ENGPHYS 2A04
Electricity and Magnetism
Fall 2017
Course Outline

CALENDAR/COURSE DESCRIPTION

Development of electromagnetic theory - fields, Gauss' law, electric potential, Laplace equation, dielectrics, Ampere's law, magnetism, Faraday's law, inductance, development of Maxwell's equations via vector calculus.
Three lectures, one tutorial, one lab (three hours each) every other week, first term.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in any Engineering Physics or Mechatronics Engineering Program; PHYSICS 1E03; and credit or registration in one of MATH 2M03, 2P04 or MATH 2Z03
Antirequisite(s): ENGPHYS 2A03, MEDPHYS 2B03

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Jon Bradley
JHE A413
jbradley@mcmaster.ca
ext. 24013

Office Hours:
See course website

LAB SUPERVISOR OFFICE HOURS AND CONTACT INFORMATION

Chris Mitchelitis
BSB B102
mitchc1@mcmaster.ca
ext. 22657

Office Hours:
See course website

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Aysegul Abdelal abdelala@mcmaster.ca
Henry Frankis frankihc@mcmaster.ca
Dylan Genuth-Okon genuthod@mcmaster.ca
Kunyu Liang liangk5@mcmaster.ca
Jeremy Miller millej29@mcmaster.ca
Chenglin Zhang zhanc17@mcmaster.ca

Office Hours:
See course website

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/

It is the students' responsibility to regularly check the course web page (Avenue to Learn) for updates and announcements.

COURSE OBJECTIVES

By the end of this course, students should be able to:

- Demonstrate the basic fundamental knowledge of electricity and magnetism to provide background for future courses.
- Understand the development of Maxwell's electricity and magnetism equations via vector calculus.
- Demonstrate the knowledge and ability to solve problems in basic electromagnetic theory.
- Perform experiments to prove and explore electromagnetic theory.
- Apply the concepts of electromagnetic theory to basic design problems.

MATERIALS AND FEES

Required Texts:

Fawwaz T. Ulaby and Umberto Ravaioli, *Fundamentals of Applied Electromagnetics*, Seventh Edition, Pearson

Calculator:

Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:

Lab Manual (see course website)

COURSE ORGANIZATION

The course is organized as follows:

- 3 classroom-based lectures per week
- 1 tutorial per week
- Laboratory sessions every other week including:
    - 2 instructional laboratory sessions with fill-in-the-blank/question-and-answer lab reports
    - 2 instructional laboratory sessions with formal lab reports
    - 1 design lab
- 3 assignments
- 2 in-class midterm tests
- A 2.5 hour final exam

COURSE CONTENT

- Waves and Phasors
- Transmission Lines
- Vector Analysis

- Electrostatics
- Magnetostatics
- Maxwell's Equations
- Plane-Wave Propagation
- Wave Reflection and Transmission
- Radiation and Antennas

TEXTBOOK

The textbook for this course is Ulaby and Ravaioli, *Fundamentals of Applied Electromagnetics*, 7th Edition (Pearson, 2015). Additional textbook resources (including exercise solutions) can be found on the textbook website: http://em7e.eecs.umich.edu.

ASSIGNMENTS

3 problem sets will be assigned throughout the course. Assignments are to be handed in to the dropbox located in the 3rd floor JHE annex hallway near the Engineering Physics main office by the due date. Late assignments will not be marked and a grade of ZERO will be assigned.

MIDTERM TESTS

There will be two 50-minute midterm tests held during class time. The dates and locations will be announced in class and on Avenue to Learn. There will be no make-up midterms – if a midterm is missed for a valid reason the weight of the final exam will be increased accordingly.

EXAMINATION

There will be a cumulative, 2.5-hour final exam during the exam period.

INSTRUCTIONAL LABORATORIES

Laboratory manuals are available on the webpage. Laboratory work can only be carried out at your scheduled time. All lab experiments must be completed. Laboratory experiments will be completed in groups of 2 but laboratory reports must be completed and submitted individually (see section "Academic Integrity" below). The reports for labs 1 and 3 will be fill-in-the-blank and question-and-answer-based and will be due 1 week after the lab. The reports for labs 2 and 4 will be formal and due 2 weeks after the lab. Details about the requirements for both types of lab reports will be given during the lab session. Lab 5 will be a design lab and follow-up questions will be due during the lab session. Attendance will be taken by the TAs during each lab. Lab notes must be signed by the TA and must be submitted with the lab report. Lab reports submitted for labs not attended are not acceptable. Late reports will not be marked and a grade of ZERO will be assigned. Lab reports are to be handed in to the dropbox located in the 3rd floor JHE annex hallway near the Engineering Physics main office by 2pm on the due date. Students are not

allowed to participate in labs without attending the safety lecture (first part of lab 1) and submitting the safety quiz.

ASSESSMENT

Component	Weight
Labs (5 total)[1-4]	25%
Assignments (3 total)	15%
Midterm Test 1 [5]	a. 10, b. 10, c. 0 or d. 0%
Midterm Test 2 [5]	a. 10, b. 0, c.10 or d. 0%
Final Exam [5]	a. 40, b. 50, c. 50 or d. 60%
Total	100%

1. In order to pass the course you must obtain a pass mark in the instructional labs + design lab sections (≥ 12.5/25) AND obtain a pass markin non-lab components (≥ 37.5/75).
2. Students must attend all labs and submit all lab-related materials to pass.
3. Students are not allowed to participate in labs without attending the safety lecture (first part of lab 1) and submitting the safety quiz.
4. Students who are repeating the course are allowed to transfer their passing lab grades from the previous year (2015). However, their grades will be rescaled to reflect the current year's grading scheme. Instructor must be notified during the first week of class if this option is to be chosen.
5. For midterms 1 and 2 and the final exam, the best grade as determined from one of the following weighting schemes will be used to determine the final grade:
    a. 10% Midterm 1, 10% Midterm 2, 40% Final Exam
    b. 0% Midterm 1, 10% Midterm 2, 50% Final Exam
    c. 10% Midterm 1, 0% Midterm 2, 50% Final Exam
    d. 0% Midterm 1, 0% Midterm 2, 60% Final Exam

    Note: For weighting schemes b, c or d to be applied, students must have written and obtained at least 25% on each of midterm 1 and 2 and/or missed midterm 1 and/or 2 for a valid reason and obtained official approval (see section "Notification of Student Absence and Submission of Request for Relief for Missed Academic Work" below for policy).

COURSE POLICIES

1. It is the students' responsibility to regularly check the course web page (Avenue to Learn) for updates and announcements.
2. Students are required to obtain and maintain a McMaster e-mail account for timely communications between the instructor and the students.
3. You are expected to behave in a way that does not disrupt the learning experience of your peers. Disruptive behaviour including making noise, leaving and entering the classroom, and use of cellular phones is forbidden and students presenting this type of behaviour will be asked to leave the classroom.

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be directly taken into consideration in determining a student's actual grade in the course.

Our detailed learning outcomes are defined below. Their associations with various graduate attribute indicators* are shown in this section. These indicators are being measured for engineering accreditation purposes.

- Understand traveling waves and the application of phasor analysis in transmission lines. Use phasor representation to develop transmission-line equations and solve related problems. [Indicators: 1.1, 1.2]

- Understand the development of Maxwell's electricity and magnetism equations using vector calculus. Use vector operations, differential calculus, and integral calculus to solve electromagnetics problems. [Indicators: 1.1, 1.2]

- Understand the concept of electrostatics, including topics such as electric field, electric flux, Coulomb's law, electric charge, Gauss's Law, conductors, capacitors, and electric potential. Use vector calculus techniques, the Laplace equation, and the method of images to solve electrostatics problems. [Indicators: 1.2, 2.2]

- Understand the concept of magnetostatics, including topics such as magnetic fields, magnetic forces, magnetic vector potential and magnetic dipole moments. Understand the mechanisms behind the Lorentz force law, Biot-Savart law, and Ampère's law and how electric current affects magnetic fields. Solve problems using these theorems. [Indicators: 1.2, 2.2]

- Understand how electric and magnetic fields interact with matter and induce electric and magnetic dipoles inside materials, respectively. [Indicators: 1.2, 2.2]

- Understand the concept of the wave equation and its associated features. Be able to develop the wave equation (and plane wave equation) for electric and magnetic fields. Understand how electromagnetic waves propagate through matter. [Indicators: 1.2, 2.2]

- Understand important engineering applications of electromagnetics, including transmission lines, capacitors, electromagnets, antennas and waveguides. [Indicators: 1.2, 2.2]

- Demonstrate an ability to use electromagnetic theory in a hands-on design problem given copper coils, power supplies, and other materials to build an everyday device based on electromagnetic principles. [Indicators: 4.1, 4.2]

- Demonstrate an ability to select and use proper engineering tools involved in the experiments attached to this course and the design lab. [Indicators: 5.1, 5.2]

- Demonstrate individual dependence and team work and communication abilities to complete labs and reports on time. [Indicators: 6.1, 6.3, 7.1, 7.2, 7.3]

For more information on Accreditation, please visit: https://www.engineerscanada.ca

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The McMaster Student Absence Form is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/H301). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.

6. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: http://www.eng.mcmaster.ca/current/documents.html

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their wok to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to http://www.mcmaster.ca/academicintegrity/.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf.