

## Course Outline (W2024)

### ELE401: Electric and Magnetic Fields

<b>Instructor(s)</b>	Dr. Marco Antoniadis [Coordinator] Office: ENG453 Phone: (416) 979-5000 x 556097 Email: mantoniades@torontomu.ca Office Hours: Thursdays 3:00 - 5:00 pm by email
<b>Calendar Description</b>	Review of vector analysis and coordinate systems. Coulomb's law and electric field intensity. Gauss's law and electric flux density. The electric potential and potential gradient. Electric fields in material space. Poisson's and Laplace's equations. Capacitance. Biot-Savart's Law and magnetic field intensity. Ampere's circuital law and the magnetic flux density. Magnetic forces. Self and mutual inductances. Time-varying fields and Maxwell's equations.
<b>Prerequisites</b>	MTH 312
<b>Antirequisites</b>	None
<b>Corerequisites</b>	None
<b>Compulsory Text(s):</b>	<ol style="list-style-type: none"> <li>1. F.T. Ulaby and U. Ravaioli, Fundamentals of Applied Electromagnetics, 8th edition, Pearson Education, 2020.</li> <li>2. M.N.O. Sadiku, Elements of Electromagnetics, 7th edition, Oxford University Press, 2018.</li> </ol>
<b>Reference Text(s):</b>	<ol style="list-style-type: none"> <li>1. W.H. Hayt and J.A. Buck, Engineering Electromagnetics, 8th edition, McGraw-Hill, 2012.</li> <li>2. D.K. Cheng, Fundamentals of Engineering Electromagnetics, Addison-Wesley, 1993.</li> <li>3. J.A. Edminister, Theory and Problems of Electromagnetics, 2nd edition, Schaum's Outline Series, McGraw-Hill, 1993.</li> </ol>
<b>Learning Objectives (Indicators)</b>	<p>At the end of this course, the successful student will be able to:</p> <ol style="list-style-type: none"> <li>1. Develops further knowledge of science in support of applications to engineering problems. <b>(1a)</b></li> <li>2. Applies mathematical principles, skills, and tools to solve engineering problems, highlighting limitations or a range of applications. Applies appropriate mathematics principles to evaluate expressions, find and test potential solutions. <b>(1b)</b></li> <li>3. Demonstrates and applies core engineering principles and concepts to solve engineering problems. <b>(1c)</b></li> <li>4. Illustrates concepts in graphical form. <b>(7a)</b></li> </ol> <p><b>NOTE:</b> Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>
<b>Course Organization</b>	4.0 hours of lecture per week for 13 weeks 2.0 hours of tutorial per week for 12 weeks

<b>Teaching Assistants</b>	Nickolas Papoutsis (nickolas.papoutsis@torontomu.ca) Mahdi Tahmasebi (mtahmasebi@torontomu.ca)								
<b>Course Evaluation</b>	<table border="1"> <tr> <td>Quizzes</td> <td>20 %</td> </tr> <tr> <td>Midterm Exam</td> <td>30 %</td> </tr> <tr> <td>Final Exam</td> <td>50 %</td> </tr> <tr> <td>TOTAL:</td> <td>100 %</td> </tr> </table> <p><b>Note:</b> In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both "<b>Theory and Laboratory</b>" components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the "<b>Course Evaluation</b>" section above for details on the Theory and Laboratory components (if applicable).</p>	Quizzes	20 %	Midterm Exam	30 %	Final Exam	50 %	TOTAL:	100 %
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<b>Examinations</b>	<p>NOTE: This course has only Theory components. Therefore, to pass the course, a student must simply obtain a minimum overall mark of 50%.</p> <p>All quizzes and exams will be carried out in person.</p> <p>Quizzes: Four (4) quizzes, each worth 5%, will be conducted. 30 minutes duration each.</p> <p>Mid-Term Exam: Conducted in Week 8, covers the material from Weeks 1-7. One and a half (1.5) hour duration.</p> <p>Final Exam: Conducted during the final exam period, covers all the material from Weeks 1-13. Three (3) hour duration.</p>								
<b>Other Evaluation Information</b>	None								
<b>Teaching Methods</b>	<ol style="list-style-type: none"> <li>Lectures will be delivered synchronously (i.e. for all students at the same time) during the scheduled class hours in person, and via Zoom if possible.</li> <li>Notes/slides from the class lectures will be posted on D2L.</li> <li>Lecture recordings will also be posted on D2L.</li> </ol>								
<b>Other Information</b>	None								

## Course Content

Week	Hours	Chapters / Section	Topic, description
1	2	1.1 to 1.6	* Chapter sections refer to Ulaby's book unless otherwise noted * Introduction to Electromagnetism

1-2	4	3-1 to 3-7	Review of Vector Analysis
2-7	22	4-1 to 4-11	<p>Electrostatics</p> <p>Maxwell's equations  Charge and current distributions  Coulomb's law  Gauss's law  Electric scalar potential  Conductors  Dielectrics  Electric boundary conditions  Capacitance  Electrostatic potential energy  Image method</p>
8	4		<p>Electrostatic Boundary-Value Problems  (Sadiku, sections 6.2 to 6.4)</p> <p>Poisson's and Laplace's equations  Uniqueness theorem  Solutions of Poisson's and Laplace's equations</p>
9-12	14	5-1 to 5-8	<p>Magnetostatics</p> <p>Magnetic forces and torques  The Biot-Savart law  Gauss's law for magnetism  Ampere's law  Vector magnetic potential  Magnetic properties of materials  Magnetic boundary conditions  Inductance  Magnetic energy</p>
12-13	6	6-1 to 6-7	<p>Maxwell's equations and time-varying fields</p> <p>Faraday's law  Stationary loop in a time-varying magnetic field  The ideal transformer  Moving conductor in a static magnetic field  The electromagnetic generator  Moving conductor in a time-varying magnetic field  Displacement current</p>

## University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](#)

Refer to the [Departmental FAQ page](#) for further information on common questions.

## Important Resources Available at Toronto Metropolitan University

- [The Library](#) provides research [workshops](#) and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the [Library's virtual research help service](#) to speak with a librarian.
- [Student Life and Learning Support](#) offers group-based and individual help with writing, math, study skills, and transition support, as well as [resources and checklists to support students as online learners](#).
- You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radio button on the top right hand side entitled: **Academic Consideration Request (ACR)** to submit this request.

*For Extenuating Circumstances, Policy 167: Academic Consideration allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration](#).*

- If a student is requesting accommodation due to a religious, Aboriginal and/or spiritual observance, they must submit their request via the online [Academic Consideration Request \(ACR\) system](#) **within the first two weeks of the class or, for a final examination, within two weeks of the posting of the examination schedule**. If the required absence occurs within the first two weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these requests should be submitted with as much lead time as possible in advance of the required absence.
- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The [Remote Learning Guide](#) for students includes guides to completing quizzes or exams in D2L Brightspace, with or without [Respondus LockDown Browser and Monitor, using D2L Brightspace](#), joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for [Faculty](#) and [students](#).

## Accessibility

- Similar to an [accessibility statement](#), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

## Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

## Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email [csdc@torontomu.ca](mailto:csdc@torontomu.ca)
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email [osvse@torontomu.ca](mailto:osvse@torontomu.ca)
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.