Course Objectives
Obtain an understanding of Maxwell’s equations and be able to apply them to solving practical electromagnetic fields problems. Fundamental concepts covered will include: laws governing electrodynamics, plane wave propagation in different media, power flow, polarization, transmission and reflection at an interface, transmission lines, microwave networks, waveguides, radiation and antennas, wireless systems design and examples.

Prerequisites
ECE 3580 Foundations of Electromagnetics

Course Content
The following topics will be covered:

- Maxwell’s Equations (Ch. 6, 8): Review of Current Continuity, Faraday’s Law, Ampère-Maxwell’s Law, time-harmonic fields, scalar and vector potentials, boundary conditions
- Plane electromagnetic waves (Ch. 9): Uniform plane waves, phase and group velocity, wave impedance, dielectric and conducting media, polarization, energy and Poynting vector
- Plane wave reflection and refraction at boundaries (Ch. 10): Normal and oblique incidence
- Transmission line theory (Ch. 11, 12): Distributed parameter model, Transmission line equations, lossless and lossy lines, terminated t-lines, Smith chart, impedance matching
- Microwave Networks (supplementary notes): Two-Port networks, S-parameters, filters, basic microwave devices and circuits
- Introduction to Waveguides and Antennas (Ch. 13, 14): Rectangular waveguide, radiation from a dipole, arrays, antenna parameters, introduction to communication systems

Accreditation Units
Mathematics: 0
Natural Science: 25%
Complementary Studies: 0
Engineering Science: 75%
Engineering Design: 0

Web Page
http://courses.ece.umanitoba.ca/ECE3590
E-text available on CourseSmart:
http://www.coursesmart.com/

Textbook

Other References
**Evaluation Details**
Students who are unable to write the mid-term exam for medical (or other acceptable) reasons will have their final examination weighted to include the mid-term weighting. Students must complete all the laboratories in order to be eligible to receive a passing grade.

**Mid-Term(s)**
Wednesday, February 29, 2012, 6 pm, Room TBA

**Instructor**
Prof. Greg Bridges  
Room: E3-465 EITC  
Telephone: (204) 474-8512  
Email: bridges@ece.umanitoba.ca (reference to ECE 3590 must be in the subject line)

**Office Hours**
Thursday 11:30am – 12:30pm and as posted

**Teaching Assistants**
Mr. Tim Cabel, Rm. E3-474 EITC  
Email: timcabel@ee.umanitoba.ca

**Voluntary Withdrawal Date**
Friday, March 16th, 2012.

**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 (approximately 5 recommended)

1. Have an understanding of Maxwell’s equations and be able to manipulate and apply them to EM problems.
2. Formulate and analyse problems involving lossy media with planar boundaries using uniform plane waves.
3. Able to derive and apply the steady state transmission line equations to the design of simple distributed circuit components.
4. Analyse and design basic microwave circuits using microwave network parameters.
5. For simple antennas derive fundamental antenna parameters starting from Maxwell’s equations and be able to use these in the design of rudimentary wireless communications systems.

Expected Competency Level **

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<th>Learning Outcome</th>
<th>Attribute</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 hr tutorial × 0 weeks = 0 hrs

Evaluation

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<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)