**ECE493 – Telehealthcare Engineering**

**ABET Syllabus**

**Catalog Data:** ECE 493: Tele-healthcare Engineering. Three (3) credit hours. Medical signal processing, medical sensors, mobile health system, and medical security & privacy.

**Prerequisites:** ECE 370. Prerequisite topics: knowledge of signals and systems.

**Textbook:**  None.

# Contact Hours and Additional Course Information:

The course meets multiple lecture periods weekly with a total of 150 minutes of lecture contact per week. This is a professional electives course.

**Relationship of Course toward Meeting ABET Program Outcomes:**

The course supports instruction for Program Outcomes C, G, K, and L as required by ABET Criterion 3 and ABET Program Criteria. The relationships are indicated in the Course Educational Objectives.

**Course Learning Objectives:**

The overall course objectives are to introduce electrical engineering and computer engineering students the fundamentals of medical signal analysis and medical sensor design, to understand remote patient monitoring techniques, to develop the tools necessary to analyze patient symptoms in the presence of signal noise, and to determine methods for improving medical data transmission performance. At the end of this course, students are expected to be able to:

1. Draw the general model of a remote patient monitoring system, describe the function of each of the blocks, define technical terms relevant to the model, and name the signal processing modules. (Outcome C)
2. Develop and properly use the mathematical tools available for Wavelet analysis of medical signals. (Outcome G) including the mother wavelet choice, time-frequency domain wavelet analysis, and multi-resolution analysis. (Outcomes K)
3. Design wireless networks to transmit medical sensor data across wireless channels. Design radio transmitters and receivers, calculate probability of bit errors for various wireless systems, draw waveforms for various data patterns, determine optimum transmission protocols, calculate and draw the received signal waveform after passing a noisy channel. (Outcomes C and L)
4. Understand the medical signal sensing, sampling, coding, and communication principles. (Outcomes C and L)
5. Wireless-Sensor-based hardware hands-on labs. This includes EEG, ECG and other medical sensor design (Outcome K)

**Contribution of Course to Meeting the ABET professional component:**

* Skills required, used, and developed include mathematics, circuit analysis, digital electronics, probability, statistics, Matlab simulation, and wireless sensor programming.
* Estimated Content: Engineering Science – 1.5 credits, and Engineering Design – 1.5 credits

# Relationship of Course to Program Educational Objectives:

The course supports Program Educational Objective 1 by developing knowledge of telehealthcare engineering system.

**Topics Covered During Class:**

1. Tele-healthcare system architecture (3 hrs)
2. Mobile-Health: using mobile computing for remote patient monitoring (3 hrs)
3. Medical data acquisition devices (5 hrs)
	1. RFID for medical object recognition such as medicine bottle recognition
	2. Medical sensors and sensor network
4. ECG sensor design (5 hrs)
	1. Sensor circuit
	2. ECG sensor design
	3. ECG sensor Printed Circuit Board (PCB) design
5. Medical signal analysis (8 hrs)
	1. Wavelet algorithms
	2. Time-frequency domain data visibility analysis
	3. DWT (Discrete Wavelet Transform)
6. Bayesian models for medical signal processing (4 hrs)
	1. Bayesian theorem
	2. Maximum Likelihood and Maximum A Posterior for signal learning
7. ECG signal processing (5 hrs)
	1. Heart beat signal patterns
	2. Abnormal ECG signal identification via Bayesian models
8. EEG (brain activity) signal processing (3 hrs)
9. IMD (implantable medical devices) design (2 hrs)
10. Medical privacy and security (3 hrs)
11. Labs and projects (5 hrs)
12. Comprehensive final examination (2.5 hrs)

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