



## Course Outline

### Instructor

- Prof. Greg Bridges, P.Eng.  
E3-465 EITC  
(204) 474-8512  
Gregory.Bridges@umanitoba.ca  
(Reference to ECE 4430 must appear  
in the subject line.)

### Office Hours

- Tuesday, 11:30AM-12:30PM  
or by appointment

### Teaching Assistant

- Amirmasoud Amirkabiri  
amirkaba@myumanitoba.ca
- Max Kelly  
kellym37@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 4430 – Design of RF Devices & Wireless Systems

Fall 2021

### IMPORTANT NOTICE – In-Person Laboratories

This course will be delivered using online lectures 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 22<sup>nd</sup>, second dose by October 31<sup>st</sup>). 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

Learn techniques for the design, simulation, fabrication and testing of RF and microwave circuits at the systems level. Gain experience with CAD tools for design of RF systems. Design, implementation and test of example RF devices and systems. Basics of radar and RFID technology will be covered.

### Course Content

The following topics will be covered:

- Foundations of RF system design:
  - Brief review of microwave network theory.
  - Noise and distortion in microwave systems.
  - Antennas and propagation models.
- Wireless system architectures:
  - Case studies of satellite and terrestrial communication systems.
  - Radar.
- System level modelling and implementation:
  - Passive circuits, filters, amplifiers, mixers, oscillators.
- RFID:
  - Near-field and UHF technologies.

### Laboratories

The course will consist of 5 laboratories involving design, simulation, fabrication, and testing of RF circuits and systems.

### Textbook (Suggested)

*Microwave Engineering*, D.M. Pozar, 4th edition, Wiley, 2011. (ISBN: 978-0-470-63155-3).

### Other References

*RFID Handbook*, K. Finkenzeller, 3rd ed, Wiley, 2010.

*Wireless Communications*, T.S. Rappaport, 2nd edition, Prentice-Hall, 2002.

*Microwave and RF Design of Wireless Systems*, D.M. Pozar, Wiley, 2001.  
(ISBN:0-471-32282-2) (short version of the above textbook).

## Important Dates

- **Term Test**  
November 4<sup>th</sup>, 2021  
6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**  
November 23<sup>rd</sup>, 2021
- **National Day for Truth and Reconciliation**  
September 30<sup>th</sup>, 2021  
No classes or examinations
- **Thanksgiving Day**  
October 11<sup>th</sup>, 2021  
No classes or examinations
- **Remembrance Day**  
November 11<sup>th</sup>, 2021  
No classes or examinations
- **Fall Term Break**  
November 8<sup>th</sup>–12<sup>th</sup>, 2021  
No classes or examinations

## Accreditation Details

### Accreditation Units

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

### 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. Understand the architecture of a transceiver and parameters used to specify its performance.
2. Be able to design a RF system using filters, amplifiers, mixers, oscillators, etc.
3. Measure and evaluate the performance parameters of RF components and systems.
4. Be able to use appropriate CAD tools for wireless system analysis.
5. Be able to design and construct a wireless system such as a radar.

## Expected Competency Levels

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

## Evaluation

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

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	5	F, S	1, 2, 3, 5
Quizzes	15	F, S	1, 2, 3, 5
Laboratories	20	F, S	2, 3, 4, 5
Term Test	20	S	1, 2, 3
Final Examination	40	S	1, 2, 3, 5

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

## CEAB Graduate Attributes Assessed

- KB.4 – Recalls and defines, and/or comprehends and applies, first principles and concepts in specialized engineering science.
- DE.2 – Uses an appropriate design process that considers all relevant factors (i.e., health & safety risks; standards; economic, environmental, cultural and societal considerations).

## 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.

## Copyright Notice

All materials provided in this course are copyright and are provided under the fair dealing provision of the Canadian Copyright Act. This material may not be redistributed in any manner without the express written permission of the relevant copyright holder.

## 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.

## 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 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](#)

## 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.