University of Manitoba

Department of Electrical & Computer Engineering

Graduate Course Outline

FALL 2022 ECE 8200 – Advanced Engineering Electromagnetics

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 per week (13 weeks in total)

COURSE CONTENT:

The following topics will be covered (emphasis will depend on interests of the class):

- Review of the Maxwell equations, energy/power concepts, potentials, and the constitutive relations.
- Concepts of time-harmonic fields: waves, waveguides, radiation.
- Boundary Value Problems: Eigenfunctions, Green's functions, Integral Equations.
- Applications using rectangular coordinates, cylindrical coordinates, and spherical coordinates.
- Electromagnetic theorems: duality, uniqueness, image theory, the equivalence principle, the induction theorem, reciprocity, TE/TM decompositions.
- Perturbational and variational techniques.
- Microwave circuit concepts.
- Time-domain problems.

Additional topics as determined by the instructor.

HOMEWORK:

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

TEXTBOOK:

No official textbook. Some reference books are:

1. Julias A. Stratton, Electromagnetic Theory, McGraw-Hill Book Company, 1941.
2. Philip M. Morse & Herman Feshbach, Methods of Theoretical Physics, Vols. I & II, McGraw-Hill, 1953.
3. Roger F. Harrington, Time-Harmonic Electromagnetic Fields, McGraw-Hill Book Company, 1961.
4. Douglas S. Jones, Acoustic and Electromagnetic Waves, Clarendon Press, Oxford, 1986.
5. Robert E. Collin, Field Theory of Guided Waves, 2nd Edition, IEEE Press, 1991.
6. John D. Jackson, Classical Electrodynamics, 3rd Edition, Wiley, 1998.

EVALUATION:

Your final course grade is determined by your performance in assignments and a final examination with weighting according to the Evaluation Table. 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
Assignments	5	10%	%50	Approximately every 2-3 weeks
Final Examination	1	50%	%50	Take-home
TOTAL			100	

GRADE SCALE:

LETTER	MARK	LETTER	MARK	LETTER	MARK	LETTER	MARK
A+	90-100	B+	75-79	C+	65-69	D	50-59
A	80-89	B	70-74	C	60-64	F	<50

INSTRUCTOR INFO:

Name:.....Joe LoVetri
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Office Hours:.....By appointment

VOLUNTARY WITHDRAW:

TBD

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.

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