SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: BMT-220 Class/Lect. Hours: 3 Lab Hours: 3 Credits: 4 Dept.: Biomedical

Course Title: Sensors for Bio-Medical Systems Semester: Fall Year: 2018

Course Description, Prerequisite, Corequisite:

This course will introduce the student to the fundamentals of sensor systems typically used in biomedical equipment found in a clinical and/or home health care setting. Starting with an introduction to the non-invasive sensors used to obtain classic vital signs (i.e. temperature, blood pressure, and respitory rate) and pulse oximeters for blood-oxygen level, the course precedes to answer the question of how these sensors are electronically interfaced to recording and display equipment. Next, sensors used to to monitor the electrical activity of the heart, brain, and skeletal muscle systems are examined (i.e. EKG, EEG, and EMG) with emphasis again given to the interface of the physical sensors to the electronics of recording equipment. Newly emerging, acceleration, pressure, magnetic, and touch sensors are studied in the context of medical sensing for a variety of functions including home health care. Again, the interface technologies (i.e. I^2C and serial peripheral interface, SPI, bus) used for this new class of sensors is studied. Invasive imaging devices used for endoscopy are examined next with attention given to the fiber-optics and CMOS active-pixel sensor technology employed. An overview of the theory and operation of standard imaging devices (i.e. X-ray, Ultrasound, MRI, CT, PET, and PET-CTor PET-MRI) is given with particular attention paid to the networking of these devices. Students are introduced to basic test and measurement equipment used in this field and the fundamentals of sensor system operation evaluation.

Prerequisites: Senior standing and ESET-371

Course Objectives	Competencies

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1. To become familiar with the concept of biomedical sensor systems	a. To be able to describe the purpose of a biomedical sensor system and the components used to construct such a system b. To be able to recognize the functions of the various components of a biomedical sensor system including the microcontroller used to direct the operation of the system and how one interfaces with it
2. To become familiar with basic sub-systems of biomedical sensor systems	a. To be aware of the various transducers and interface functions used to bring sensor data into a data acquisition device b. To be aware of the operation of linear amplifiers, filters, adders, A/D and D/A converters, detectors, and other miscellaneous electronic functions
3. To become familiar with the types of electrical signals generated by the human body and their respective basic physiology origins	a. To be able to describe the various types of physiological electrical signals generated by the human body and used for medical diagnosis
5. To become familiar with the newly emerging MEMS and NEMS based sensors and their interfacing technologies	a. To be able to demonstrate a knowledge of the concept of operation of newly emerging medical sensors constructed on a microscale using MEMS, NEMS, and microfluidics technology b. To be able to demonstrate a knowledge of the interfaing technologies for this new class of devices – I^2C and SPI technologies
6. To be come familiar with endoscopy technology	a. To be able to demonstrate a knowledge of the theory and operation of endoscopy technology

Course Objectives	Competencies
7. To become familiar with the operation of the classic and newer bio-medical imaging systems (i.e. X-ray, Ultrasound, MRI, CT, PET, PET-CT, and PET-MRI)	a. To be able to demonstrate a knowledge of the fundamental operation and technology used to image the human body b. To be aware of the use network technology to send and receive both data and software updates for these imaging systems
8. To become familiar with the techniques used to diagnose and evaluate the correct operation of biomedical sensor systems	a. To be able to demonstrate the ability to correctly evaluate the proper operation of a biomedical sensor system