JEFFERSON COLLEGE

COURSE SYLLABUS

BET215

BIOMEDICAL PHYSICS AND DEVICE TECHNOLOGY

3 Credit Hours

Prepared by: Melissa Coolich, PhD
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BET215 Biomedical Physics and Device Technology

I. CATALOGUE DESCRIPTION

A. Pre-requisite:
   1. Reading Proficiency
   2. ETC104 AC Circuits with a Grade of "C" or Better or Instructor Permission

B. 3 Credit Hour Award

C. Biomedical Physics and Device Technology exposes students to the quantification of biological phenomena and subsequent measurements in biomedical engineering. Students learn to correlate biorhythms and signals to device output, and they identify potential modes of device and biological failure. (F)

II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

| Demonstrate knowledge and understanding of the importance of signals and noise | Participation/Attendance Homework Exams Hands-On Skill Exercises |
| Define the various types of biomedical electrodes, sensors, and transducers used in the biomedical field | Participation/Attendance Homework Exams Hands-On Skill Exercises |
| Demonstrate knowledge and understanding of the physics of pressure and flow for blood circulation in the heart, lungs, and rest of the body | Participation/Attendance Homework Exams Hands-On Skill Exercises |
| Demonstrate knowledge and understanding of physiologic parameters as they relate to biomedical equipment | Participation/Attendance Homework Exams Hands-On Skill Exercises |
| Operate and troubleshoot biomedical equipment | Participation/Attendance Hands-On Skill Exercises |
III. OUTLINE OF TOPICS

A. Introduction to Biomedical Field
   1. Discuss areas of the biomedical field
   2. Define major medical instruments in a hospital
   3. Define components of medical instruments
   4. Define the different biomedical companies

B. Nature of Biosignals and Noise
   1. Explain phase shift between two signals
   2. Describe types of biosignals
   3. Describe the types of noise
   4. Identify different types of biomedical noisy signals

C. Analog Biomedical Electronics
   1. Identify analog circuits
   2. Identify reactance and impedance
   3. Identify loading and max power problems in electronics
   4. Describe how a Zener diode regulator functions

D. Digital Biomedical Electronics
   1. Determine the output of a D/A converter
   2. Determine the output of an A/D converter
   3. Discuss the tables of various logic gates
   4. Discuss the architecture of a microprocessor

E. Biomedical Electrodes, Sensors, and Transducers
   1. Define and compare sensors, transducers, and electrodes
   2. Explain the types of biomedical electrodes
   3. Explain oxidation and reduction reactions
   4. Discuss the types of pressure transducers
   5. Explain the various types of temperature transducers

F. Instrumentation in Diagnostic Cardiology
   1. Sketch a normal ECG signal with proper labels
   2. Explain depolarization and repolarization of the heart
   3. Describe three abnormal ECG signals
   4. Describe the components of an ECG machine

G. Defibrillators and Pacemakers
   1. Define the defibrillator and pacemaker terminology
   2. Explain the components and the operation of the defibrillator circuit
   3. Compare the differences of various defibrillators
   4. Identify the components of a pacemaker
   5. Identify the rational of using various pacemakers
H. Instrumentation in Blood Circulation
   1. Define cardiac output
   2. Calculate mean arterial pressure
   3. Calculate vascular resistance and compliance
   4. Describe the differences among various types of sphygmomanometers
   5. Describe the problems in pressure monitors

I. Instrumentation in Extracorporeal Circulation and Cardiac Assist Devices
   1. Name serval extracorporeal devices
   2. Name the components of a dialysis machine
   3. Discuss the processes of a heart-lung machine
   4. Define apheresis and discuss the components of apheresis systems
   5. Name two cardiac assist devices
   6. Describe the function of ventricular assist devices and their applications

J. Instrumentation in Respiration
   1. Describe respirators and ventilators
   2. Compare normal and abnormal data in respiratory care
   3. Compare the various spirometers used in hospitals
   4. Compare humidifiers, aspirators, and inhalers
   5. Define oximetry

K. Electroencephalography and EMG Instrumentation
   1. Describe the differences in the frequencies of various EEG waves
   2. Explain the patient’s physiological environment in acquiring various EEG waves
   3. Define evoked potentials in EEG and EMG
   4. Describe EEG leads placed on the scalp
   5. Describe EEG and EMG electrodes

L. Artifacts and Noise in Medical Instrumentation
   1. Describe noise sources in biomedical instrumentation
   2. Name the types of noise in biomedical instrumentation
   3. Name the filters use in noise reduction
   4. Name the steps taken in reducing motion artifacts in hospitals

M. Instrumentation in Diagnostic Ultrasound
   1. Describe the components of an ultrasound machine
   2. Name various ultrasound transducers
   3. Discuss ultrasound applications in medicine
   4. Describe safety issues of medical ultrasound

N. Instrumentation in Intensive Care Units
   1. Differentiate various types of intensive care units
   2. Discuss the equipment in intensive care units
   3. Describe telemetry concepts, such as modulation and carrier
   4. Describe bedside monitors and their parameters
   5. Describe central monitoring systems used in hospitals
O. Instrumentation in the Operating Room
   1. Describe the operating suite environment and the operating room of a hospital
   2. Describe the various components of an anesthesia machine
   3. Describe the sterilization processes

IV. METHOD(S) OF INSTRUCTION

   A. Lectures
   B. Readings from Textbook
   C. Supplemental Handouts/Industry Journals and Websites
   D. Peer Interactive Activities/Discussions in Classroom

V. REQUIRED TEXTBOOK(S)

   Chatterjee, S., *Biomedical Instrumentation Systems*, (Current Edition), Delmar
   Cengage Learning

VI. REQUIRED MATERIALS

   Flash Drive

VII. SUPPLEMENTAL REFERENCES

   Class Handouts

VIII. METHOD OF EVALUATION

   A. Distribution of the Final Grade:
      1. Participation/Attendance 10%
      2. Homework 30%
      3. Hands on skill exercises 25%
      4. Exams 35%

   B. Assignment of Final Letter Grade:

      A – 90 to 100%
      B – 80 to 89%
      C – 70 to 79%
      D – 60 to 69%
      F – Below 60%
IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Library phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College website, http://www.jeffco.edu).

XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.