University of Manitoba | Price Faculty of Engineering
Department of Electrical and Computer Engineering

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

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

Important Dates

- **Term Test**
  November 4th, 2020
  6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**
  November 23rd, 2020
- **Thanksgiving Day**
  October 12th, 2020
  No classes or examinations
- **Remembrance Day**
  November 11th, 2020
  No classes or examinations
- **Fall Term Break**
  November 9th–13th, 2020
  No classes or examinations

ECE 4430 – Design of RF Devices & Wireless Systems

Fall 2020

IMPORTANT NOTICE – Mandatory Requirement to Report

This course will be conducted using remote instruction. Students who are accessing the course from outside of Canada or the USA ***must notify the instructor*** and indicate in which country they are located. Access to software may be restricted from some countries and failure to comply with these restrictions may result in criminal prosecution.

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).

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.

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)

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.

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).

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 Information

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.

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.