ECE 7440 – Dielectric-Based RF Components and Microfabrications

COURSE OUTLINE – FALL 2014

COURSE DESCRIPTION:
This 3-credit course starts with comparison examples between metallic and dielectric-based RF components. It will address the fundamentals of materials science, microfabrications, and microwave engineering, which are necessary to develop dielectric-based RF components. Challenges in the realization of these types of components are reviewed. Recent dielectric-based devices utilized in telecommunication and sensing systems are studied and analyzed. Design procedures are discussed along with methods to evaluate the performance of these components.

This course is ideal for students who are interested in smart, small, bio-compatible, and environmental-friendly telecommunication and sensing systems!

COURSE OBJECTIVE:
This course has the following objectives:
• Establish well-informed connections between materials and fabrications, and include these two important factors in the design procedure of RF components
• Encourage students to think deeply about dielectric-based RF components, how they can improve circuit performance, and why they are beneficial for future applications
• Introduce the discipline of materials science, with an emphasize on dielectric materials and their electrical properties
• Introduce the discipline of polymer-based microfabrications, with an emphasize on lithographic techniques

PRE-REQUISITES:
This course is designed for graduate engineering students. Students entering this class are assumed to have passed the following courses:
ECE 3590 Electromagnetic Theory
and at least one of these two courses:
ECE 4290 Microwave Engineering or ECE 4270 Antennas

COURSE CONTENT:
The following topics are covered:
• An introduction to dielectric-based materials
• Dielectric characteristics and evaluation techniques
• Polymer-based microfabrications
• Lithographic techniques
• Dielectric-based passive component design
• Measurement and simulation techniques
• Specific topics in the related area suggested by students. This can be a specific dielectric-based fabrication, a recently developed dielectric material, or a special dielectric-based RF component.

TEXTBOOK:
1. Notes available from instructor
2. Recommended reference textbook:
   The textbook may be purchased through the University Bookstore, or at any other bookstore such as Amazon.
3. Recently published articles in the field
TEACHING STRATEGY:
Besides lecturing which takes 50% of the class time, we have interactive sessions, lab works, and seminars. The contents for the lecturing part will be printed and distributed in the class one week ahead. In the interactive sessions, students are encouraged to think deeply about a specific problem and discuss it with other students. Regarding seminars, each student prepares a specific topic with his/her own choice and present it in the class for other students. The content of the seminar should be sent to the other students one week ahead. Other students should read and write one page abstract/critics about the subject before they come to the seminar. In lab works, students will work on a specific component or procedure (again with their own choice) and will try to apply their designs in an experimental setup.

Lectures: 2 hrs lecture/week × 13 weeks/term = 26 hrs
Laboratories: 2 hrs laboratory × 5 weeks = 10 hrs
Interactive Sessions: 2 hrs × 3 weeks = 6 hrs
Seminars: 1 hrs seminar/week × 10 weeks = 10 hrs

EVALUATION:
Your final course grade is determined by your performance in assignments, seminars, projects and midterm and final examinations. The weighting of each of these components is as follows:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>NO</th>
<th>VALUE</th>
<th>TOTAL VALUE</th>
<th>DETAILS / ADDITIONAL INFO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar</td>
<td>1</td>
<td>20%</td>
<td>20</td>
<td>Due dates and subjects will be defined by students in the second week</td>
</tr>
<tr>
<td>Homework/Assignments</td>
<td>2</td>
<td>5%</td>
<td>10</td>
<td>Dues on the fourth week and eighth week</td>
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<tr>
<td>Project</td>
<td>1</td>
<td>20%</td>
<td>20</td>
<td>Due one week before final exam</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>1</td>
<td>20%</td>
<td>20</td>
<td>Third week of October</td>
</tr>
<tr>
<td>Final Examination</td>
<td>1</td>
<td>30%</td>
<td>30</td>
<td>TBD</td>
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<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>100</td>
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</tbody>
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POLICY ON LATE/MISSING ASSIGNMENTS/PROJECTS:
It is important that students keep the appropriate pace in this course. For that reason, assignments and projects are expected to be submitted on time. Assignments will be accepted up to two weeks late with a 10% penalty for each week. Work submitted after two weeks will not be accepted. Exception may be made for some circumstances such as illness and family emergencies.

INSTRUCTOR INFO:
Name: Dr. Atabak Rashidian
Office: E1-567 EITC
Phone: (204) 474-9680
Email: rashidia@cc.umanitoba.ca
Office Hours:
Mondays and Wednesdays 10:00 am – 11:00 am or by appointment.

VOLUNTARY WITHDRAW:
Nov. 13, 2014

REQUIREMENTS/REGULATIONS
• Student Responsibilities: It is the responsibility of each student to contact the instructor if he/she is uncertain about his/her standing in the course and about his or her potential for receiving a failing grade. Students should
also familiarize themselves with Sections 4 and 6 of the Regulations dealing with incomplete term work, deferred examinations, and attendance and withdrawal.

- **Lectures:** Attendance at lectures is essential for successful completion of this course. Students must satisfy each evaluation component in the course.

**ACADEMIC INTEGRITY:**

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism* or any other form of cheating is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university) regardless of media

- examinations
- assignments
- laboratory reports
- term exams

A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty

*Plagiarism:* to steal and pass off (the ideas or words of another) as one's own; use (another's production) without crediting the source