



Course Outline

Instructor

- Prof. Dustin Isleifson, P.Eng.
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Office Hours

- Tuesdays & Thursdays
1:00PM–2:00PM, or by appointment.

Teaching Assistant

- Monsurul Alam
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- Nolan Evans
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- Shirin Ramezanzadehyazdi
ramezans@myumanitoba.ca

Contact Hours

- 4 credit hours
- Lectures:
3 hours x 13 weeks = 39 hours
- Laboratories:
3 hours x 5 weeks = 15 hours

Prerequisites:

- ECE 3590 Electromagnetic Theory

Course Website:

<https://umanitoba.ca/umlearn>

Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

ECE 4290 – Microwave Engineering

Fall 2021

IMPORTANT NOTICE – In-Person Laboratories

This course will be delivered using online lectures, and a combination of remote and *in-person laboratories*. **Students are required to pre-screen themselves** before travelling to campus for their laboratory and must not attend the campus if they are experiencing any COVID-19 symptoms or if they have been in contact with someone who has tested positive for COVID-19.

In addition, the University requires that **all students must be fully vaccinated** (first dose by Sept 22nd, second dose by October 31st). As well, **students must wear a face mask** at all times while attending the laboratory and in all common indoor spaces on campus, or whenever social distancing can not be maintained. For further information, please visit the *UofM COVID-19 Resources* website (<https://umanitoba.ca/coronavirus/recovery>).

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 behaviour. 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. 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.

Course Content

The following topics will be 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

Projects

A design project 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.*

Textbook

Microwave Engineering: Notes for Course ECE 4290, Ernest Bridges. This textbook is available in PDF format from the course webpage.

Other Resources

A list of reference books relevant to the course topics appears in the first chapter of the course notes.

Important Dates

- **Term Test**
October 25th, 2021
6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**
November 23rd, 2021
- **National Day for Truth and Reconciliation**
September 30th, 2021
No classes or examinations
- **Thanksgiving Day**
October 11th, 2021
No classes or examinations
- **Remembrance Day**
November 11th, 2021
No classes or examinations
- **Fall Term Break**
November 8th–12th, 2021
No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 60%
- Engineering Design: 40%

Graduate Attributes

KB: A knowledge base for engineering
 PA: Problem analysis
 IN: Investigation
 DE: Design
 ET: Use of engineering tools
 IT: Individual and team work
 CS: Communication skills
 PR: Professionalism
 IE: Impact of engineering on society/
 environment
 EE: Ethics and equity
 EP: Economics and project
 management
 LL: Life-long learning

Competency Levels

- 1 - Knowledge (Able to recall information)
- 2 - Comprehension (Ability to rephrase information)
- 3 - Application (Ability 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 a whole)
- 6 - Evaluation (Able to judge the worth of something)

Learning Outcomes

1. Demonstrate knowledge and understanding of microwave analysis methods by solving microwave engineering problems in laboratory assignments and in timed examinations.
2. Analyze passive and active microwave devices to determine their circuit properties.
3. Model a microwave circuit or system and obtain its performance characteristics using computer-aided design methods.
4. Identify standard types of transmission line structures, waveguide structures, and associated interconnect components.
5. Design passive and active microwave devices and transmission line structures to meet specified performance requirements.

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	3	4	3		3							3
2		4	3	5	6							3
3	3	4	3	5	2	4	6					3
4	6		3									6
5	3	3	3	6	6	3						3

Evaluation

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

In the event that a student misses the Term Test for medical or compassionate reasons, a deferred test will not be given and the value of the Final Examination will be increased to 75%.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Project	5	F, S	1, 2, 3, 5
Quizzes	5	F	1, 2, 4, 5
Laboratories	15	F, S	1, 2, 3, 4, 5
Term Test	25	F, S	1, 2, 4, 5
Final Examination	50	S	1, 2, 4, 5

* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

CEAB Graduate Attributes Assessed

DE.3 – Develops/implements possible solutions to an open-ended design problem, leading to an appropriate recommendation.

CS.2 – Designs and produces appropriate engineering documents (i.e., research reports, engineering reports, design documents, graphics).

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 on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

Requirements and 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 the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic 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.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

 [Supplemental Resources](#)

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