

**FALL 2022**

## ECE 7440-T31 – Microwave Materials Measurement Techniques

### COURSE DESCRIPTION:

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

### COURSE OBJECTIVE:

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 per 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:

Homework will consist of assignments, evaluation of measured lab results, a design project and preparation of a seminar on the project.

### REFERENCE MATERIALS:

1. D. Pozar, Microwave Engineering, Wiley, 4th ed., 2012
2. Keysight Application Notes

### GRADE ANNOUNCEMENTS:

*Grades for this course will typically be announced by January 2023*

## EVALUATION:

Your final course grade is determined by your performance in the components list below in the Evaluation Table (labs, project, and a final examination). Students must receive a minimum of 50% on the final examination and must complete and pass all components in the course in order to be eligible to receive a passing grade.

Each component is weighted as follows:

COMPONENT	NO	VALUE %	TOTAL VALUE	DETAILS / ADDITIONAL INFO
Labs	6	7%	35	
Assignments	3	0%	0	
Project/presentation	1	15%	15	
Mid-Term Exam				
Final Examination	1	50%	50	
<b>TOTAL</b>			100	

## GRADE SCALE:

LETTER	MARK	LETTER	MARK	LETTER	MARK	LETTER	MARK
A+	95-100	B+	80-84	C+	65-69	D	45-54
A	85-94	B	70-79	C	55-64	F	<45

## INSTRUCTOR INFO:

Name:..... Greg Bridges  
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Tel:..... (204) 474-8512  
Email:..... Gregory.Bridges@umanitoba.ca

Office Hours: ..... By appointment

## VOLUNTARY WITHDRAW:

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## 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 his/her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with, among others, incomplete term work, deferred examinations, attendance and withdrawal, etc.

**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

Please refer any questions regarding Academic Integrity to your course instructor.

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