

FALL 2021

ECE 7440 – Near-Field Antenna Measurements

COURSE DESCRIPTION:

The use of near-field and far-field measurement techniques for antenna measurements and characterization will be studied. The focus of the course will be on data collection procedures, data processing algorithms, system implementation, and error analysis associated with the planar, cylindrical, and spherical near-field microwave antenna measurement techniques.

COURSE OBJECTIVE:

The main purpose of this course is to investigate the theory and applications of near-field antenna measurement techniques. As a graduate-level course, it also aims to introduce and discuss current research issues and research directions in near-field techniques and algorithms for antenna measurements.

PRE-REQUISITES:

Background on electromagnetic theory, antenna theory, microwave engineering, mathematical concepts and numerical algorithms/programming, which are normally contained in an undergraduate electrical engineering curriculum.

CONTACT HOURS:

3-hours per week

COURSE CONTENT:

The following topics will be discussed:

- Overview of antenna measurement techniques;
- Absorbers and anechoic chambers;
- Compact antenna test range measurements;
- Planar near-field antenna measurement technique;
- Cylindrical near-field antenna measurement technique;
- Spherical near-field antenna measurement technique;
- Near-field probe correction;
- Error analysis in near-field antenna measurements;
- Antenna diagnostics and electromagnetic inverse source problem;
- Phaseless near-field antenna measurements.

Additional advanced research topics as determined by the instructor.

HOMEWORK:

Homework/assignments will be from the materials covered in class by the instructor and from the materials covered in seminar presentations by students. There might also be assignments, which will involve reviewing technical papers.

TEXTBOOK:

No official textbook. Some reference books are:

- C. Parini, S. Gregson, J. McCormick, and D. Janse van Rensburg, *Theory and Practice of Modern Antenna Range Measurements*, Institution of Engineering and Technology (IET), 2014.
- V. Rodriguez, *Anechoic Range Design for Electromagnetic Measurements*, Artech House, 2019.
- C. Parini, S. Gregson, J. McCormick, D. Janse van Rensburg, and Thomas Eibert, *Theory and Practice of Modern Antenna Range Measurements*, 2nd Expanded Edition, Institution of Engineering and Technology (IET), 2020.
- D. Slater, *Near-Field Antenna Measurements*, Artech House Inc., 1991
- S. Gregson, J. McCormick, and C. Parini, *Principles of Planar Near-Field Antenna Measurements*, Institution of Engineering and Technology (IET), 2007.
- M. H. Francis and R. C. Wittmann, *Near-Field Scanning Measurements: Theory and Practice*, in *Modern Antenna Handbook*, C. A. Balanis (Ed.), John Wiley & Sons Inc., 2008 (Chapter 19).
- J. E. Hansen (Ed.), *Spherical Near-Field Antenna Measurements*, Peter Peregrinus Ltd., London, 1988.
- C. A. Balanis, *Antenna Theory; Analysis and Design*, John Wiley & Sons, 4th edition, 2016.
- W. L. Stutzman and G. A. Thiele, *Antenna Theory and Design*, 3rd Edition, Wiley, 2012.

GRADE ANNOUNCEMENTS:

Grades for this course will be announced by March 2022

EVALUATION:

Your final course grade is determined by your performance in the components list below in the Evaluation Table (seminar, assignments, project, mid-term, 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
Seminars	1	10%	10	
Assignments	5	6%	30	
Project	1	15%	15	
Mid-Term Exam				
Final Examination	1	45%	45	
TOTAL			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:

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Office Hours:..... By appointment

VOLUNTARY WITHDRAW:

Wednesday, 18 November 2020

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