School of the Environment
UNIVERSITY OF TORONTO

299Y/399Y RESEARCH OPPORTUNITY PROGRAM Contract
Fall/Winter 2021/2022

SUPERVISOR'S NAME Brad Bass
DEPARTMENT School of the Environment
NUMBER OF HOURS PER WEEK REQUIRED: 8 - 10 hrs/week

I am pleased that you have chosen to participate in the Research Opportunities Program "Studying Complexity in Natural Systems Through Simulation Models" or "Simulating the emergence of behavioural change and the impact on the environment". I look forward to an enjoyable and a fruitful experience as you develop skills in research, mentoring, training and leadership. The purpose of this syllabus is to set out the understanding as to what you will do as well as the evaluation, expectations and assignments.

Students admitted to the Research Opportunity Programs must fulfil all program requirements as established at the beginning of the 299Y/399Y course. When you chose the ROP Course, a description was made available to you in your contract, and I am confirming that those arrangements are applicable for the academic year 2021-22. In particular, I want to point to the provisions that set out the assignments to be completed, the timetable for those assignments and the weight to be given to the assignments and other factors in the final mark on the ROP Course; please note there is a small but important weight given to participation.

With respect to the conduct of the course, I hope to meet in person, but we have to be prepared to offer it partially or entirely online. We will have meetings on a weekly basis but we might consider a bi-weekly schedule based on the availability of the Lab and changes that might result from the current pandemic. We are planning to meet Monday, starting at 5:00 PM. This would include both our regular work session hours as well as additional time for ROP matters. I am planning on offering a separate time for office hours (Thursdays at 4:30) as well as separate work meetings, both of which are optional and offered online.

Course description
Complexity is an interdisciplinary concern that emerges in every field with interactions between system components as they cope with a change in the gradient of energy or information. The nature of these interactions is often quite simple, but the patterns that emerge in system behaviour can be quite unexpected. The emergence of specific patterns is hard to predict, but software such

as COBWEB allows us to represent the system by representing the behaviour and interactions of individual components.   To learn about complexity across multiple disciplines requires us to encourage dialogue and collaboration between students in the natural sciences, social sciences, and the humanities. The models that you develop will also be your virtual laboratory, your experimental platform and a visualization of your system. Conducting actual experiments with your systems is costly, time consuming and in some cases not even possible. Although many of you will not be able to tell me if your model could reproduce an actual system outcome, you will be able to know if you are representing the dynamics of your system. With sufficient experiments and a proper experimental design, which is possible with COBWEB and will be discussed in the Lab, we can extract signals from the noise and make statements about change in the system.

Models that can act as virtual labs will be a vital tool in medicine, public policy, economics, ecology and other areas. These models will provide the first, quick answer to the question "What if?" and will provide the answer at no cost. Your future career may involve making or advising on decisions or proposing changes to policy and practice in your field. To be effective as professional in your field, they must know how to answer that "What if" question on the fly, within ranges of uncertainty and with some confidence that you do understand how your system will respond to interventions.

ENV299 and ENV399 are designed as a practical introduction to research in complexity across multiple disciplines. Even though the connections might not seem obvious to you now, these multiple disciplines give us an understanding of the complexity of the environment and how changes to our environment will affect our health and well-being at different scales. More specifically, it aims to familiarize you with the methods and techniques used in research, allow you to develop a basic set of skills to write proposals, literature reviews, develop and conduct experiments, work with other professionals from a myriad of disciplines and communicate results to suitable audiences. The course is inspired by a philosophy of "learning by doing" and collaboration. Our meetings allow you to meet with me and each other while learning COBWEB and working through problems in the development of your models.

We will also use our meetings to discuss issues in research. The main topics discussed include: understanding and explaining modelling, subject selection and the formulation of a research question, using the literature including articles outside of your expertise, design thinking - translating systems into the language of models, model development and assessment, and communication skills in different media. The course consists primarily of working meetings, modelling complexity, designing and completing a large, multipart research project, enhanced by active-learning activities in mentoring, teamwork and communication. By the end of the course, you will have the confidence to generate, evaluate, and communicate reliable and relevant information, either individually, as part of team or as a team leader.

Learning Objectives

This course will allow students to develop basic skills that will enable them to locate and critically assess existing research, design a model of their system to answer a question, conduct and report on a complex research project on a complex system involving modelling, experimentation and analysis. More concretely, by the end of the course students should be able to:

- Understand how to develop a testable research question that can guide research.
- Design a research project using modelling as the research tool.
- Identify available information and a suitable means for model development
- Synthesizing the available research literature
- Translate a system into model components with causal diagarams.
- Conduct experiments with a model.
- Communicate research results effectively through different forms (orally, written and visually).
- Develop the ability to work collaboratively with a partner or a research team.
- Develop skills in leadership, mentorship and training.

COURSE REQUIREMENTS

1. Journal – this will be a documentation of progress agreed upon with the professor. It is often hand written, somewhat messy, informal and a record of your thoughts and ideas.
2. Meetings - weekly with ROP supervisor, and record dates and times in the journal.
3. Attend any demonstrations, orientations, etc., that the supervisor may require. Special modules focused on bibliographic searching and citation practices, accessing the map and data library, and developing archival research skills may be scheduled at Robarts Library.
4. The supervisor will offer an assessment of the student's progress **BEFORE THE DEADLINE FOR DROPPING COURSES WITHOUT PENALTY.**
5. Students will participate in the Spring Undergraduate Research Forum

MEANS OF EVALUATION and MARKING SCHEME (**no ONE assignment is worth more than 50%**).

Note on modelling software: You will be conducting your research with the COBWEB (Complexity and Organized Behaviour Within Environmental Bounds) software. It is hosted in the Gerstein Library and has a long history of use in this ROP as well as by other students outside of the ROP.

Note on grading of group work: The Journal, mental model, start-up guides and annotated bibliography will be completed by each student individually. The Literature Review, Poster and the Final Report can be submitted as a Research Team if you opt to work with a partner or a team (a maximum of 3 students may work together). You will receive a grade for your literature review, poster and final report. Each member of the research team will receive the same grade unless you have not met your commitments to your partner(s). Students who fail to fulfill their commitments with fellow group members will receive a lower grade; group members whose contributions to the project are outstanding will have points deducted accordingly.

Note on the evaluation of participation: There are sufficient opportunities for observation to make this assessment. This discretionary component will be determined at the end of the fall and winter semester; these are not simply bonus points and will be applied at my discretion. Please note that severe lack of participation in group work may lead to an individual zero grade on the group project and, as such, likely a failing grade for the course.

Assignment Description	Due Date	Weight (%)
Journal Fall Semester	Dec 11	5%
Journal Spring Semester	Mar 26	5%
Start-Up Guide with focus on newest tabs in COBWEB	Dec 11	5%
Mental Models Exercise	Sept 25	5%
Annotated Bibliography	Oct 30	10%
Research Proposal & Literature Review	Nov 27	20%
Final Report Draft	Mar 19	20%
Final Report Revised with Guide to COBWEB model and PPT	Apr 09	15%
Participation (5% per semester)	Ongoing	10%
UNDERGRADUATE RESEARCH FORUM Research Poster	Date TBD	5%
TOTAL	**N/A**	**100%**

COURSE POLICIES AND STUDENT RESPONSABILITIES
Meeting policies
- Arrival: If you have to come into class late, please do so in the least disruptive manner possible. As a sign of respect to the instructor and the rest of the class, please let the instructor know ahead of time if you need to arrive late or leave early.
- Attendance: Students are expected to come to class meetings. Attendance will be noted.
- Class preparation and student participation: Physical/virtual presence in the lab will earn 1/5 for participation. Students are expected to engage in the course, work outside of the meetings, participate in discussions and provide help to others. I want this class to foster an environment that encourages student participation and questions. Student participation in class count towards your evaluation.
- Respect: Students are expected to handle themselves with respect toward the instructor, peer assistants, and your peers in all matters related to the course, including participation in class, group work, student presentations, communications regarding course content or evaluation, and assisting other students.
- Etiquette regarding the use of computers and other electronic devices: The use of your own computers is required outside of the Lab. If we are able to return to the Instructional Lab in Gerstein you will be able to bring your own computers and this has been a common practice. While we are in the Lab wearing earphones and watching unrelated videos are disruptive to your peers and the instructor. As such, they are unacceptable.

- This ROP is designed to be run in person as this improves your experience and the experience of the instructor. Current online meetings take place on Monday from 5:00 – 6:30. Additional time may be added after the meeting for individul student concerns.
- Wearing Masks & Physical Distancing: All students will be expected to wear masks and maintain an appropriate distance from other students and the instructor. All students will be expected to follow the University of Toronto practice for self-assessment before leaving for campus. We may be asked to take other measures by the Library while using their facilities, and you will be expected to adhere to all requests from the Library.

Written assignments
- Formatting: Coursework must be word processed double-spaced, 12 point font size, unless otherwise noted. Assignments must be proofread prior to submission to insure that they are free of grammatical and spelling errors, and must include a list of all references cited in the text, using the APA citation style (see "UofT Libraries Research Services" link in the resources section below). All coursework must also include the student's name and the last 5 digits of your ID number, the course's code and name and that of the instructor in order to avoid loss or improper identification. Note, however, that there is no need to use cover page to do so.

Submission guidelines:
- Submission guidelines: All assignments will be submitted electronically through Quercus or by email **by 11:59 PM** on the date specified by the instructor, **unless otherwise noted**. It is recommended that you keep copies of your assignments and early drafts until you receive your graded assignment. Prior to the due date, students will be given instructions about submitting assignments.

- Late submissions: Work submitted late will be accepted with a **5% daily penalty (including weekend days), up to seven days** after the due date. If needed, you may submit your assignment during the weekend as a way to minimize late penalties. In such cases, the date/time of submission will be considered, using 11:59 PM as time of reference. In case of an outstanding **valid** situation you must contact me, preferably in advance. I cannot consider a particular situation unless I know about it, so do not wait until the end of the term to communicate with me if something did come up. Currently, you do not need to use a completed University of Toronto Verification of Student Illness or Injury form. If that situation changes, forms can be found at (http://www.illnessverification.utoronto.ca/). If you need to be absent for a prolonged period of time due to medical reasons, you will also be required to submit and Absence Declaration online via ACORN in addition to informing me of your absence. Other proof may be required by the instructor for nonmedical reasons - see general guidelines and form put together by FAS available at: http://www.artsci.utoronto.ca/current/petitions/process#documentation. The instructor will provide guidance if special exemptions are to be made COVID-19 related symptoms or other illnesses. No extensions will be granted unless you have communicated with the instructor and your reasons have been deemed valid.

Communication with the instructor

I will make myself available for you on Monday evenings and during office hours. Occasionally we will arrange other online meetings. For urgent matters or simple questions, you may also contact me via email, but the rule of thumb is that email should not be a substitute for lab meetings. I will make an effort to respond to you within 48 hours. You will find that I am very committed to your success and your ability to complete your research.

Email
I will accept email from all e-mail addresses, however your utor email is recommended. If you plan to use another another email account, that is not readily identifiable to your name, let me know when you need to do this, and I will look out for your message. I will be sending you messages from my utoronto account and my cobweb.ca account.

Quercus
A Quercus site may be set up for this course. If Quercus is used, I will use the site to post grades, additional readings, instructions for assignments and other useful materials. Quercus may also be used by the instructor to communicate with the class. Please make sure to check it regularly. To access the ENV299 and 399 Quercus, go to the UofT login page at: https://q.utoronto.ca/ and login using your UTORid and password. Once you have logged in, click on the Dashboard module on the right margin of your screen. You will then be able to see the tab for ENV299 and 399 (along with all your other Quercus-based courses).

Accessibility Needs
Accessibility Needs: The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible: disability.services@utoronto.ca or http://studentlife.utoronto.ca/as You may also want to contact Accessibility Services Office if you have problems arising from chronic issues or injuries sustained during the term that affect your ability to do tests or course work.

Academic integrity
Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves. Familiarize yourself with the University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm It is the rule book for academic behaviour at the U of T, and you are expected to know the rules. Potential offences include, but are not limited to:
In papers and assignments:
▪ Using someone else's ideas or words without appropriate acknowledgement
▪ Copying material word-for-word from a source (including lecture and study group notes) and not placing the words within quotation marks

- Submitting your own work in more than one course without the permission of the instructor
- Making up sources or facts
- Including references to sources that you did not use
- Obtaining or providing unauthorized assistance on any assignment including:
  - working in groups on assignments that are supposed to be individual work
  - having someone rewrite or add material to your work while "editing"
  - Lending your work to a classmate who submits it as his/her own

Misrepresentation:
- Falsifying or altering any documentation required by the University, including doctor's notes
- Falsifying institutional documents or grades

Please note that potential offences will be addressed in accordance with institutional procedures.

Useful UofT Resources

UofT Libraries
- Library Catalogue (search for books, journal articles, documents, databases): http://search1.library.utoronto.ca/UTL/search.jsp
- Research services for students (e.g., research guides, citation resources, refworks, etc.): https://onesearch.library.utoronto.ca/research

UofT Writing (for advice on: planning and organizing, reading and researching, using sources, types of writing, style and editing and English as a second language):
- http://advice.writing.utoronto.ca/ ; http://writing.utoronto.ca/support/english-language-support/

Evaluation criteria for written work
The primary criteria used in evaluating written work are the following:
1. Mechanics:
   - Marks will be deducted to correct grammatical and spelling errors.
   - You must pay attention to sentence and paragraph structure and minimize the use of run-on sentences and overly long paragraphs.
   - Students are expected to include thorough, accurate and consistent references in an established academic referencing style that includes page numbering.
2. Writing style: Your papers should be written in a clear, concise and unambiguous style, which assists, rather than impedes, communication with the reader.
3. Structure: Defined as coherence of the organization of the paper. The logic of the structure is determined by the purpose, which is to answer a research question, communicate instruction/information or defend a thesis statement. Instructions on appropriate structure for the literature review and final report will be discussed in the meetings.

4. Precision and accuracy: Precision means saying exactly and specifically what you mean, avoiding vague generalities. Accuracy refers to absence of major factual errors.
5. Analysis: Student essays are expected to include critical distance and originality of thought.

These five grading criteria are not meant to impede your creativity, but to allow other readers to appreciate your creativity.

Evaluation criteria for poster presentations

The primary criteria used in evaluating presentations are the following:
1. Success in communicating key concepts succinctly and accurately, thereby demonstrating sound understanding of the work being presented, both in the poster and orally.
2. Mechanics of communication, such as manner of speaking (including good diction and tone), structure of the poster and level of organization, neatness, effective use of visuals and proper referencing.
3. Ability to respond appropriately to questions.