**PURDUE UNIVERSITY**  
REQUEST FOR ADDITION, EXPIRATION,  
OR REVISION OF AN UNDERGRADUATE COURSE  
(10000-40000 LEVEL)

**DEPARTMENT**: Engineering  
**EFFECTIVE SESSION**: Fall 2013  
**INSTRUCTIONS**: Please check the items below which describe the purpose of this request.

- [ ] 1. New course with supporting documents  
- [ ] 2. Add existing course offered at another campus  
- [ ] 3. Expiration of a course  
- [ ] 4. Change in course number  
- [ ] 5. Change in course title  
- [ ] 6. Change in course credit/typo  
- [ ] 7. Change in course attributes (department head signature only)  
- [ ] 8. Change in instructional hours  
- [ ] 9. Change in course description  
- [ ] 10. Change in coursequisites  
- [ ] 11. Change in semesters offered (department head signature only)  
- [ ] 12. Transfer from one department to another

**PROPOSED:**
- **Subject Abbreviation**: ECE  
- **Course Number**: 540  
- **Long Title**: Antenna Design, Analysis and Simulation Methods Syllabus  
- **Short Title**: Antenna Des., Anly. and Sim.

**EXISTING:**
- **Subject Abbreviation**:  
- **Course Number**:  
- **Long Title**:  
- **Short Title**:  

**TERMS OFFERED**
- **Check All That Apply**:
  - Summer  
  - Fall  
  - Spring

**CAMPUS(ES) INVOLVED**
- Calumet  
- Cost Ed  
- Ft. Wayne  
- Tech Statewide  
- W. Lafayette  
- Indianapolis

**CREDIT TYPE**
1. Fixed Credit Cr. Hrs.
2. Variable Credit Range:
   - Minimum Cr. Hrs.  
   - (Check One) To □ Or □  
   - Maximum Cr. Hrs.  
3. Equivalent Credit: Yes □ No □

**COURSE ATTRIBUTES**
- 6 Registration Approval Type
- 7 Variable Title
- 8 Honors
- 9 Full Time Privilege
- 10 Off Campus Experience

**COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):**

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.

**Pre-requisites**: ECE 311 Electric and Magnetic Field

**Signature and Dates**

- **Calumet Department Head**  
  Date:  
- **Calumet School Dean**  
  Date:  
- **Fort Wayne Department Head**  
  Date:  
- **Fort Wayne School Dean**  
  Date:  
- **Indianapolis Department Head**  
  Date:  
- **Indianapolis School Dean**  
  Date:  
- **North Central Department Head**  
  Date:  
- **North Central Chancellor**  
  Date:  
- **West Lafayette Department Head**  
  Date:  
- **West Lafayette College/School Dean**  
  Date:  
- **West Lafayette Registrar**  
  Date:

**Office of the Registrar**
ECE 54000 Antenna Design, Analysis and Simulation Methods

Course Information:

Course Number and Title: ECE 54000 Antenna Design, Analysis and Simulation Methods
Credit Hours: 3

Course 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.

Prerequisites:

ECE 311 Electric and Magnetic Field

Textbook:


References:

Fang, D. G., Antenna Theory and Microstrip Antennas, CRC Press Taylor&Francis, Boca Raton
Yang, Fan, and Yahya Rahmat-Samii. Electromagnetic Band Gap Structures in Antenna
Engineering Cambridge, UK: Cambridge UP, 2009

Coordinator:

Abdullah Iroglu, Associate Professor of Electrical Engineering

Schedule:

Two 75-minute lectures per week

<table>
<thead>
<tr>
<th>Topic</th>
<th>Lecture</th>
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<tbody>
<tr>
<td>1. Introduction, Antenna Types and Radiation</td>
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<td>2. Antenna patterns, radiation intensity, directivity, gain, efficiency and impedance</td>
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<td>3. Use of potential functions, far fields, duality, reciprocity</td>
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6. Half wave dipole, dipole characteristics, image theory, monopole antenna 3
7. 3D and Planar electromagnetic antenna simulation tools and antenna simulation 2
8. Small loop antennas 2
9. Antenna arrays, broadside and end-fire arrays 2
10. Microstrip antennas and implementation of EBG structures 3
11. Antenna matching techniques 3
12. Reviews 2
13. Exams 2

Grading Distribution:

Homework: 20%
Midterm Exam: 25%
Final Exam: 25%
Project: 30%

Grading Scale:

93-100 % = A
90-92 % = A-
87-89 % = B+
83-86 % = B
80-82 % = B-
77-79 % = C+
73-76 % = C
70-72 % = C-
60-69 % = D
< 60% = F

Course Objectives:

To have fundamental understanding of electromagnetic radiation, antenna parameters such as radiation patterns, directivity, gain, impedance, wire antennas and microstrip antennas, EBG structures and their implementation, Poynting’s theorem, image theory and reciprocity, antenna matching techniques. In addition, students are expected to be able to simulate wire and microstrip antennas using 3D and planar electromagnetic simulators.

Course Outcomes:

A student who successfully fulfills the course requirements will have demonstrated:

1. an understanding of antenna parameters
2. an understanding of electromagnetic radiation
3. a basic knowledge of wire antennas
4. a basic knowledge of microstrip antennas
5. a basic knowledge of EBG structures
6. a basic knowledge of antenna matching techniques
7. an ability to use electromagnetic simulators in antenna design
**ABET Category:**

Engineering science: 2 credits or 75%
Engineering design project: 1 credits or 25%

**Course Policies:**

**Homework:**
Homework is due before the start of the following class one week after it’s assigned. Credit for late homework will diminish at the rate of 10% per day.

**Attendance:**
Regular attendance is critical for the successful completion of the course work. Attendance will be recorded.

**Student Dishonesty:**
Student dishonesty (cheating or plagiarizing) will not be tolerated. Students are encouraged to inform their academic advisors of instances of cheating or plagiarizing.

**Plagiarism** is another form of cheating. Students are guilty of plagiarism when they present someone else’s work as their own. Examples are: asking a friend to write an assignment paper for you, or including portions of material from a book, journal, or computer file, without giving appropriate credit to the author.

**Penalties** for student dishonesty can include a grade of “F” in the course. However, if a student believes she/he has been unjustly accused of dishonesty, he or she may follow the Grade Appeal Procedure to request a review of the case.

**Policy Concerning Students with Disabilities:**
If you have a disability and need assistance, special arrangements can be made to accommodate most needs. Contact the Director of Services for Students with Disabilities (Walb Union, Room 113, telephone number 481-6658) as soon as possible to work out the details. Once the Director has provided you with a letter attesting to your needs for modification, bring the letter to me. For more information, please visit the web site for SSD at http://www.ipfw.edu/ssd/.
Supporting Documents

A. Justification of The Course

This course is a fundamental course in antenna design for graduate students who will conduct their research in the area of applied electromagnetics. In addition, it illustrates the real life simulation and design techniques of modern antennas including high performance microstrip antennas with EBG structures. It complements nicely the courses that are offered at the Department of Engineering at the graduate level and gives students depth in knowledge in engineering applications. Furthermore, it is a unique course that attracts engineers in industry located in surrounding area of IPFW and meet the demand in this area.

This course is designed to be offered for Master students with the course number: ECE 54000. The expected enrollment for the course is 20.

B. Learning Outcomes and Method of Evaluation or Assessment

Course Objectives:

- Understanding the fundamentals of electromagnetic radiation
- Understanding the fundamentals of antenna parameters such as radiation patterns, directivity, gain, impedance,
- Understanding of Poynting’s theorem, image theory and reciprocity
- Fundamentals and design of wire antennas and microstrip antennas
- Fundamentals and design of EBG structures
- Understanding of antenna matching techniques.
- Ability to simulate wire and microstrip antennas using 3D and planar electromagnetic simulators.

Grading:

- Assignments: 20%
- Midterm Exam: 25%
- Final Exam: 25%
- Project: 30%

Student Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated:

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

- Lecture

C. Prerequisites

ECE 311 Electric and Magnetic Field

D. Course Instructor:

Abdullah Broglu, Assistant Professor of Electrical Engineering

Department of Engineering, IPFW

Instructor is the Graduate Faculty.

E. Course Outline

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F. Reading List

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