



Faculté des sciences sociales | Faculty of Social Sciences  
Département de science économique | Department of economics

Economic System Design  
ECO6108A00/SYS5140A00  
Fall Term 2022

## Course Information

**Class Schedule:** We 8:30AM - 11:20AM 200 Lees (LEE) A131

### Instructor Information:

**Name:** Nguyen Van Quyen

**Email:** nvquyen@UOTTAWA.CA

Phone Number: (613) 562 5800 ext 1696

**Office Hours:** Tu 2:30PM-4:00PM

We 2:30PM-4:00PM

Communication Preferences: By email

Call Me:

Short Bio:

### Other instructor(s)/TAs:

Before emailing a question, please *fully* read this syllabus and explore the associated resources. The answers to many questions can be found in this document and students may be referred back to the syllabus if the answer is already available. Please allow at least **two (2) business days** for responses to inquiries before pursuing another route of communication.

## Official Course Description

*Deterministic dynamic optimization methods: economic and managerial applications of the maximum principle of Pontryagin and of dynamic programming. Discrete time stochastic dynamic optimization methods: Bayesian and Markovian decision theory, measures of risk-aversion and risk, portfolio theory, elements of search theory, applications of discrete time stochastic control to economics.*

## Additional Course Description

*This is a course on mathematical modeling. The course is structured as a set of modeling exercises that involve formulation and interpretation of problems encountered in the fields of biology, decision theory, economics, demography, operations research, politics and sociology, traffic studies...*

## Indigenous Affirmation

### **ANISHINÀBE**

*Ni manàdjiyànànig Màmìwininì Anishinàbeg, ogog kà nàgadawàbandadjig iyo akì eko weshkad. Ako nongom ega wikàd kì migiwewàdj.*

*Ni manàdjiyànànig kakina Anishinàbeg ondaje kaye ogog kakina eniyagizidjig enigokamigàg Kanadàng eji ondàpinangig endàwàdjìn Odàwàng.*

*Ninisidawinawànànig kenawendamòdjig kije kikenindamàwin; weshkinìgidjig kaye kejeyàdizidjig.*

*Nigijeweninmànànig ogog kà nìgànì sòngideyedjig; weshkad, nongom; kaye àyànikàdj.*

[Listen to the audio file](#)

### **ENGLISH**

We pay respect to the Algonquin people, who are the traditional guardians of this land. We acknowledge their longstanding relationship with this territory, which remains unceded.

We pay respect to all Indigenous people in this region, from all nations across Canada, who call Ottawa home.

We acknowledge the traditional knowledge keepers, both young and old.

And we honour their courageous leaders: past, present, and future.

## Inclusion

The University of Ottawa aims to be an equitable and inclusive institution, actively participating in ensuring the wellbeing of students, personnel and faculty members. The University is committed to eliminating obstacles to student inclusion in accordance with the [Ontario Human Rights Code](#). The Code provides that every person has the right to equal treatment with respect to goods, services, facilities, housing, contracts and employment as well as membership in trade or professional associations and unions without discrimination because of "Race, Ancestry, Place of origin, Colour, Ethnic origin, Citizenship, Creed, Sex, Sexual orientation, Gender identity, Gender expression, Age, Record of offence (in employment only), Receipt of public assistance, Marital status, Family status, Disability".

The [Human Rights Office of the University of Ottawa](#) adds "although the Human Rights Code does not provide a definition of discrimination, the notion of discrimination covers unfair treatment on the basis of race, disability, sex, or any other personal characteristic. It can take many different forms, can target a single person or a group and can be part of a system."

If you have experienced discrimination or harassment, you can seek confidential assistance through the University Human Rights Office to discuss your situation and/or [to file a formal complaint](#).

The following uOttawa Campus based services are available to you and your fellow students:

- [uOttawa Counselling Service](#) including Individual Counselling provided by uOttawa Counsellor, Pierre Bercy who specializes in anti-black racism;
- University of Ottawa Students' Union (UOSU) [Resources for/from the Black Community](#), [Centre for Students with Disabilities](#), [Racialized and Indigenous Students Experience Centre](#), [Womxns Resource Centre](#) and [uOttawa Pride Center](#)
- Anti-racism student committee (Email: [car.arc.uottawa@gmail.com](mailto:car.arc.uottawa@gmail.com))
- Mashkawazìwogamig: [Indigenous Resource Center](#)
- [University of Ottawa's Human Rights Office](#) including [policies on accessibility](#).

## Course Learning Outcomes

### General Course Learning Outcomes

*At the end of the course, the student will have learned enough Dynamic Programming and Optimal Control to formulate and solve a mathematical model in various areas, such as economics, politics, management...*

### Specific Course Learning Outcomes

*At the end of the course, the student will have learned how to do mathematics on the computer with Mathematica – both symbolically and numerically – to solve a mathematical model.*

## Teaching Methods

*The materials covered in the course consist of inclass 3-hour lectures given every week during the session. Formal lecture notes - typewritten like a research paper and complete with the mathematical model and the explicit computations carried out by Mathematica – are uploaded every week on Brightspace, and the student can download them at any time from any place to study.*

*The assignments are uploaded on Brightspace as the course progresses. The date on which an assignment is due is indicated in the statement of the assignment.*

*The computations needed to do the assignments and solve exam questions are heavy and unbearable to do by hand. Without Mathematica, a student will not survive the course. So, the student need to purchase a license of the software to learn how to type equations and how to do mathematics on the computer.*

### Guidelines on recording Class Sessions

Classes may be recorded if required to meet an approved academic accommodation plan for one or more students. Access to recordings for those students will only be available through Brightspace and

will be removed after 150 days. Recordings are the intellectual property of the professor and are protected by copyright. Students authorized to receive recordings are not permitted to share or download them, and they will lose the right to their accommodation if they do.

**Notice - Collection of Personal Information with Class Recordings:** In accordance with the Ontario Freedom of Information and Protection of Privacy Act and with University [Policy 90](#), your personal information is collected under the authority of the University of Ottawa Act, 1965. Classes will only be recorded for purposes consistent with the fulfillment of the course learning activities and outcomes. The recording may include the use of your video presence, picture, and voice, depending upon the technology used. You may ask your instructor to inform you of the specifics of the technology. If you choose not to have your video presence, picture or voice recorded, you may disable the audio and video functionality or request accommodation from your instructor. The recording will be available only to authorized individuals through University of Ottawa systems. If you have questions about the collection, use and disclosure of your personal information in this notice, please contact your instructor.

## Required Materials

*The course covers Dynamic Programming – in discrete and continuous time under both finite and infinite time horizon. Lecture notes on these subjects will be uploaded on Brightspace as the course progresses. For these subjects, the materials in the following books might be helpful:*

1. *Dynamic Programming and the Calculus of Variations, 1965, Academic Press, New York and London*  
*Author: Stuart E. Dreyfus*  
*Online Access: University of Ottawa Library*  
*Chapter 1: Discrete Dynamic Programming*
2. *Mathematical Modeling: A Source Book of Case Studies*  
*Edited By I. D. Huntley and D. J. G. James, 1990, Oxford University Press*  
*QA401.M374.1990*  
*On Reserve*  
*Chapter 3: Forest Management*  
*Chapter 10: Epidemic and the Spread of Diseases*  
*Chapter 11: Pollution of the Great Lakes*  
*Chapter 16: Marketing a New Variety of Seeds*  
*Chapter 27: Sheep Farming.*
3. *Optimal Control Applied to Biological Models*  
*Suzanne Lenhart and John T. Workman, Chapman & Hall/CRC, 2007, Mathematical and Computational Biology Series*  
*QA324.8.L46.2007*  
*Online Access: University of Ottawa Library*  
*Chapter 16 Lab 10: The Glucose Model*

4. The software required for the course is **WOLFRAM MATHEMATICA**, the world's definitive system for modern technical computing. One can purchase a license of Mathematica for a little more than \$250 by going to the website of Wolfram Mathematica.

## Optional Materials

For an appreciation of the use of modern mathematics in economics, management, the mathematical biosciences... as the students are encouraged to read the following book by R. E. Bellman.

*Some Vistas of Modern Mathematics; Dynamic Programming, Invariant Imbedding, and the Mathematical Biosciences, 1968, The University Press of Kentucky, Lexington, KY  
QA264B45 1968*

## Assessment Strategy

### Policy on the EIN grade (incomplete):

In all economics courses, a student who does not complete 25% or more of the course work will receive the grade EIN in the course. The grade EIN is equivalent to the grade F. See regulation 10.6 (<https://www.uottawa.ca/administration-and-governance/academic-regulation-10-grading-system>) for more details. Note that if the request for a deferred exam is refused, the student will receive a failure grade.

## Assessment Policies and Expectations

*The student must complete all the assignments. Failure to do so will result in a failure grade for the course. The assignments must be typed using Mathematica. Hand-written assignments are not acceptable. In exams, the student can answer a question by typing with Mathematica or hand writing or both.*

### Attendance

*The student should attend all the classes. Missing a class will have a negative impact on the performance in the assignments and exams, with the ensuing consequence of a lower final grade.*

### Time Commitment

In order to succeed in a 3-credit course, alongside the standard 3 hours of in-class instruction, students should expect to spend a minimum of 6 hours per week outside of the classroom engaged in activities related to the course, e.g. homework, reading, studying, etc., and should expect a minimum time commitment of 9 hours per week per course (on average).

## Language Expectations

This course is delivered in English, and in class interactions, including the online discussion boards, and feedback will also be managed in English. As part of your evaluation will be on your writing abilities, it is recommended to take the appropriate measures to avoid mistakes such as spelling, syntax, punctuation, inappropriate use of terms, etc. You may be penalized up to 15% for poorly written materials, to the professor's discretion.

## Mobile Devices

Unless explicitly requested, please refrain from using mobile devices during class. As in class time is quite limited, I would ask that you prioritize using this time to engage with class discussions and other content-related activities. Active participation and engagement with the content and your peers helps ensure full participation marks for your contributions this semester.

## Late Assignments

All assignments are to be submitted by their due date and time.

All late submissions will be immediately docked 5%, with an additional 5% for each subsequent day late to a maximum of 3 days, *including weekends*. **After 3 days all outstanding assignments will be given a zero (0%) grade.**

Exceptions are made only for illness or other serious situations deemed as such by the instructor. University regulations require all absences from exams and all late submissions due to illness to be supported by a medical certificate. Absence for any other serious reason must be justified in writing, to the professor, within five business days following the date of the exam or submission of an assignment.

The Faculty reserves the right to accept or refuse the reason; **reasons such as travel, jobs, or any misreading of the examination timetable are not acceptable.**

## Missed exams and requests for deferral

An absence from an evaluation that is not excused will result in a mark of 0. As of September 2022, according to [Academic Regulation I-9.5](#), students can request to be excused from only one evaluation per course. An absence will be excused only in the case of illness or other serious situations. The Faculty reserves the right to accept or refuse the reason. Conflicts due to travel, jobs, or any misreading of the examination timetable are not acceptable reasons.

Students who wish to be excused for an absence **must submit a service request (deferred mark) via their uOzone and attach this a deferral form** and submit credible external documentation (e.g. medical certificate, police report, death certificate, etc.) within five working days of the evaluation. Students whose request is approved will be required to write a deferred evaluation, except where the professor offers a re-weighting scheme. (If available, such a scheme is described in this syllabus.) A deferred evaluation must be taken as soon as possible after the original date, but in any case no later than (6) months after the end of the term ([Academic regulation I-9.5](#)). For the final exam, the date of the deferral is January 14 (set by the department).

## Exam conflicts

- Any conflict with a midterm exam schedule should be reported to the Professor at the beginning of the term. This request is especially applicable to the type 3 conflict (two in-class exams back-to-back) for students with special learning needs.
- Any conflict with a final exam schedule should be reported to the Faculty's undergraduate office as soon as the final examination schedule is released.

## Assessment Details

*The exams – midterm as well as final – are in class, open book, and laptops are allowed. The midterm covers all the materials discussed up to the last week before it. The final exam covers only the materials after the midterm.*

Assessment Type	Weight	Expected Date
Assignments (4)	20%	A1: September 21, 2022 A2: October 12, 2022 A3: November 16, 2022 A4: December 7, 2022
Midterm exam (in class)	30%	October 19, 2022
Final Exam (in class, not cumulative) Deferred final exam (in class)	50%	During the Exam Period January 14, 2023

## Regulation on Academic Fraud

### Preamble

Academic integrity is a fundamental value at the core of all academic activities. [The regulation on academic fraud](#) defines the acts that can compromise academic integrity and outlines the various sanctions and consequences of such acts, and the procedures for handling allegations and setting sanctions. Further information on academic integrity is available on the [website of the Provost and Vice-President, Academic Affairs](#).

### Definition

1. Any act by a student that may result in a distorted academic evaluation for that student or another student. Academic fraud includes but is not limited to activities such as:
  1. plagiarizing or cheating in any way;
  2. submitting work not partially or fully the student's own, excluding properly cited quotations and references. Such work includes assignments, essays, tests, exams, research reports and theses, regardless of whether the work is in written, oral or any other form;
  3. presenting research data that are forged, falsified or fabricated in any manner.
  4. attributing a statement of fact or reference to a fabricated source;

5. submitting the same work or a significant part of the same piece of work in more than one course, or a thesis or any other piece of work submitted elsewhere without the prior approval of the appropriate professors or academic units;
6. falsifying or misrepresenting an academic evaluation, using a forged or altered supporting document or facilitating the use of such a document;
7. taking any action aimed at falsifying an academic evaluation.

### **Sanctions**

1. Students who commit or attempt to commit academic fraud, or who are a party to academic fraud, are subject to one or more sanctions ([full list](#)), such as:
  1. a written warning;
  2. zero for part of the work in question;
  3. zero for the work in question;
  4. zero for the work in question and the loss of additional marks for the course in question;
  5. zero for the work in question, with a final grade no higher than the passing grade for the course in question;
  6. an F or NS grade for the course in question.

## **Notice of Collection of Personal Information - Respondus**

In accordance with the Ontario [Freedom of Information and Protection of Privacy Act](#) (“FIPPA”) and with the University of Ottawa (the “University”) [Policy 90](#), your personal information is collected under the authority of the *University of Ottawa Act*, 1965.

Your personal information collected for remote proctoring will be used by the University for the purposes of and those consistent with the fulfillment of the course learning activities, administering online exams and maintaining the academic integrity of the exam process. After each evaluation, the personal information collected during the remote proctoring session will be reviewed by your instructor (or their designate) for the purposes stated above. The personal information collected may be used where academic fraud is alleged as described in [Academic regulation I-14 - Academic fraud](#).

The remote proctoring is supported by Respondus, an online proctoring tool integrated with and accessed through Brightspace. LockDown Browser is a customized browser that locks the testing environment and Respondus Monitor is a companion service for LockDown Browser that uses webcam technology to maintain the integrity of online evaluations. Consult the Respondus [Privacy Policy](#) and [Terms of Use - LockDown Browser](#) or [Terms of Use - Respondus Monitor](#) for information on how Respondus collects, uses and discloses information and its security measures for safeguarding the information maintained by it. The personal information may be stored outside Canada and subject to the laws of the jurisdiction where it is stored. The information collected in accordance with this notice will be retained for one year from the end of the semester.



If you have questions about the collection, use and disclosure of your personal information in this notice, please contact Hope MacLean. Questions of a general nature regarding the collection, use and disclosure of information should be addressed to the Chief Privacy Officer by email at [aipo@uottawa.ca](mailto:aipo@uottawa.ca).

## Course Calendar

<b>Date</b>	<b>Topic</b>	<b>Assignments/readings</b>
<i>Week 1</i>	<i>Differential equations Chapter 11 in Huntley and Jasmes: Pollution of the Great Lakes</i>	
<i>Week 2</i>	<i>Chapter 10 in Huntley and Jasmes: Epidemic and the Spread of Diseases</i>	
<i>Week 3</i>	<i>Chapter 3 in Huntley and James: Forest Management</i>	
<i>Week 4</i>	<i>Chapter I in Dreyfus: Discrete Dynamic Programming</i>	
<i>Week 5</i>	<i>Chapter 16 in Huntley and James: Marketing a New Variety of Seeds</i>	
<i>Week 6</i>	<i>Chapter 27 in Huntley and James: Sheep Farming</i>	
<i>Week 7</i>	<i>Midterm: October 19, 2022</i>	
<i>Week 8</i>	<i>Discrete Time Dynamic Programming under Infinite Time Horizon</i>	
<i>Week 9</i>	<i>The Pontryagin Maximum Principle under Finite Time Horizon and Fixed Endpoints</i>	
<i>Week 10</i>	<i>The Pontryagin Maximum Principle with Free Endpoint and under Finite Time Horizon</i>	
<i>Week 11</i>	<i>Chapter 16 Lab 10 in Suzzane Lenhart and John T. Workman: The Glucose Model</i>	
<i>Week 12</i>	<i>The Maximum Principle under Infinite Time Horizon: The Ramsey Model in Continuous Time</i>	
<i>Week 13</i>	<i>Green GDP</i>	
<i>Exam period</i>		

## University Policies

### Intellectual property right of course content

The materials you receive for this course are protected by [copyright](#) and must be used for this course only. You do not have permission to disseminate these materials, regardless of the means of dissemination including the uploading of these materials to any website or mobile application. These materials include but are not limited to, any course notes provided by the professor, their Powerpoint presentations, and any lecture recordings you may have.

If you require clarification, please consult your professor.

© [Instructor name] All rights reserved.

### Regulation on Bilingualism at the University of Ottawa

Every student has the right to require that a course be given in the language used to describe the course in the course calendar ([Academic Regulation I-2](#)).

Except in programs and courses for which language is a requirement, all students have the right to produce their written work and to answer examination questions in the official language of their choice, regardless of the course's language of instruction.

### Prevention of Sexual Violence

**If you feel unsafe, call 9-1-1 or reach out to Campus Protective Services at 613-562-5411.**

The University of Ottawa has a zero-tolerance policy for any sexual act or act targeting a person's sexuality, gender identity or gender expression. This includes both physical and psychological acts that are committed, threatened, or attempted against a person without the person's consent, such as sexual assault, sexual harassment, stalking, indecent exposure, voyeurism, sexual exploitation, and cyberbullying. The University, as well as various employees and student groups, offers a variety of services and resources to ensure that all uOttawa community members have access to confidential support and information, and to procedures for reporting an incident or filing a complaint.

## Student Services & Resources

### Faculty Student Experience Centre

The goal of the [Student Experience Centre](#) is to help students with their academic and social well-being during their time at the University of Ottawa. Regardless of where a student stands academically, or how far along they are in completing their degree, the Student Experience Centre is there to help students continue on their path to success.

A student may choose to visit the [Student Experience Centre](#) for very different reasons. Younger students may wish to talk to their older peers to gain insight into programs and services offered by the University, while older students may simply want to brush up on study and time management skills or learn about programs and services for students nearing the end of their degree.

In all, the [Student Experience Centre](#) offers a place for students to talk about concerns and problems that they might have in any facet of their lives. While students are able to voice their concerns and

problems without fear of judgment, mentors can garner further insight in issues unique to students and find a more practical solution to better improve the services that the Faculty of Social Sciences offers, as well as the services offered by the University of Ottawa.

### **Academic GPS**

The *Academic GPS* hub is a one-stop shop for academic support. Whether you're an experienced student or just starting out, you'll find some great resources to help you succeed.

#### **With the Academic GPS, you can:**

- chat with a mentor seven days a week
- register for study groups
- take part in study methods workshops (note taking, time management, exam preparation, stress management, Academic Integrity Session, etc.)
- book an appointment with a mentor

### **Health and Wellness**

Your wellness is an integral part of your success. If you don't feel well, it can be hard to focus on your studies.

Dedicated professionals and fellow students who care about you are always ready to provide advice and support. Depending on your needs, many activities and services exist to accompany you during your academic journey.

Services include:

- opportunities to connect;
- counselling sessions
- peer support;
- physical activity;
- wellness activities and workshops;
- spiritual guidance.

If you want to connect with a counsellor, you can book an appointment online or go to their walk-in clinic at 100 Marie-Curie, fourth floor.

You can also drop-in to our wellness space, chat online with a peer helper, or access 24/7 professional help through the website.

### **Academic accommodations**

The [Access Service](#) tries to make sure all students with disabilities have equal access to learning and research environments, the physical campus and University-related programs and activities. The Academic Accommodations service works with other campus services to create an accessible campus learning environment, where students with disabilities have an equal opportunity to flourish.

We offer a wide range of services and resources, provided with expertise, professionalism and confidentiality.

**Some services we offer**

- Help for students with disabilities in making the transition
- Permanent and temporary accommodation measures
- Learning strategy development
- Adaptive exams
- Transcriptions of learning material
- Interpretation (ASL and LSQ)
- Assistive technologies

If you think that you might need any of our services or supports, [email the Academic Accommodations service \(adapt@uOttawa.ca\)](mailto:adapt@uOttawa.ca).

**Human Rights Office**

The mandate of the [Human Rights Office](#) is to provide leadership in the creation, implementation and evaluation of policies, procedures and practices on diversity, inclusion, equity, accessibility and the prevention of harassment and discrimination.

**Contact information:** 1 Stewart St. (Main Floor – Room 121) - Tel.: 613-562-5222 / Email: [respect@uOttawa.ca](mailto:respect@uOttawa.ca)

**Career Services**

[Career Services](#) offers various services and a career development program to enable you to recognize and enhance the employability skills you need in today's world of work.