PHYSICS
Science
Special Topics in Physics: Introduction to Research in Brain Imaging

203-BZT-DW (all sections)
Fall 2019

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Pre-requisites Mechanics (203-NYA-05)

Co-requisites None

Ponderation 3-2-3 (3 hours of lecture, 2 hours of labs, and 3 hours of work outside class per week)

Course objectives

The objective of the course is to develop research skills through projects and group investigations. The targeted skills are critical thinking, self-efficiency, ability to communicate efficiently, collaborative skills, integration of knowledge, good organization during a long term project and perseverance despite the difficulties.

Students taking this course are eligible to participate in the summer internship, where they would work on projects in university or hospital labs in Montral.
Detailed information regarding the objectives and standards for this course and the specific performance criteria is available at https://www.dawsoncollege.qc.ca/physics/program-documents/science/.

Course competencies

This course will allow the student to partially achieve the competency:
00UV: Apply the experimental method in a scientific field.

1. Represent various situations, drawing upon relevant concepts, laws and principles of science.
2. Solve problems using a method proper to science.
3. Apply techniques of experimentation or validation specific to science.

Evaluation

The Institutional Student Evaluation Policy (ISEP) is designed to promote equitable and effective evaluation of student learning and is therefore a crucial policy to read and understand. The policy describes the rights and obligations of students, faculty, departments, programs, and the College administration with regard to evaluation in all your courses, including grade reviews and resolution of academic grievance. ISEP is available on the Dawson website.

In class presentations	30%
Participation in discussions	10%
Term project[†]	60%

[†]Your teacher will provide a detailed breakdown of these components during the first week of class.

If the student receives a grade less than 60% in the term project, the maximum course grade they will be granted is 55%.
In order to pass the course, students must show a basic understanding of the course material at the level covered in the lectures and in the lab. This is achieved by attaining a final grade of at least 60%, calculated according to the evaluation scheme above. **Note: course work not submitted by the due date may be penalized at the teacher's discretion.**

Required materials

There will be no textbook. Bringing a personal laptop to class would be very useful, though arrangements will be made for those who cannot bring a laptop.

Teaching methods

The emphasis will be on competency development rather than on content, thus the teaching methods will be tailored to this end. Most of the class time will be devoted to student presentations, class discussions or to team work. Through the course, students will research various topics assigned to them by the teacher and will present to the group. Thus, they will get experience at exploring a new topic by themselves and trying to make sense of it. It will be clear that they are not expected to have gained a deep understanding before presenting, but to have collected a lot of pertinent information and matter for discussion on the topic. Through this peer instruction, the group will get an overview of the field. The students will also work on the various stages of an authentic experiment: design, writing of proposal for ethic board approval, planning, data collection, data preprocessing, data analysis, discussion of results. The role of the teacher will be to lead the students through a process very new to them and to add content when necessary. The approach will be adapted from the summer internship, which has proven to be very successful.

Attendance & participation

Attendance and participation are keys to success in this course. In the rare event that a student for valid reason (e.g. due to an intensive course, illness, etc.) is or anticipates to be absent for a class, the student must, where possible, inform the teacher and provide the necessary documents before the absence or, at the latest, on the day of their return. For additional information regarding attendance, students should refer to the Institutional Student Evaluation Policy (ISEP section IV-C).

Literacy standards

It is expected that students will be able to comprehend the course material and express themselves appropriately as a normal part of their academic performance in the course. Marks may be deducted for inadequate communication skills.

Laboratory work

Experimentation is an essential part of science. Students will be expected to perform experiments and report on their results. Your teacher will provide you with instructions for lab experiments and activities (there is no manual to purchase). **Students must be present during the entire lab activity to receive credit.**

Student conduct

Everyone has the right to a safe and non-violent environment. Students are obliged to conduct themselves as stated in the Student Code of Conduct and in the ISEP section on the roles and responsibilities of students (ISEP section II-D). Disruptions or excessive noise will not be tolerated. Students who do not comply with these rules will be asked to leave the class and may be referred to Student's Services for disciplinary action. **Mutual respect is the key to a harmonious learning environment.**

Academic integrity

Cheating, copying, or any other form of academic dishonesty will not be tolerated. Students should acquaint themselves with the policy of the College on plagiarism and cheating. According to ISEP, the teacher is required to report to the Sector Dean all cases of cheating and plagiarism affecting a student's grade (ISEP section V-C). The usual penalty for the first instance of cheating will be a grade of zero for the piece of work in question to all parties involved (under certain circumstances, even a first offence may be penalized by failure in the course). A second offence may result in the failure of the course. Students should note that using someone else's laboratory data without authorization from the student and the teacher is cheating.

Intensive course conflicts

If a student is attending an intensive course, the student must inform the teacher, within the first two weeks of class, of the specific dates of any anticipated absences.

Policy on religious observance

Students observing religious holidays must inform their teachers, in writing, as prescribed in the ISEP Policy on Religious Observances, no later than the end of the second week of the impacted semester or term. This applies both to the semester or term, as well as to any final examination period. (ISEP Section IV-D) Please refer to the academic calendar for the exact dates. Forms for this purpose are available from your teacher. Your teacher will inform you of any modifications to planned course activities resulting from the teacher's own religious commitments.

Course content

The presentations topics and group work tasks will be following this tentative schedule.

Weeks	Presentations topics	Group work task
1	Brain anatomy and functions	Activity on brain anatomy
2	Overview of brain imaging techniques	
3	How to do a literature review	Developing the research question for project
4	Physics of MR	Developing the research question for project
5	RF spectroscopy, fMRI, dMRI	Developing the proposal for approval by REB
6	Ethics of working on human data	Establishing the method for experiment
7	Physics of EEG and MEG	Performing the experiment
8	EEG analysis	Performing the experimen
9	Unix, virtual machine, specialized software	Practice with software
10	Programming	Practice with programming
11	Image registration, Linear Algebra	Analysis of experiment
12	Group comparison Statistics	Analysis of experiment
13	Neuropsychology and Major pathways	Analysis of experiment
14	Structural and functional connectivity	
15	Presentations of results	Presentations of results

Comprehensive examination Second-year students can opt to complete the independent study portion of their comprehensive examination in this course. (This option is not available in continuing education courses.) The project will be evaluated on pass or fail basis independently from the course grade.