General information

Course description
This course is a continuation of PHYS*2330. Topics include magnetic forces and fields, the Biot-Savart equation, Ampere's Law, magnetic induction, LRC transients, AC circuits and magnetic materials.

Class schedule and location
Tuesday and Thursday, 11:30am to 12:50am, in MINS 106

Tutorials
Alternating Tuesdays, 7:00pm to 9:50pm, in MACS 121

Midterm exam
Tuesday February 27, from 7:00pm to 9:00pm. The location will be posted in due course.

Final examination
Monday April 9, from 7:00pm to 9:00pm. The location will be posted in due course.

Final exam weighting
45% (Scheme A) or 55% (Scheme B). See below.

Course website
On Courselink

Instructor information

Instructor
Eric Poisson (epoisson@uoguelph.ca)

Office location and phone number
MacNaughton 452, 519-824-4120 x53653

Office hours
I will be generally available on Tuesday, Wednesday, and Thursday. Please schedule an appointment if you have trouble finding me.

Eric is very much an informal guy, and he prefers to be addressed simply as “Eric”. He does not appreciate being subjected to such pompous titles as Doctor, Professor,
or His Gracious. Eric’s field of research is general relativity, including black holes and gravitational waves. For additional details, please consult his research web page at www.physics.uoguelph.ca/poisson/research/.

**Graduate Teaching Assistant information**
Tyson Schilbach ([tschilba@uoguelph.ca](mailto:tschilba@uoguelph.ca))

**Course content**

**Specific learning outcomes**
After taking this course, the student will be able to:

1. Demonstrate a mastery of the Biot-Savard law for the magnetic field, and apply it to calculate the field due to various distributions of current.
2. Demonstrate a working understanding of the Lorentz force, and its action on moving charges.
3. Apply Ampere’s law to obtain the magnetic field of various current distributions.
4. Demonstrate an understanding of the vector potential and its relation to the magnetic field.
5. Demonstrate a rudimentary understanding of magnetic moments and their role in the magnetic response of materials.
6. Demonstrate a working knowledge of the electromotive force in electric circuits.
7. Apply Faraday’s law to calculate the magnetic field produced by a time-changing electric field.
8. Demonstrate a working understanding of inductors.
9. Formulate all the laws of electromagnetism in the form of Maxwell’s equations.
10. Demonstrate an understanding of electromagnetic waves as a consequence of Maxwell’s equations.
11. Appreciate some of the connections between electromagnetism and special relativity.

**Lecture, tutorial, and assignment schedule**
The following table provides a rough guide of the material covered during each week of the semester, as well as key information regarding tutorials and assignment due dates. All dates are tentative; check Courselink regularly to get the most updated information. Regular attendance at lectures and tutorials is the best way to ensure that you are up to date on the relevant course material.

<table>
<thead>
<tr>
<th>Week</th>
<th>Material covered</th>
<th>Tutorials/assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Jan 9, 11</td>
<td>Introduction; current; charge conservation</td>
<td>No tutorial</td>
</tr>
<tr>
<td>2: Jan 16, 18</td>
<td>Currents in matter; Biot-Savard law</td>
<td>Tutorial Jan 16</td>
</tr>
<tr>
<td>Week</td>
<td>Material covered</td>
<td>Tutorials/assignments</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>3: Jan 23, 25</td>
<td>Biot-Savard law; Lorentz force</td>
<td>No tutorial</td>
</tr>
<tr>
<td>4: Jan 30, Feb 1</td>
<td>Ampere’s law; applications</td>
<td>Assignment #1 due</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial Jan 30</td>
</tr>
<tr>
<td>5: Feb 6, 8</td>
<td>Applications of Ampere’s law; vector potential</td>
<td>No tutorial</td>
</tr>
<tr>
<td>6: Feb 13, 15</td>
<td>Magnetic moment; force and torque on current loop</td>
<td>Assignment #2 due</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial Feb 13</td>
</tr>
<tr>
<td>7: Feb 27, March 1</td>
<td>Magnetic fields in matter; electromotive force</td>
<td>Midterm exam</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tuesday Feb 27</td>
</tr>
<tr>
<td>8: March 6, 8</td>
<td>Faraday’s law; inductance</td>
<td>No tutorial</td>
</tr>
<tr>
<td>9: March 13, 15</td>
<td>Inductance; Maxwell’s equations</td>
<td>Assignment #3 due</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial March 13</td>
</tr>
<tr>
<td>10: March 20, 22</td>
<td>Electromagnetic waves</td>
<td>No tutorial</td>
</tr>
<tr>
<td>11: March 27, 29</td>
<td>Electromagnetic waves; potential formulation of Maxwell’s equations</td>
<td>Assignment #4 due</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tutorial March 27</td>
</tr>
<tr>
<td>12: April 3, 5</td>
<td>Relativistic aspects of electromagnetism</td>
<td>No tutorial</td>
</tr>
</tbody>
</table>

**Laboratories**

There are no labs for this course.

**Tutorials**

Tutorials are held on alternating Tuesdays, 7:00pm to 9:50pm, in MACS 121, starting on January 16.

**Course evaluation**

The final mark for the course will be the highest of the two marks calculated under the following two schemes. No other marking schemes will be considered. A final mark of at least 50% is required to pass the course.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Quizzes</th>
<th>Assignments</th>
<th>Midterm exam</th>
<th>Final exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5%</td>
<td>15%</td>
<td>35%</td>
<td>45%</td>
</tr>
<tr>
<td>B</td>
<td>5%</td>
<td>15%</td>
<td>25%</td>
<td>55%</td>
</tr>
</tbody>
</table>

A number of quizzes will be made available on Courselink, each quiz appearing several days prior to a specific lecture. Completion of these quizzes by the assigned deadline is mandatory, and the quizzes will be marked to provide 5% of the final mark.

A set of four homework assignments will also be made available on Courselink, to be returned before class begins on the assigned due date. A penalty will be applied to
late assignments, and no assignment will be accepted after the start of the evening’s tutorial. Assignments provide 15% of the course’s final mark.

In **marking scheme A**, the midterm and final exams account for 35% and 45% of the final mark, respectively. In **marking scheme B**, the midterm and final exams account for 25% and 55% of the final mark, respectively. Both midterm and final exams will be closed-book exams, meaning that you will not be allowed to consult your notes nor any other source of information. You will, however, be provided with relevant material such as a formula sheet. Calculators may be required; only non-programmable pocket calculators are permitted. Personal communication or entertainment devices (such as smart phones or MP3 players) are not permitted during the exams.

**(Not) Working with other students**
All work submitted for grading in this course must be each individual student’s own work. While students are encouraged to share thoughts and ideas prior to writing up the solutions, **it is not acceptable to share assignment solutions.** The assignments are not group projects, and it is important that you do not show your final written solutions to other students.

**Getting help**
One of the best sources of help is the course’s TA and tutorial instructor. In addition, you can come to Eric’s office hours, or make an appointment for a special meeting at another time.

**Course resources**

**Required text**

**Recommended text:**

The book by Griffiths is the same book that is used in PHYS*2330 (Electricity and Magnetism I). My lectures will loosely follow the book, and reading assignments will be given each week to ensure that you keep up with the material. The quizzes will provide even more incentive to keep up with the reading. The book by Young and Freedman is the one you used in first year; you may want to refer to it from time to time.

**Course policies**

**Grading policies**
Each homework assignment will be submitted by you before class begins on the day the assignment is due. A penalty will be applied to late assignments, and no
assignment will be accepted after the start of the evening’s tutorial. No partial credit will be given to unaccepted assignments.

Both midterm and final exams will be closed-book exams, meaning that you will not be allowed to consult your notes nor any other source of information. You will, however, be provided with relevant material such as a formula sheet. Calculators may be required; only non-programmable pocket calculators will be permitted. Personal communication or entertainment devices (such as smart phones or MP3 players) are now permitted during the exams.

**Course policy on group work**
You are permitted to discuss the homework problems with your colleagues while trying to solve them. However, and this is important, after the discussions you must write up the solutions yourself, independently of anyone else. Copying will not be tolerated. Evidence of copying will be considered under the Academic Misconduct section of this document (see below).

**Course policy on electronic devices and recording of lectures**
What you do with your laptop, smart phone, tablet, etc, during lectures is your own business, so long as it does not create a distraction for your classmates or the instructor. If such a distraction arises you will be asked to leave the classroom.

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

**University Policies**

**Academic Consideration**
When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for academic consideration.

**Academic Misconduct**
The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University’s policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a
student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

**Accessibility**
The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community’s shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact Student Accessibility Services (SAS) as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208.

**Course Evaluation**
The Department of Physics requires student assessment of all courses taught by the Department. These assessments provide essential feedback to faculty on their teaching by identifying both strengths and areas of improvement. In addition, student assessments provide part of the information used by the Department Tenure and Promotion Committee in evaluating the faculty member’s contributions in the area of teaching. You are therefore encouraged to take the evaluation procedures seriously, and to provide feedback about this course and its instructor.

**Drop date**
The last date to drop one-semester courses, without academic penalty, is March 9, 2018. For regulations and procedures for Dropping Courses, see the Undergraduate Calendar.