# COURSE OUTLINE

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<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>RAD 120</td>
<td>Principles of Imaging Science II</td>
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**Hours:**
- 2 Lecture
- 2 Lab

**Pre-requisites:** RAD119, RAD107, RAD127

**Co-requisites:** RAD 114, RAD 128

**Catalog description (2016-2017 Catalog):**
Radiographic principles which control and contribute to the radiographic image including density, contrast and recorded detail are examined. The principles of electricity, magnetism and x-ray circuitry are presented. The laboratory component is designed to demonstrate the application of image production and evaluation.

**Required texts/Supplements:**

**REQUIRED:**
- **Title:** Principles of Radiographic Imaging
  - **Author:** R. Carlton, A. Adler
  - **Publisher:** Delmar
  - **Edition:** 5th

- **Title:** Radiologic Science for Technologists
  - **Author:** S. Bushong
  - **Publisher:** Mosby
  - **Edition:** 10th

- **Title:** Mosby’s Radiography Online: Radiologic Physics
  - **Author:** Mosby
  - **Publisher:** Mosby Elsevier
  - **Edition:** 2nd

- **Title:** Mosby’s Radiography Online: Radiologic Imaging
  - **Author:** Mosby
  - **Publisher:** Mosby Elsevier
  - **Edition:** 2nd

**Mathematical Instrument:** Basic Non-Programmable Calculator

**Revision date/No Changes:**
- Fall 2016

**Course coordinator:**
- Deborah Greer, 215-630-6371, email: greerd@mcc.edu
- Sandra L. Kerr, 609-570-3337, e-mail: kerrs@mccc.edu
Course Competencies/Goals:
This course combines lecture and laboratory components. Questions and discussion of the clinical application of theory are encouraged in lecture. The laboratory component is designed to provide students with the necessary skills to produce a diagnostic quality image, and evaluate for level of quality. Laboratory projects will be performed to ensure the correlation of the theoretical and clinical applications.

Upon completion of this course the student will be able to:
1. Develop an understanding of the purpose, function, types of grids used in conventional and digital imaging.
2. Analyze the factors that affect image quality relative to density, contrast, and geometric recorded detail.
3. Apply digital and conventional imaging principles to produce diagnostic quality images in the laboratory; determine and implement corrective action when images are suboptimal.
4. Apply sensitometric principles to film-screen imaging.
5. Differentiate among the variety of automated exposure systems utilized in diagnostic radiology departments.
6. Correlate the principles of electricity, magnetism, and electromagnetism to diagnostic imaging.
7. Describe the function of the x-ray circuit components and recognize conventional and mobile equipment malfunctions.
8. Perform laboratory experiments to correlate the theoretical applications associated with the darkroom, density, contrast, recorded detail, and grids.

Course-specific General Education Knowledge Goals and Core Skills.

General Education Knowledge Goals

Goal 1. Communication. Students will communicate effectively in both speech and writing.

Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

MCCC Core Skills

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal C. Ethical Decision-Making. Students will recognize, analyze and assess ethical issues and situations.

Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Lecture Unit Objectives:

Week #1: Grids

Following the completion of week 2, the student will be able to:

- State the purpose of a grid and compare grid types. (CG 1, 2, 3; GE 3)
- Select the most appropriate grid for a given clinical situation. (CG 1, 2, 3; GE 3, B)
- Interpret grid efficiency in terms of grid ratio and frequency. (CG 1; GE 2, 3, B)
- Define grid cutoff and summarize the factors that influence grid cutoff. (CG 1; GE 3)
- Evaluate grid artifacts in conventional and digital imaging. (CG 3; GE 3, B)

Week #2 - 5: Density and Contrast

Following the completion of week 4, the student will be able to:

- Describe the purpose of radiographic density. (CG 2; GE 3)
- Identify the acceptable range of radiographic density. (CG 2; GE 3)
- Calculate mathematical problems using the factors that affect radiographic density. (CG 2, 3; GE 2)
- Analyze radiographs for density adequacy using all technique factors. (CG 2, 3; GE 2, B)
- Describe the function of radiographic contrast. (CG 2; GE 3)
- Differentiate between subject contrast and film contrast. (CG 2; GE 3, B)
- Analyze radiographs for contrast adequacy using all technique factors. (CG 2, 3; GE 2, 3, B)
- Analyze relationships of factors affecting radiographic density and contrast. (CG 2, 3; GE 2, 3, B)
- Compare digital image characteristics to film screen image quality. (CG 2, 3; GE 2, 3, B)

Week #6 - 8: Automatic Exposure Control, Recorded Detail, and Distortion

Following the completion of week 8, the student will be able to:

- Describe the purpose and clinical application of automatic exposure control systems. (CG 5; GE 3)
- Identify errors associated with exposure control systems. (CG 5; GE 2, B)
- Define recorded detail and its relationship to diagnostic radiography. (CG 2; GE 3)
- Describe the factors that affect recorded detail. (CG 2; GE 3)
- Describe methods to minimize patient motion. (CG 2; GE 3)
- Analyze radiographs for adequacy of recorded detail. (CG 2, 3; GE 2, 3, B)
- Explain methods to minimize distortion when performing mobile radiographic procedures while ensuring maximum recorded detail. (CG 2; GE 2, 3, B)
- Discuss the process of formulating imaging standards. (CG 2; GE 3, C)
- Identify the imaging standard process and develop an individualized quality standard. (CG 2,3; GE 3, C)

**Week #9 - 10: Film Sensitometry, Image Receptors**
Following the completion of week 9, the student will be able to:
- Describe intensifying screen characteristics as related to image quality. (CG 4; GE 3)
- Discuss the selection process for the appropriate film-screen combination. (CG 4; GE 3)
- Define sensitometry and discuss the application to radiography. (CG 4; GE 3)
- Describe the elements of a sensitometric curve; compare and contrast curve results. (CG 4; GE 3, B)
- Compare digital image receptors to film screen cassettes (CG 2, 3; GE 2, 3, B).

**Week #11 – 15: Electricity, Magnetism, Electromagnetism, X-Ray Circuitry**
Following the completion of week 14, the student will be able to:
- Differentiate between a series and parallel circuit. (CG 5; GE 3)
- Apply Ohm’s Law to series and parallel circuits. (CG 5; GE 2, 3)
- Define magnetism and discuss its application to radiography (CG 5; GE 3).
- Identify the classifications of magnets. (CG 5; GE 3)
- State the hand rules of electromagnets. (CG 5; GE 3)
- State the laws of magnetism. (CG 5; GE 3)
- Describe electromagnetic induction. (CG 5; GE 3)
- Differentiate between a motor and generator. (CG 5; GE 3)
- Differentiate between alternating and direct current motors and generators. (CG 5; GE 3)
- Describe the function of a transformer and its application to radiography. (CG 5; GE 3)
- Identify the various types of transformers and discuss their efficiency. (CG 5; GE 3)
- Calculate transformer law problems. (CG 5; GE 2)
- Differentiate between single phase and three phase power. (CG 5; GE 3)
- Compare the types of mobile radiographic units available. (CG 6; GE 3, B)
- Identify the components of an x-ray circuit and describe the purpose of each. (CG 6; GE 3)
- Given a diagram of an x-ray circuit, label the components. (CG 6; GE 3)
Laboratory Unit Objectives:

Week #1 - 15:
Following the completion of week 15, the student will be able to:
- Orient to the digital imaging systems. (CG 8; GE 1, 3, A, F)
- Perform a variety of experiments associated with the density, contrast, and recorded detail (CG 8; GE 1, 2, 3, 9, A, B, C, F)
- Compare and contrast conventional radiography to digital radiography (CG 8; GE 1, 2, 3, 9, A, B, C)

Evaluation of Student Learning:
The student must earn a grade of "C" (75%) or higher in the lecture and laboratory sections of the course to advance to Clinical Practicum (RAD 206). The following grading policy will be utilized:

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<tr>
<th>Course Grade</th>
<th>Lecture Grade</th>
<th>Laboratory Grade</th>
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<tbody>
<tr>
<td>Lecture: 100%</td>
<td>Examinations: 65%</td>
<td>Attendance/ Participation 100%</td>
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<tr>
<td>Lab: Pass/Fail</td>
<td>Mosby Assignments: 10%</td>
<td>Project/Oral Presentation: 25%</td>
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A minimum of three (3) examinations will be administered and a laboratory project with oral presentation is required. Online assignments will be listed on the MCCC Virtual College website. Students will complete laboratory assignments to provide them with the necessary skills to produce diagnostic quality radiographs, to reinforce specific lecture topics and to prepare for the oral presentation. Details of test formats, dates, and the laboratory project will be provided by the instructor. A basic non-programmable calculator is permitted for examinations. The instructor must approve the calculator on the examination day.

Academic Integrity:
Mercer County Community College is committed to Academic Integrity -- the honest, fair and continuing pursuit of knowledge, free from fraud or deception. This implies that students are expected to be responsible for their own work.

Academic Integrity is violated whenever a student:
A. Uses or obtains unauthorized assistance in any academic work.
B. Gives fraudulent assistance to another student.
C. Knowingly represents the work of others as his/her own, or represents previously completed academic work as current.
D. Fabricates data in support of an academic assignment.
E. Inappropriately or unethically uses technological means to gain academic advantage.

For any academic integrity violation, the faculty member will determine the penalty and shall notify the chairperson of the Academic Integrity Committee of the violation and the penalty imposed. Students should refer to the MCCC Student Calendar/Handbook for the complete policy and OMB210
http://www.mccc.edu/academic_policies_integrity.shtml.
Accessibility:
Mercer County Community College is committed to ensuring the full participation of all students in its programs. If you have a documented differing ability or think that you may have a differing ability that is protected under the ADA or Section 504 of the Rehabilitation Act, please contact Arlene Stinson in LB216 (stinsona@mccc.edu) for information regarding support services.

Radiation Protection

1. All students will be provided a monthly laboratory dosimeter that must be worn at the collar. A monthly laboratory radiation monitoring report will be distributed to all participants.
2. A radiography faculty member will be present in the laboratory during the experiment set up and radiographic exposure.
3. All laboratory doors must be closed during the radiographic exposure.
4. All students must be behind the lead-lined barrier or control panel or outside the energized lab during the radiographic exposure.
5. Become accustomed to the normal sounds and operation of the radiographic unit. Students must report any unusual sounds or irregularities in system performance to the radiography faculty member.
6. Immediately report any damage, malfunction, or error messages on the control panel to the radiography faculty member.
7. Students must arrive at least 5 minutes prior to the start of the experiment and be prepared to start at the designated time. Students will not be admitted to the laboratory after the designated start time, resulting in a grade of zero for the lab experiment.

Attendance Policy

1. All students are required to attend every class session and lab session. In case of emergency or illness, students must contact the instructor prior to the class session. A message may be left on the instructor’s voice mail system. The student is responsible for any material covered in a missed session.

2. Students who miss an examination must directly contact the instructor prior to the scheduled class session by e-mail or voice mail. The student must provide a valid, documented excuse, i.e. doctors note, vehicular repair by next class session. If determined valid by the instructor, the make-up exam will be arranged by the instructor and will be a format other than multiple choice.

3. Make-up lab sessions are not permitted. Students who miss a laboratory session or arrive after the designated start time will receive a score of zero (0) for that assignment. Refer to the radiation protection policy for additional information regarding prompt arrival.

4. Lab sessions begin promptly at the scheduled time. Faculty recommends that students arrive at least five minutes before the scheduled lab session. Students will not be admitted to the lab after the scheduled start time. A grade of zero will be recorded for the missed lab session.
Topical Outline
The general plan for the fifteen (15) week semester identifies the topic to be discussed and reinforced in the laboratory. Reading assignments and laboratory projects will be provided by the individual instructor.

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<th>Week #</th>
<th>Topic</th>
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<td>1</td>
<td>Grids</td>
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<td>2 – 5</td>
<td>Density and Contrast</td>
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<td>6 - 8</td>
<td>Automatic Exposure Control</td>
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<td>Distortion</td>
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<td>Film, Sensitometry,</td>
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<td>11 – 15</td>
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