRAM REQUIREMENTS

Prior to the first class meeting, Board approval to offer the course is required. In order to receive approval, please meet these requirements and provide the Board with the following information:

1. The portions of the limited permit course you plan to teach.
2. The number of classroom hours for each portion.
3. The location of the course.
4. The topics that will be covered in each portion of the course.

If you don't plan to follow the enclosed outlines for the didactic portions of the course, please provide the Board with a detailed outline of the topics you plan to cover.

Additionally, please provide detailed information about how you plan for the practical experience requirement to be fulfilled, after the coursework is completed, including any types of examinations your students will be required to perform on live patients.

If you plan to offer limited permit classes on a continual basis, please request approval annually by submitting to the Board an outline of the program and the names of all Board approved instructors. The deadline for your annual submittal is July 1; the Board will remind you of this obligation.

A. DIRECTOR

1. Currently licensed, and in good standing in Diagnostic Radiologic Technology and
2. Currently ARRT certified (No CE Probation) in Diagnostic Radiologic Technology and
3. 10,000 hours of documented diagnostic experience in Radiologic Technology or
4. A licensed physician acceptable to the Board

B. INSTRUCTORS

1. Formal teaching method of newly approved instructors will be evaluated by the Board on a case-by-case basis. This assessment will include the use of:
 - a. Instructional aids
 - b. Demonstration methodology
 - c. Handouts/study materials
 - d. Curriculum guide
 - e. Personal interview with a site survey member

2. Qualifications of Radiation Protection Instructors
 - a. Currently ARRT certified (No CE Probation) in Diagnostic Radiologic Technology; and
 - b. Currently licensed, in good standing for at least two years in Diagnostic Radiologic Technology; and
 - c. 4,000 hours of documented diagnostic experience in Radiologic Technology; or
 - d. Medical Radiation Physicist; or
 - e. Doctor of Medicine, Osteopathy, Chiropractic or Podiatric Medicine, board qualified in Diagnostic Radiology.

3. Qualification of Equipment Operation, Quality Control, Image Production, Image Evaluation, and Patient Care Instructors
 - a. Currently ARRT certified (No CE Probation) in Diagnostic Radiologic Technology; and
 - b. Currently licensed, in good standing for at least two years in Diagnostic Radiologic Technology; and
 - c. 4,000 hours of documented diagnostic experience in Radiologic Technology; or
 - d. Licensed physicians qualified in diagnostic radiography.

4. Qualifications of Radiographic Procedure Modules Instructors
 - a. Currently ARRT certified (No CE Probation) in Diagnostic Radiologic Technology; and
 - b. Currently licensed, in good standing for at least two years in Diagnostic Radiologic Technology; and
 - c. 4,000 hours of documented diagnostic experience in Radiologic Technology; or
 - d. As an exception to the above qualifications, lectures associated with positioning classes may be given by a physician who is board qualified/certified in Diagnostic Radiology (based on their scope of practice).

C. FACILITIES

1. Minimum of one energized X-ray machine available for student use under the direct supervision of the Board approved training program instructor, for Radiation Protection, Image Production and Evaluation labs. X-ray simulator units can be used for anatomic positioning demonstrations.
2. Digital imaging equipment
3. Technique charts designed for the type of equipment being used, specifically correlated to each control panel utilized by students.
4. Distant classes must be conducted via simultaneous live audio and video conferencing with a class instructor present in all locations for the entirety of each session.

D. STUDENT POSITIONING PRACTICE

During positioning practice and labs, after demonstration and explanation by the instructor, the student will:

1. Demonstrate on a peer or other instructor the proper patient positioning, tube alignment and angulations, and film or image receptor position for all major and most secondary views that pertain to the anatomical area being taught as outlined in the "Content Specifications for the Examination for the Limited Scope of Practice in Radiography" published by the ARRT.
2. Prior to being allowed to perform positioning on live patients, the student will demonstrate proficiency in performing the appropriate positions in a simulated setting. Also, the student will need to obtain a temporary permit from the OBMI before positioning live patients.

III. COURSE OBJECTIVES

NOTE: The following course objectives should be used in correlation with the “**Content Specifications for the Examination for the Limited Scope of Practice in Radiography**” published by the American Registry of Radiologic Technologists.

A. RADIOGRAPHIC PROCEDURES and POSITIONING

1. Name the position/projection when given a description of the position/projection.
2. When given a specific projection for a specific anatomic part, select the aspect of the part that is in contact with the image receptor.
3. Name and select the appropriate landmarks when given a specific projection for a specific anatomic structure.
4. Identify the proper alignment of the body plane to the image receptor for a specific projection for a specific anatomic structure.
5. Identify the orientation of the central ray relative to the specific body plane, the image receptor and the specific anatomic structure when given a specific projection for a specific anatomic structure.
6. Identify the appearance of a specific anatomic structure when that structure is properly positioned.
7. Give the reason for a general requirement of correct positioning for a specific projection. Describe the specific positioning method required and/or a description of the radiographic evidence verifying the correct positioning.
8. Identify common positioning errors for a specific projection.
9. Describe an appropriate modification of a usual positioning technique for a specific examination when pathologic conditions require modification of the usual technique.
10. Identify the correct orientation of a reference line to the image receptor and/or the orientation of the central ray to a reference line of a specific projection.

B. Exam Selection

1. Select the anatomic structure(s) best demonstrated or not well demonstrated and/or pathology that must be demonstrated when given the name of a specific projection or examination.
2. Select the appropriate projections or positions and/or the most common projections when given an anatomic structure or an area to be radiographed.
3. When given the name or description of a specific pathologic condition, select the appropriate projection(s)/position(s) that will demonstrate that specific pathologic condition.
4. When given an anatomic diagram designating a specific structure, select the appropriate projection/position to demonstrate the designated structure.
5. When given a specific description of a specific fracture, select the name of the fracture or fracture type.

C. ANATOMY

1. When given an anatomic term, select its synonym and/or its definition.
2. When given the name of an anatomic structure, identify the following:
 - a. a description of the structure
 - b. a description of its location
 - c. the name(s) of one or more components
 - d. a name which does not designate a component
 - e. the number of its components
 - f. the name of the surrounding structure(s)
 - g. a description of the surrounding structure(s)
3. When given the description and/or location of an anatomic structure or group of structures, select:
 - a. the names of additional parts
 - b. the name of the structure
 - c. the location of the structure
 - d. the location of the part relative to the structure

4. When given the name of a bone, identify the following:
 - a. the name(s) of (a) bone(s) with which it articulates
 - b. the number of bones with which it articulates
5. When given an anatomic diagram, identify the following:
 - a. the name of the structure depicted
 - b. the position or aspect of the structure depicted
6. When given the name of a specific anatomical structure, state the basic physiology of that structure.

D. TECHNIQUE

1. Explain the effect of kVp, mAs and SID on the formation of the image.
2. Explain the source of scatter radiation and how the following factors will affect it
 - a. part size
 - b. kVp selection
 - c. collimation
 - d. grid use
3. Identify the factors that influence the selection of a grid for specific radiographic procedures.
4. Explain the image receptor used for an exam
 - A. Computed radiography (CR)
 - B. DR or flat panel receptors
 - C. Exposure indicator numbers
5. Select the appropriate corrective measure when given a specific radiographic examination and description of a problem or error.
6. Select the purpose, the examination or projection for which a specific respiratory phase or method is used and the anatomy best demonstrated when given a specific respiratory phase or method.
7. Select proper machine settings for given radiographic positions taking into consideration all technical variables such as patient size, age, pathologies, casts, and accessory devices.

E. EQUIPMENT OPERATION and X-Ray Production

1. Identify the basic components of an x-ray tube, state the composition, function of each and its purpose in the production of x-rays. Include:

- a. Cathode -Filament - electron source, focal spot size, focusing cup
 - b. Anode - target
 - c. Characteristic radiation
 - d. Bremsstrahlung
2. Operator Console
 - a. kVp selection
 - b. mA selection
 - c. Time selection
 - d. mAs
 - e. AEC selection
3. Identify the basic components of the x-ray generator, state the function of each and its purpose in the production of x-rays. Include:
 - a. Basic electrical circuits
 - b. Transformers
 - c. Rectifiers
 - d. Phase, pulse, and frequency
4. Identify and operate the basic components of the radiographic unit, state the function of each and its purpose in the overall operation of the unit. Include:
 - a. Operator's console and all controls
 - b. Exam table, upright bucky and all controls
 - c. Tube and beam restriction devices and all controls
5. Explain the basic characteristics of the x-ray beam and those exposure factors that affect each. Include:
 - a. Wavelength and frequency
 - b. Primary, remnant (exit), and scatter
 - c. Quantity vs. quality
6. Explain the basic concepts of photon interaction with matter. Include:
 - a. Tissue attenuation
 - i. atomic number,
 - ii. size, thickness
 - iii. density
 - b. Compton effect (scatter)
 - c. Photoelectric effect (absorption)
7. Image Processing and Display
 - a. Digital data processing
 - b. display monitors
 - c. Informatics

F. RADIATION PROTECTION

1. Explain the biological effects of radiation on humans, giving examples of those effects. Include:
 - a. The relative radiosensitivity of, and reactions to radiation of each body system
 - b. Somatic Effects
 - c. Genetic Effects
 - e. Fetal risks

2. Explain methods of reducing patient exposure during radiographic examinations. Include:
 - a. relationship of exposure factors to dose (kVp, mAs, SID, OID)
 - b. Collimation and beam restriction methods
 - c. Shielding
 - d. Filtration, requirements, and effects

3. Explain methods of protecting personnel and other non-patients from exposure during radiographic examinations.
 - a. Identify sources of exposure
 - b. Identify methods of protection to include time, distance, and shielding
 - c. Identify types of protective devices and their required lead equivalents

4. Define the SI units of measurement for radiation exposure.

5. Identify the recommended exposure limits for the following:
 - a. Public
 - b. Occupational workers
 - c. Embryo/fetus

6. Identify dosimeters used for occupational exposure and explain how they are used.

7. Explain and give examples for applying ALARA.

G. Regulatory Requirements concerning scope of practice and licensing process

IV. LIMITED SCOPE EXAMINATION IN DIAGNOSTIC RADIOLOGIC TECHNOLOGY

After successful completion of the Core Module and the Radiographic Procedure Module(s), students will be required to take the **Limited Scope of Practice in Radiography Examination** administered through the American Registry of Radiologic Technologists (ARRT) effective date: January 1, 2018, or most current version.

A minimum score of 70% is required, in Core Module as well as any radiographic procedure modules, to be considered a passing score. Any change to the minimum score would require an amendment to The OBMI's administrative rules.

V. PROCESS TO OBTAIN A PERMANENT LIMITED PERMIT

The process to obtain a Temporary LXMO Permit in order to gain your clinical experience, the process to obtain a Permanent LXMO Permit and the Oregon Administrative Rules and Oregon Revised Statutes can be found on the OBMI website. www.oregon.gov/OBMI

Additional program questions should be directed to the Board office (971) 673-0215