

COMMON COURSE NUMBER:   EST 2436C  

COURSE TITLE:   Biomedical Instrumentation I  

CREDIT HOURS:           3          

CONTACT HOURS BREAKDOWN:

Lecture/Discussion           32          

Lab                   32          

Other                           

Contact Hours/Week           4          

CATALOG COURSE DESCRIPTION:

Prerequisite: EET 2142C, CET 2131C, CHM 1033, HSC 1531

Co requisite: None

Students will acquire proficiency in biomedical equipment maintenance through classroom and laboratory environment and will gain familiarity with and learn to evaluate, troubleshoot, test, and repair various types of biomedical equipment.

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

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

UNIT TITLES:

1. A Perspective on Medical Instrumentation
2. The Origin of Bio-potentials, Electrocardiograms, and Electrical Shock
3. Hospital Equipment Safety and Organization, and a Logical Approach to Troubleshooting
4. Medical Instrument Transducers and Component-Level Troubleshooting
5. Bio-potential Amplifiers
6. The Electrocardiograph and Unit-Level Troubleshooting
7. The Electroencephalograph and Filtering
8. The Defibrillator and Step Response
9. The Pacemaker - A Digital Pulse Oscillator

10. Electrosurgical Units and Laser Surgery
11. Catheters and Blood Pressure Monitoring
12. Respiratory Equipment

LAST REVIEW Academic Year 1995-96

NEXT REVIEW Academic Year 2000-01

*Interim Revision Dates:*

## **I. Course Overview:**

Upon successful completion of this course, the students should be able to describe the function and technical operation of various types of biomedical equipment and should be able to troubleshoot and repair this equipment.

## **II. Units:**

### **Unit 1. Medical Instrumentation**

#### General Outcome:

- 1.0 The students should be able to discuss the history of medical instruments, and explain the role of electronic circuit theory in medical equipment.

#### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 1.1 Define a medical instrument.
- 1.2 Discuss historical considerations.
- 1.3 Describe the role of electronic circuit theory in medical equipment.

## Unit 2. Origin of Biopotentials

### General Outcome:

2.0 The students should be able to list the laws for current in biological tissue and to explain the effects of microshock and macroshock.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

2.1 List the laws for current in biological tissue.

2.2 Describe biopotentials in the heart.

2.3 Discuss the electrocardiogram.

2.4 Describe the effects of electrical shock.

### Unit 3. Hospital Equipment Safety

#### General Outcome:

3.0 The students should be able to identify ways to protect themselves against electrical hazards and to find a logical approach to troubleshooting.

#### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 3.1 Identify electrical hazards of medical instruments.
- 3.2 Select devices to protect against electrical hazards.
- 3.3 Discuss an equipment safety program.
- 3.4 Describe a preventive maintenance program.
- 3.5 Find a logical approach to troubleshooting.

## Unit 4. Medical Instrument Transducers

### General Outcome:

4.0 The students should be able to understand inductive transducers and to find a logical approach to troubleshooting at the component level.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 4.1 Describe electrode transducers.
- 4.2 Discuss thermal transducers.
- 4.3 Understand the wheatstone bridge.
- 4.4 List types of strain gauges.
- 4.5 Explain the operation of the differential capacitive transducer.
- 4.6 Report on inductive transducers.
- 4.7 Find a logical approach to troubleshooting at the component level.

## Unit 5. Biopotential Amplifiers

### General Outcome:

5.0 The students should be able to run an analysis of an operational amplifier and to troubleshoot medical instruments.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 5.1 Identify a transistor differential amplifier.
- 5.2 Describe the operational amplifier analysis.
- 5.3 List the sources of biopotential measurement interference.
- 5.4 Troubleshoot medical instruments.

## Unit 6. The Electrocardiograph

### General Outcome:

6.0 The students should be able to discuss the electrocardiograph and understand the unit-level troubleshooting.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 6.1 Discuss the concept of ECG.
- 6.2 Identify ECG lead connections.
- 6.3 Describe common-mode voltage reduction.
- 6.4 Identify push-pull power amplifiers.
- 6.5 Select power supplies.
- 6.6 Troubleshoot unit-level ECGs.

## Unit 7. The Electroencephalograph and Filtering

### General Outcome:

7.0 The students should be able to explain how a electroencephalograph works and understand the troubleshooting of an EEG.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

7.1 Describe the EEG.

7.2 Identify filters.

7.3 Determine how to troubleshoot the EEG.

## Unit 8. Defibrillator and Step Response

### General Outcome:

8.0 The students should be able to discuss the defibrillator and explain how to troubleshoot the defibrillator.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 8.1 Describe the operation of a defibrillator.
- 8.2 Determine defibrillator energy delivery.
- 8.3 Fine the analysis of the defibrillator.
- 8.4 Understand how to troubleshoot a defibrillator.

## Unit 9. The Pacemaker - A Digital Pulse Oscillator

### General Outcome:

9.0 The students should be able to describe the characteristics of a pacemaker.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 9.1 Discuss the important properties of the pacemaker.
- 9.2 Explain the operation of programmable pacemakers.
- 9.3 Describe digital pulse oscillators.

## Unit 10. Electrosurgical Units and Laser Surgery

### General Outcome:

10.0 The students should be able to discuss the concept of laser surgery.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 10.1 Discuss the basic ESU.
- 10.2 Describe sinusoidal oscillators.
- 10.3 Identify an ESU power amplifier.
- 10.4 Troubleshoot an ESU.
- 10.5 Select the appropriate laser surgical device.

## Unit 11. Catheters and Blood Pressure Monitoring

### General Outcome:

11.0 The students should be able to discuss functions of catheters and blood monitoring.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

11.1 Discuss the purpose of catheters and blood pressure monitoring.

11.2 Identify and list catheter measurements.

## Unit 12. Respiratory Equipment

### General Outcome:

12.0 The students should be able to identify various types of respiratory equipment.

### Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 12.1 Discuss therapeutic and diagnostic equipment.
- 12.2 Explain ventilator modes of operation.
- 12.3 Discuss the operation of a spirometer.
- 12.4 List pneumotachograph airflow measurements.
- 12.5 Describe the plethysmograph.
- 12.6 Troubleshoot various types of pneumatic equipment.