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Office Hours TBD

TA Information and Office hours
Mohamed Abdelazez
Curtis Lacelle

Course Number and Calendar Description
SYSC 4201 [0.5 credit]
Ethics, Research Methods and Standards for Biomedical Engineering
Ethical theories, ethical decision-making, biomedical research ethics: informed consent, confidentiality, privacy, research ethics boards; research methods: hypothesis formulation, data collection, sampling bias, experimental design, statistical literacy; regulations for design, manufacture, certification of medical devices; impact of technology and research (social, political, financial).
Lectures three hours a week, problem analysis three hours alternate weeks.

Prerequisites
Prerequisite(s): ELEC 3605 or SYSC 3203.

Course Objectives

Learning Outcomes
By the end of the class, students should be able to:
- justify a course of action in an ethical dilemma
- evaluate the ethics of research involving humans
- explain the purpose and results of statistical analysis, including common misinterpretation and misapplication of statistics
- describe the regulatory process for medical devices
- discuss the impact of biomedical technology with a multidisciplinary audience
- design an appropriate research methodology to investigate a research question

Graduate Attributes (GA’s)
The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 graduate attributes:
1. **A knowledge base for engineering**: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

2. **Problem analysis**: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

3. **Investigation**: An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

4. **Design**: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

5. **Use of engineering tools**: An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

6. **Individual and team work**: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

7. **Communication skills**: An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

8. **Professionalism**: An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.

9. **Impact of engineering on society and the environment**: An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.

10. **Ethics and equity**: An ability to apply professional ethics, accountability, and equity.

11. **Economics and project management**: An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.

12. **Life-long learning**: An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

This course is intended to develop and assess students’ competence in:

- **Investigation**
  - Design of experiment
  - Interpretation of data (synthesis) and discussion

- **Communication skills**
  - Oral and written presentations
• Ethics and equity
  o Ethics and equity
• Life-long learning
  o Self-awareness
  o Information from relevant publications
  o Research process and skills
  o The place of engineering in society

_textbooks (or other resources) if applicable_

There are no mandatory textbooks for this course. The following are

Online Statistics: An Interactive Multimedia Course of Study (http://onlinestatbook.com/)

Internet Encyclopedia of Philosophy (http://www.iep.utm.edu/)

Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans
(http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/Default/)

Ropella, Kristina, Introduction to Statistics for Biomedical Engineers, Morgan & Claypool, 2007. (available online via Carleton Library)


Vallero DA, Biomedical Ethics for Engineers: Ethics and Decision Making in Biomedical and Biosystem Engineering, Elsevier 2007.


Evaluation and Grading Scheme

<table>
<thead>
<tr>
<th>Element</th>
<th>Note</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>TCPS 2: CORE Tutorial (students must complete this tutorial to pass the course)</td>
<td>due last day of class (recommended to be completed end of January)</td>
<td>0%</td>
</tr>
<tr>
<td>Ethics Video</td>
<td>two attempts, best mark used (one due mid February one due mid March)</td>
<td>15%</td>
</tr>
<tr>
<td>Research Project (a complete ethics closure form must be submitted to pass the course)</td>
<td>proposal and REB application due end of January; paper due mid March; presentation beginning of April</td>
<td>30%</td>
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### Statistics Assignment
<table>
<thead>
<tr>
<th>Assignment</th>
<th>Due Date</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Statistics Assignment</td>
<td>end of March</td>
<td>10%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>Weekly</td>
<td>10%</td>
</tr>
<tr>
<td>Journals</td>
<td>Bi-weekly</td>
<td>5%</td>
</tr>
<tr>
<td>Final Exam</td>
<td></td>
<td>30%</td>
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The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

### Week-by-Week breakdown

**Week 1 (Jan 8 and Jan 10)**
- Course introduction
- Introduction to ethics
- Ethical theories

**Week 2 (Jan 15 and 17)**
- Research and library resources (Heather Macdonald)
- Research ethics (Alisha Seguin)
- Moral status
- Common versus particular moralities
- Ethical decision making
- History of research ethics

**Week 3 (Jan 22 and 24)**
- Research involving humans
- Informed consent

**Week 4 (Jan 29 and Feb 31)**
- Confidentiality and privacy
- Research methods

**Week 5 (Feb 5 and Feb 7)**
- Introduction to statistics
- Plagiarism
- Graphs

**Week 6 (Feb 12 and Feb 14)**
- Bivariate data
- Research methods

**Reading Week (Feb 18 to 22)**
Week 7 (Feb 26 and Feb 28)
- Probability
- Receiver Operating Characteristic Curve
- Sampling Distributions

Week 8 (Mar 5 and Mar 7)
- Estimation
- Hypothesis testing
- Type I and Type II Errors

Week 9 (Mar 12 and Mar 14)
- Medical Device Standards

Week 10 (Mar 19 and Mar 21)
- Testing Means

Week 11 (Mar 26 and Mar 28)
- Technology and society

Week 12 (Apr 2 and Apr 4)
- Technology and society
- ERMSBE Conference

Week 13 (April 9)
- ERMSBE Conference

General Regulations

Attendance: Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current Undergraduate Calendar, Academic Regulations of the University, Section 1.2, Course Selection and Registration and Section 1.5, Deregistration.

Health and Safety: Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: http://sce.carleton.ca/courses/health-and-safety.pdf

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 (3.0) working 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. For more information, see the current Undergraduate Calendar, Academic Regulations of the University, Section 2.6, Deferred Term Work.
**Appeal of Grades**: The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the *Undergraduate Calendar, Academic Regulations of the University, Section 2.7, Informal Appeal of Grade and Section 2.8, Formal Appeal of Grade.*

**Academic Integrity**: Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: [https://carleton.ca/registrar/academic-integrity/](https://carleton.ca/registrar/academic-integrity/). This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

**Plagiarism**: Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

**Academic Accommodation**: You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at [http://www.carleton.ca/equity/](http://www.carleton.ca/equity/) 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 more details see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

- **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 see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

- **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](mailto: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 [https://carleton.ca PMC/students/dates-and-deadlines/](https://carleton.ca PMC/students/dates-and-deadlines/) 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/sexual-violence-support/](https://carleton.ca/sexual-violence-support/).
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 must be provided to students who compete or perform at the national or international level. Please contact your instructor 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, see https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

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