ECE 8200 – Advanced Engineering Electromagnetics
COURSE OUTLINE – FALL 2014

COURSE DESCRIPTION:
The foundations of electromagnetic theory will be studied with a focus on the formulation of solvable mathematical problems associated with engineering applications. Mathematical techniques used for solving such problems will be investigated. Problems in wave propagation, radiation and scattering will be used as examples but the emphasis will be on the methods of solution.

COURSE OBJECTIVE:
The purpose of this course is to expand on elementary level electromagnetic theory, as taught in the undergraduate electrical engineering curriculum, by investigating advanced mathematical techniques used for applications as well as studying the foundations of the subject. By applying these techniques to various problems the student will gain a deeper understanding of electromagnetic theory and be better able to investigate the founding principles of the theory.

PRE-REQUISITES:
A firm grasp of electromagnetic theory and the mathematical concepts which are normally contained in an undergraduate electrical engineering curriculum: Maxwell’s equations, multivariable calculus, and linear analysis.

CONTACT HOURS:
3 hours/week

COURSE CONTENT:
The following topics will be covered (emphasis will depend on interests of the class):
1. Review of the Maxwell equations, energy/power concepts, potentials, and the constitutive relations.
3. Boundary Value Problems: Eigenfunctions, Green’s functions, Integral Equations
4. Applications using rectangular coordinates, cylindrical coordinates, and spherical coordinates.
5. Electromagnetic theorems: duality, uniqueness, image theory, the equivalence principle, the induction theorem, reciprocity, TE/TM decompositions.
6. Perturbational and variational techniques.
7. Microwave circuit concepts.
8. Time-domain problems.

HOMEWORK:
Assignments which expand on the material covered in class will be given approximately every two weeks.

TEXTBOOK:
No official textbook. Some reference books are:
2. Philip M. Morse & Herman Feshbach, Methods of Theoretical Physics, Vols. I & II, McGraw-Hill, 1953.
EVALUATION:

Your final course grade is determined by your performance in assignments, a mid-term test, and a final examination. 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>Assignments</td>
<td>5</td>
<td>5%</td>
<td>25</td>
<td>Approximately every two weeks</td>
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<tr>
<td>Midterm Test</td>
<td>1</td>
<td>25%</td>
<td>25</td>
<td>2 hours intramural (end of October)</td>
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<tr>
<td>Final Examination</td>
<td>1</td>
<td>50%</td>
<td>50</td>
<td>Take home</td>
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<tr>
<td>TOTAL</td>
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INSTRUCTOR INFO:

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Office Hours: by appointment

VOLUNTARY WITHDRAW:

November 12, 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