FALL 2024, ELEC 4503

RF LINES & ANTENNAS

DEPARTMENT OF ELECTRONICS (DOE)

Instructor Shulabh GUPTA, Mackenzie Building, room 4160 (office) shulabh.gupta@carleton.ca

TA name(s) Keigan MacDonell, KeiganMacdonell@cmail.carleton.ca

Course Description and requirements

1) Course description

Introduction to distributed circuits, traveling and standing waves, reflection coefficient, SWR, impedance transformation, Smith charts. Introduction to transmission lines; coaxial, rectangular waveguide, resonators, optical fibers. Introduction to antennas; gain, directivity, effective area. Introduction to linear arrays.

2) Precluded courses none

3) Prerequisites (and recommended knowledge) ELEC 3909 or permission of the Department

4) Accreditation Units:

Accreditation units (AU's) are used by the Canadian Engineering Accreditation Board (CEAB) to determine if an Engineering program meets a minimum number of class hours required for accreditation in each of 5 components: math, natural science, engineering science, engineering design, and complementary studies. Accreditation metrics are based on courses common to all students in a program. ELEC4503 is an elective course and is not included in AU counts.

5) Learning outcomes / Graduate Attributes

The Canadian Engineering Accreditation Board requires graduates of undergraduate engineering programs to possess 12 attributes: Graduate-Attributes.pdf (engineerscanada.ca) or GA's. Courses in all four years of our programs evaluate students' progress towards acquiring these attributes. Aggregate data (typically, the data collected in all sections of a course during an academic year) is used for accreditation purposes and to guide improvements to programs. Some of the assessments used to measure GAs may also contribute to final grades; however, the GA measurements for individual students are not used to determine the student's year-to-year progression through the program or eligibility to graduate.

Accreditation metrics are based on courses common to all students in a program. ELEC4903 is an elective course and does not include GA assessments.

6) Textbooks

There are no official textbook for this course. I will be occasionally uploading relevant materials on Brightspace as the course progresses. However, some suggested textbooks covering the course contents are:

- Branislav M. Notaros, "Electromagnetics," (Prentice Hall, 2011).
- David M. Pozar, "Microwave Engineering", 4th Edition, Wiley. [recommended]
- M. Sadiku, "Elements of Electromagnetics", 6th edition. [recommended]
- Saleh and Teich, "Fundamentals of Photonics", 2nd Edition, Wiley.

I will be using slides in classes. Additional material will be used to reinforce the understanding. Several many good textbooks cover Electromagnetics and studying from them outside lecture hours is strongly recommended: If you were

to attempt to study and pass the final exam by using only the lecture slides, you would likely fail the course. The lecture slides will be available to you after every lecture, however. If there are any important changes, they will be communicated to you, well in advance.

7) Course Schedule

There is total 6 Lab sessions

- Session #1 (and any other software lab) will be focused on Ansys HFSS computer modelling lab and will be held in **MC6030** (Minto Building). All hardware labs will be conducted in ME4140 in Mackenzie Building. The lab schedule and related details will be announced in class in advanced.
- All Lab sessions are mandatory, and attendance will be taken. Penalty of 5% of the total grade will be applied per session for missing each session.

- All Lab/lecture related questions **must be posted on Brightspace forum only**, to avoid repetitions and so that everyone benefits. In certain cases, questions can be emailed to me or the TA.

- While the attendance during the lectures and general PA sessions is not mandatory, a general attendance will be taken in all course sessions for information only.

8) Evaluation and Marking Scheme

1 Final exam (During normal exam period): weight 50% but you need to pass the final exam with at least 50% to pass the course.

- The Final exam will be scheduled during examination period at the end of the Fall term. Rules for a missed final exam are covered in Carleton's undergraduate calendar.
- Final exam will be 3 hour written closed-book exam.
- The final exam is exclusively for the purpose of evaluating student performance and will not be returned.
- Students who miss the final exam may be granted permission to write a deferred examination. See the Undergraduate Calendar for regulations on deferred examinations.

6 Labs: weight 30% of the final grade

- There will be total 6 labs sessions, three hours long every alternate week.
- The complete lab reports must be submitted within 2 weeks of the date of labs.
- The lab reports must be prepared and submitted in electronic format, directly on Brightspace submission page before the deadline.
- Ansys Electronics Desktop's High Frequency Structural Simulator (HFSS) and Keysight Advanced Design System (ADS) are the only softwares that will be allowed in this course, unless otherwise stated.
- The lab report must be submitted by each student for each of the graded lab. This report should include the measurement setup, a clear description of the measurement performed, data, sample calculations, discussion of results and conclusions.
- Unless otherwise mentioned, the measured lab results by each group, must be compared with the simulation results from HFSS/ADS, and must be included in your lab reports, as per the report guidelines.
- The lab reports must be submitted as a pdf file, in standard two-column IEEE format prepared using Latex only. There will be a maximum page limit specified in each of the report guidelines. No hand-written reports or hand-drawn illustrations will be accepted.
- Missing a lab without justified reason, will result in an automatic zero for that lab.
- The document will be judged based on clarity, organization, logic, presentation and professionalism (including plagiarism aspects).

1 Midterm: total weight of 20%

- Midterm will be held during the regular lecture hour on **November 7, 2024**.
- No show on the midterm is an automatic zero.
- Midterm will be returned with feedback after markings.
- It will be a timed, open book in-person exam.
- No discussions between students allowed. Any evidence of discussions, cheating, or something similar, during both the final exams and midterms, will have serious consequences.

Satisfactory performance to pass the course:

1- Minimum term grade of 50% AND
2- Minimum grade of 50% in final exam.

Students must review their assignment and quiz grades as soon as they are given back to them. Any marking concerns, and clarifications must first be directly addressed to the TA. In case, TA's clarifications are not sufficient, or students are not satisfied with their markings, they must bring this to my attention as soon as possible. I will treat such instances as an informal appeal and will review/re-mark the labs/midterm in question. All such cases must be brought to me before **December 13th, 2024.**

9) Deferred Final Examinations

Students who are unable to write the final examination because of a serious illness/emergency or other circumstance beyond their control may apply for accommodation by contact the Registrar's office. Consult the Section 4.3 of the University Calendar

(https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/examinations/)

10) Self-Declaration form and Deferred Term work

Calendar language (Section 4.4 https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/examinations/#deferred-term-work):

Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3) days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule.

Instructors can require (or not) the student to submit the self-declaration form. Include the following statement if you require the student to submit a completed self-declaration form:

Consult with the instructor no later then 3 days after any missed course work or midterm examination.

or

Contact the instructor with the completed self-declaration form no later than 3 days after the date/deadline of term work including test/midterm, labs, assignments.

Copyright

Advising and Counselling services

a) Engineering Academic Advising

The Engineering Academic Support Service : https://carleton.ca/engineering-design/current-students/undergrad-academic-support/ assists undergraduate engineering students with course selection, registration, and learning support from first-year through to graduation.

Academic Advisors Contact : https://carleton.ca/engineering-design/current-students/undergrad-academic-support/undergraduate-advisors/

b) Student Mental Health Service

As a University student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. Carleton's Wellness Services Navigator https://wellness.carleton.ca/navigator/ is designed to help students connect with mental health and wellness resources. If you need to talk to someone, please reach out for assistance: https://carleton.ca/health/emergencies-and-crisis/.

Learning and Working Environment

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca

We will strive to create an environment of mutual respect for all through equity, diversity, and inclusion within this course. The space which we work in will be safe for everyone. Please be considerate of everyone's personal beliefs, choices, and opinions.

Academic Integrity and Plagiarism

a) Please consult the Faculty of Engineering and Design information page about the Academic Integrity policy and our procedures: https://carleton.ca/engineering-design/current-students/fed-academic-integrity Violations of the Academic Integrity Policy will result in the assignment of a penalty such as reduced grades, the assignment of an F in a course, a suspension or, expulsion.

b) One of the main objectives of the Academic Integrity Policy is to ensure that the work you submit is your own. As a result, it is important to write your own solutions when studying and preparing with other students and to avoid plagiarism in your submissions. The University Academic Integrity Policy defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source.

   Examples of violations of the policy include, but are not limited to:

   - any submission prepared in whole or in part, by someone else;
   - using another's data or research findings without appropriate acknowledgement;
   - submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
   - failing to acknowledge sources of information using proper citations when using another's work and/or failing to use quotations marks.

c) Generative Artificial Intelligence (AI): Use of generative AI tools (such as ChatGPT) in course work is prohibited unless explicitly authorized by the course instructor for specific elements of the course. Submission of AI generated work without authorization may lead to an academic integrity investigation.

Academic Accommodations

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

> **Pregnancy obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form (click here).
>
> **Religious obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details click here.

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

Survivors of Sexual Violence: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/equity/sexual-assault-support-services

Accommodation for Student Activities: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation will be provided to students who compete or perform at the national or international level. Write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

Covid Protocols

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are a number of actions you can take to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's symptom reporting protocols.

Masks: Carleton has paused the COVID-19 Mask Policy, but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

Vaccines: Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in cuScreen as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the University's COVID-19 website and review the Frequently Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.