

# CAS 745 - Supervisory Control of Discrete-Event Systems

## Jan 2025

### **INSTRUCTOR:**

Dr. Ryan Leduc

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Office Hours: After lecture or by appointment.

### **LECTURES:**

- Location: ITB/222.
- Time: Tuesday, Wednesday: 16:30-18:00.
- Start: Check Avenue for date of first lecture.

**Note:** Announcements will be posted to the course's Avenue to Learn page. It's your responsibility to check the page regularly.

### **OVERVIEW:**

This course is an introduction to the control of discrete-event systems (DES), asynchronous systems discrete in space and time (eg. manufacturing systems, communication systems etc.). The course will provide a solid foundation for research in this area, focusing on architectural issues such as modular, and hierarchical control. The course will also discuss timed DES, as well as current topics of interest, time permitting.

**Note:** A grad student with an ECE background should be able to take this course without much difficulty. The material is suitable for application to both software and hardware systems.

## MAJOR TOPICS:

- Algebraic preliminaries review (posets, lattices, equivalence relations etc).
- Linguistic preliminaries (languages, Nerode equivalence, automata, generators, etc).
- Supervisory control basics (representation, synchronous product, controllability, nonblocking, maximally permissive supervision).
- Modular control.
- Hierarchical interface-based supervisory control.
- Timed discrete-event systems.
- Current topics of interest.

**NOTE:** We may not have time to cover all topics.

## GRADING SCHEME:

- Assignments 50%
- Final Exam (take home) 50%

(All work on assignments is to be done individually.)

## TEXT:

W. M. Wonham and Kai Cai, *Supervisory Control of Discrete-Event Systems*, Springer, 2019. ISBN-10: 9783319774510. Can purchase hard-copy or e-copy here (check Amazon as well):

<https://www.springer.com/us/book/9783319774510>

## REFERENCE:

Daniel Solow, *How to Read and Do Proofs, 6th ed.*, John Wiley and Sons, 2013. ISBN 1118164024.

## NOTES:

### **Discrimination**

“The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact their Chair, the Sexual Harassment Office or the Human Rights Consultant, as soon as possible.”

### **Academic Dishonesty**

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: Grade of F assigned for academic dishonesty), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy (<https://secretariat.mcmaster.ca/app/uploads/Academic-Integrity-Policy-1-1.pdf>), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

Academic dishonesty committed by graduate students will have more serious consequences than that committed by undergraduate students.

**NOTE:** Graduate student cases are supposed to be referred automatically to the Office of Academic Integrity, even if it's only the first offence.

## **Authenticity/Plagiarism Detection**

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

## **Courses With an On-line Element**

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

## **Online Proctoring**

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

## **Conduct Expectations**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the Code: <https://secretariat.mcmaster.ca/app/uploads/Code-of-Student-Rights-and-Responsibilities.pdf>). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students access to these platforms.

## **Academic Accommodation of Students With Disabilities**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS: <https://sas.mcmaster.ca/>) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster Universitys Academic Accommodation of Students with Disabilities policy (<https://secretariat.mcmaster.ca/app/uploads/Academic-Accommodations-Policy.pdf>).

## **Academic Accommodation for Religious, Indigenous or Spiritual Observances (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy (<https://secretariat.mcmaster.ca/app/uploads/2019/02/Academic-Accommodation-for-Religious-Indigenous-and-Spiritual-Observances-Policy-on.pdf>). Students should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommo-

dation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

## **Copyright and Recording**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

## **Extreme Circumstances**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.