

LAST REVIEW: 2009-2010
(i.e. 2003-2004)

NEXT REVIEW: 2014-2015
(i.e. 2008-2009)

STATUS: A
(A, I, D)

COURSE TITLE: Advanced Biomedical Instrumentation

COMMON COURSE NUMBER: EST 2438C

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN
(per 16 week term)

CLOCK HOURS:
(Voc. Course ONLY)

Lecture: **3**

Lab: **32**

Clinic:

Other: **32**

PREREQUISITE(S): EST 2436C, AS Degree in Biomedical Engineering Technology

COREQUISITE(S): None

PRE/COREQUISITE(S):

COURSE DESCRIPTION *(750 characters, maximum):*

This course is intended to inform students about the theory and operation of instrumentation employed in the medical imaging field such as x-ray machines, CT scanners, Ultrasound, Nuclear Medicine and MRI.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s):

Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s):

Area

UNIT TITLES

- 1. Radiation, Radiation Interaction with Tissues**
- 2. X-ray Production, X-ray Equipment, Tubes, Generators**
- 3. Fluoroscopic Systems, Imaging Chain**
- 4. X-ray CT scanner; Construction, Operation, Imaging**
- 5. Nuclear Medicine Imaging Systems, Radionuclides, Radio Pharmaceuticals, The Gamma Camera, Biologic Effect of Radiation**
- 6. Ultrasound Equipment, Transducers, Waves, Scanning Types, Measurements of Blood Flow, Biologic Effects**
- 7. MRI, Instrumentation, Magnets, Image Formation, Biological Effect**

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be evaluated on the course outcomes.

Student will be evaluated through hands-on exercises, including equipment, diagnosis, configuration , setup and repair, as well as in-class written exams.

Common Course Number: EST 2438C

UNITS

Unit 1: Radiation, Radiation Interaction with Tissues

General Outcome:

- 1.0 The student shall: be able to demonstrate an understanding the fundamentals of radiation, the radiation interaction with matter and basic radiation protection.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1 Describe the atomic structure, atomic emissions, nuclear emissions.**
- 1.2 Describe types of radiation such as particle and electromagnetic.**
- 1.3 Discuss radiation interaction with materials.**
- 1.4 Describe basic radiation protection and safety.**

Common Course Number: EST 2438C

Unit 2: X-ray Production, X-ray Equipment, Tubes, Generators

General Outcome:

- 2.0 The student shall: be able to demonstrate an understanding of the structure and functions of the X-ray machine.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Describe x-ray machines and explain their medical applications.**
- 2.2 Explain the structure of the x-ray tube.**
- 2.3 Describe the fundamentals of the x-ray generators.**
- 2.4 Discuss image production.**

Common Course Number: EST 2438C

Unit 3: Fluoroscopic Systems, Imaging Chain

General Outcome:

- 3.0 The student shall: be able to discuss major components of the fluoroscopic system and appreciate its advantages.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Describe the physical structure of a fluoroscopic system.**
- 3.2 Explain image formation in fluoroscopy.**
- 3.3 Discuss the difference between usual x-ray imaging and fluoroscopic imaging.**
- 3.4 Describe the components of the image display chain.**

Common Course Number: EST 2438C

Unit 4: X-ray CT Scanner; Construction, Operation, Imaging

General Outcome:

- 4.0 The student shall: be able to demonstrate an understanding of the technology of CT Scanning and the benefits of transaxial imaging.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Explain the basics of CT instrumentation.**
- 4.2 Discuss the applications of computers in image formation in CT.**
- 4.3 Describe the differences between general x-ray imaging and CT scanning.**
- 4.4 Explain the imaging properties of CT scanners.**

Common Course Number: EST 2438C

Unit 5: Nuclear Medicine Imaging Systems, Radionuclides, Radio Pharmaceuticals, The Gamma Camera, Biologic Effect of Radiation

General Outcome:

- 5.0 The student shall: be able to demonstrate an understanding of the structure and function of the gamma camera and radioactive materials in medicine.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Describe the structure of the gamma camera.**
- 5.2 Describe photomultiplier tubes, collimators, and detectors.**
- 5.3 Discuss radio nuclides and radio pharmaceuticals.**
- 5.4 Discuss various clinical studies, e.g. brain scan, liver scan and respiratory imaging.**

Common Course Number: EST 2438C

Unit 6: Ultrasound Equipment, Transducers, Waves, Scanning Types, Measurements of Blood Flow, Biologic Effects

General Outcome:

- 6.0 The student shall: be able to demonstrate an understanding of ultrasound wave characteristics and the imaging systems.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Discuss the basics of ultrasound equipment.**
- 6.2 Describe waves, wave equation interactions.**
- 6.3 Discuss various scanning types.**
- 6.4 Explain the theory of blood flow measurements.**
- 6.5 Describe the biologic effect of ultrasound.**

Common Course Number: EST 2438C

Unit 7: MRI, Instrumentation, Magnets, Image Formation, Biological Effect

General Outcome:

- 7.0 The student shall: be able to demonstrate an understanding of the major components of the MRI unit and how MRI works.**

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Describe the magnets and magnetic fields used in the MRI unit.**
- 7.2 Describe the structure of the MRI imaging unit.**
- 7.3 Describe image formation in MRI.**
- 7.4 Explain the biologic effects of the electromagnetic field.**