

## **ECE 54900 – Software-Defined Radio**

### **Type of Course**

Core course for the EE option of the MSE program

### **Catalog Description**

Overview of modern wireless systems, wireless transceiver architectures, baseband signal processing algorithms, orthogonal frequency-division multiplexing (OFDM), smart antennas, analog-to-digital converters, analog front-end components, digital hardware architectures, software architectures, middleware and the Software Communications Architecture (SCA), cognitive devices and networks. Current industry trends.

### **Credits**

3

### **Contact Hours**

3

### **Prerequisite Courses**

ECE 42800 and ECE 43600

### **Corequisite Courses**

None

### **Prerequisites by Topics**

An understanding of basic concepts of communication systems: signals, spectra; a familiarity with basic modulation techniques; familiarity with digital filters, and the discrete Fourier transform.

### **Textbook**

J.H. Reed, Software-Defined Radio, Prentice-Hall, 2002

### **Course Objectives**

The course gives students knowledge of fundamental and state-of-the-art concepts in software-defined radio.

### **Course Outcomes**

#### **Students who successfully complete this course will have demonstrated**

1. An ability to make system-level decisions for software-defined radio technology and products (a, e)
2. Knowledge of software development methods for embedded wireless systems (a, k)

3. An ability to implement smart antenna algorithms (a, e, k)
4. An ability to implement modern wireless system such as systems based on OFDM (a, e, k)
5. Knowledge of digital hardware architectures and understanding of development methods (a, e, k)
6. An understanding of middleware in SDR and the SCA (a, e, k)
7. Understanding of analog RF components (a, e, k)
8. Understanding of ADC and DAC technology (a, e, k)
9. An awareness of current industry trends (a, k)

### **Lecture Topics**

1. Radio technology evolution
2. Transceiver architectures
3. Antennas and radio front-end
4. Multirate DSP in SDR
5. Direct digital synthesis (DDS)
6. Analog to digital and digital to analog conversion
7. Introduction to smart antennas and baseband DSP algorithms
8. Antenna arrays, beamforming algorithms and architectures
9. Digital hardware for SDR
10. Software methods for SDR and the SCA
11. Cognitive networking

### **Computer Usage**

Medium

### **Laboratory Experience**

Medium

### **Design Experience**

Medium

### **Coordinator**

Todor Cooklev, Ph.D.

### **Date**

03/02/2018