ECE 7440-T31 – Microwave Materials Measurement Techniques
COURSE OUTLINE – FALL 2019

COURSE DESCRIPTION:
Measurement techniques and theory for characterization of electronic and biological materials at microwave and millimeter wave frequencies.

COURSE OBJECTIVE:
The objective is to familiarize students with the theory, test techniques and equipment used for characterization of electronic materials and biological media at microwave frequencies. The course involves experimental labs employing microwave test equipment to gain experience with and knowledge of the limitations of the different methods.

PRE-REQUISITES:
A firm grasp of undergraduate level electromagnetic theory and introductory undergraduate level transmission line and microwave circuit theory.

CONTACT HOURS:
3 hours/week

COURSE CONTENT:
1. Materials electronic properties and theory for characterization at microwave frequencies
2. Transmission line and microwave network theory review
3. Microwave device measurement using a vector network analyzer and calibration procedures
4. Characterization of materials using transmission line insertion based method
5. Resonator based methods for materials property measurement
6. Characterization of liquid and biological media
7. Impedance analysis based methods
8. Microwave/millimeter wave test issues – fixtures and on-wafer probing
9. Time-Domain-Reflectometry measurement technique

HOMEWORK:
Reading and presentation of assigned material (research papers or application notes).

TEXTBOOKS:
References:
2. Keysight Application Notes

COURSE WEBSITE:
Website: ece.eng.umanitoba.ca/graduate/ECE7440T05/EMMAT/ECE7440/Home.html
EVALUATION:
Your final course grade is determined by your performance in assignments, labs, project and a final examination. The weighting of each of these components is as follows:

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<tr>
<th>COMPONENT</th>
<th>NO</th>
<th>VALUE %</th>
<th>TOTAL VALUE</th>
<th>DETAILS / ADDITIONAL INFORMATION</th>
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<tbody>
<tr>
<td>Labs/Assignments</td>
<td>5</td>
<td>7%</td>
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<tr>
<td>Project / Presentation</td>
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<td>Midterm Exam</td>
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<td>Final Examination</td>
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INSTRUCTOR INFORMATION:
Name: Greg Bridges, Ph.D., P.Eng., Professor, Department of Electrical and Computer Engineering
Office: E3-465, EITC
Tel: 204-474-8512
Email: Gregory.Bridges@umanitoba.ca

Office Hours: by appointment

VOLUNTARY WITHDRAW:
Friday, Nov. 18, 2019

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