

## **ECE 54000 – Antenna Design, Analysis & Simulation Methods**

### **Type of Course**

Graduate Course

### **Catalog Description**

In this course, theory of electromagnetic radiation, fundamentals of antennas, wire antennas and microstrip antennas, implementation EBG structures for microstrip antennas, antenna matching techniques, antenna arrays, analysis of antenna parameters, simulation of wire and microstrip antennas using 3D and planar electromagnetic simulators will be discussed.

### **Credits**

3

### **Contact Hours**

1

### **Prerequisite Courses**

ECE 31100 Electric and Magnetic Fields

### **Textbook**

Antenna Theory, Analysis and Design, 4rd Ed. by Constantine Balanis. Publisher: Wiley, 2016. (ISBN-10: 1118642066 , ISBN-13: 978-1118642061)

### **Course Objectives**

Provide a fundamental understanding of:

1. Electromagnetic radiation
2. Antenna parameters, such as radiation patterns, directivity, gain, impedance
3. Wire antennas and microstrip antennas
4. EBG structures and their implementation
5. Poynting's Theorem
6. Image theory and reciprocity
7. Antenna matching techniques
8. In addition, provide the ability to simulate wire and microstrip antennas using 3D and planar electromagnetic simulators

### **Course Outcomes**

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

1. an understanding of antenna parameters [1]
2. an understanding of electromagnetic radiation [1]

3. a basic knowledge of wire antennas [1]
4. a basic knowledge of microstrip antennas [1]
5. a basic knowledge of EBG structures [1]
6. a basic knowledge of antenna matching techniques [1]
7. an ability to use electromagnetic simulators in antenna design [2]

### **Lecture Topics**

1. Introduction, Antenna Types and Radiation
2. Antenna patterns, radiation intensity, directivity, gain, efficiency and impedance
3. Use of potential functions, far fields, duality, reciprocity
4. Infinitesimal dipole, Poynting's theorem
5. Total power, radiation resistance, short dipole, center fed dipole
6. Half wave dipole, dipole characteristics, image theory, monopole antenna
7. 3D and Planar electromagnetic antenna simulation tools and antenna simulation
8. Small loop antennas
9. Antenna arrays, broadside and end-fire arrays
10. Microstrip antennas and implementation of EBG structures
11. Antenna matching techniques
12. Computer Usage
13. Medium

### **Laboratory Experience**

None

### **Design Experience**

Medium

### **Coordinator**

TBD

### **Date**

September 30, 2018