Course Objectives
Microwave Engineering introduces the student to RF/microwave analysis and design techniques. Scattering parameters are defined and used to characterize device and system behavior. The passive and active devices commonly used as components in a microwave subsystem are studied. Device design procedures and methods to evaluate performance are developed. The free space communication link is described and equations derived to calculate the link carrier-to-noise ratio performance factor. A computer-aided-design (CAD) platform is used in the laboratory to carry out by simulation the design and performance evaluation of devices. Laboratory assignments, quizzes and project work serve to develop student engineering design and report writing skills.

Prerequisites
ECE 3590 Electromagnetic Theory

Course Content
The following topics are covered:
- An introduction to microwave engineering
- Lines for signal transmission or as circuit elements
- The impedance of line circuits calculated using analytic and Smith chart methods
- Impedance transforming and matching circuits
- Line and waveguide physical structures and associated interconnect components
- Power waves and the network scattering matrix
- Passive device design
- Two-port network transmission properties
- Active device design
- Communication link design

Projects
A design projects is normally assigned which requires the preparation and submission of a formal report. *Late project submission may be penalized at the rate 10% of project value per day.*

Accreditation Units
Mathematics: 0%
Natural Science: 0%
Complementary Studies: 0%
Engineering Science: 50%
Engineering Design: 50%

Web Page
http://ece.eng.umanitoba.ca/undergraduate/ECE4290
*The course Web Page has solutions in PDF format to prior year mid-term tests and final examinations.*

Textbook
*Microwave Engineering: Notes for Course ECE 4290,* Ernest Bridges. This textbook is available in PDF format from the course Web Page.
Other References
A list of reference books relevant to the course topics appears in the first chapter of the course notes.

Evaluation Details
The final course grade is determined by the student’s performance on laboratory assignments, a project, the mid-term test and final examination. Students must complete all project and laboratory assignments in order to be eligible to receive a passing grade.

Mid-Term
Tuesday, October 21, 2014, 6:00-8:00 PM. Location: TBA

Instructor
Prof. E. Bridges
Room: E3-413 EITC
Telephone: (204) 474-7245
Email: Ernest.Bridges@umanitoba.ca

Office Hours
1:00pm to 2:00pm on Tuesdays and Thursdays (Also by Email appointment or drop by the office)

Teaching Assistants
TBA

Voluntary Withdrawal Date
Wednesday, November 12th, 2014

Requirements/Regulations
- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or 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, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

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 in examinations, assignments, laboratory reports or term tests is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.
Learning Outcomes

1. Gain knowledge and understanding of microwave analysis methods.
2. Have the ability to analytically determine the circuit properties of passive/active microwave devices.
3. Know how to model a microwave circuit or system using computer aided design methods and to obtain its performance characteristics.
4. Have knowledge of basic communication link design, i.e., evaluate a signal power budget, find the receiver noise level and determine the link carrier to noise ratio.
5. Gain knowledge about standard type transmission line and waveguide physical structures and associated interconnect components.

Expected Competency Level **

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<th>Learning Outcome</th>
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*Attributes:
A1 A knowledge base for engineering
A2 Problem analysis
A3 Investigation
A4 Design
A5 Use of engineering tools
A6 Individual and team work
A7 Communication skills
A8 Professionalism
A9 Impact of engineering on society/environment
A10 Ethics and equity
A11 Economics and project management
A12 Life-long learning

**Competency Levels:
1 - Knowledge (Able to recall information)
2 - Comprehension (Able to rephrase information)
3 - Application (Able to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships)
5 - Synthesis (Able to combine separate elements into whole)
6 - Evaluation (Able to judge of the worth of something)

Student Contact Time (Hrs)

Lectures: 3 hrs lecture/week × 13 weeks/term = 39 hrs
Laboratories: 3 hrs laboratory × 5 weeks = 15 hrs
Tutorials: 0 hrs tutorial × 0 weeks = 0 hrs

Evaluation

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<th>Value (%)</th>
<th>Methods of Feedback</th>
<th>Learning Outcomes Evaluated</th>
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* Methods of Feedback: F - formative (written comments and/or oral discussion), S - summative (number grades)