

# MECH 380 – Automatic Control Engineering

## Course Information

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### Instructor

Professor [Yang Shi](#)  
Office Location & Hours Thursday 1:30-2:30PM at EOW 519 (subject to change)  
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Telephone E-mail: [yshi@uvic.ca](mailto:yshi@uvic.ca)  
Web Site <http://www.me.uvic.ca/~mech380>

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### Teaching/Lab Assistants

Bingxian Mu	<a href="mailto:bxmu@uvic.ca">bxmu@uvic.ca</a>	
Nima Harsamizadeh Tehrani	<a href="mailto:nimaht@uvic.ca">nimaht@uvic.ca</a>	
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### Lecture Time Schedule and Location

Lectures: Monday and Thursday, **2:30 PM - 3:50 PM at ELL 167.**

Lecture hours will be devoted to delivering, reviewing, and discussing the course materials. It is the responsibility of the student to attend lectures and observe the progress of the course. Students should note that: Lecture dates, the assignment, mid-term exams and final exam scheduling provided in this course outline are tentative, and that notice regarding any changes will be given during lectures in advance of a change.

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## Official Calendar Descriptions

Modeling dynamic systems (linear systems and feedback control). Transfer function based analysis and design (transfer functions, root-locus, stability, transient responses). Frequency characteristics design methods (frequency responses, stability, gain and phase margins, system compensation). State-space design methods (state transition matrix, state feedback and shaping dynamic responses; linear observers).

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## Learning Outcome

This course is directed towards those who seek to grasp the fundamentals of feedback control theory. The concepts of Laplace Transforms, their applications to obtaining transfer functions of physical systems and the  $s$ -domain analysis are key to the understanding of the course material. An understanding of the stability analysis is critical to the design and analysis of control systems. Both time and frequency domains are considered in detail so that the student can appreciate both design perspectives and learn the classical feedback control strategies. Practical control examples are discussed wherever appropriate.

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## Sequence of Topics

TOPIC	TIME IN WEEKS	CONCEPTS TO BE LEARNED
Linear System Models	2	Mathematical models of physical systems, transfer functions representation
Time Response and Stability	2	First and second order system responses, BIBO stability, Routh-Hurwitz stability criterion
Block Diagrams and Signal Flow Graphs	1	Block diagrams of systems, block diagram reduction, signal flow graphs of systems, Mason's formula
Feedback Control System Characteristics	2	Transient response, system specifications and performance analysis, and steady-state analysis
Dynamic Compensation	1	Feedback compensation, lead-lag compensation

Root Locus Analysis and Design	1	The root locus method, rules for root locus plotting and construction of root locus, root locus design
Frequency Response Analysis and Design	2	Frequency response, Bode plots and Nyquist diagrams, stability criterion, gain and phase margins, compensator design in the frequency domain
State-Space Model	1	State-space representation of systems

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## Evaluation

The marks will have the following weights:

Midterm Exam (1)	Final Exam	Assignments	Lab (3)
25%	50%	15%	10%

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## Assignments

- Weekly assignments are to be given and are due the following week by 4:00PM; please drop your assignments in the MECH 380 Assignment Box.
  - Please note that *late* assignments will not be accepted unless a legitimate reason (illness, religious conviction, etc.) exists and is discussed with the instructor.
  - Solutions to the assignments will be prepared by the instructor, but your assignments will be marked by TAs. Solutions will be available on the course web-site.
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## Labs

There are three labs. The lab schedule is to be finalized soon.

- All labs are conducted in ELW B232 during the schedule time by lab TAs.
- The lab TAs are responsible for marking the lab reports.

- One lab report will be prepared per group, per laboratory.
  - The lab reports will be due exactly one week after the completion of the scheduled lab session and will be submitted into the MECH 380 drop box.
  - Lab reports should be neat and clear. They should be stapled or contained in a standard lab book.
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## Tutorial

The tutorial will provide students with a chance to review relevant problems with the instructor or teaching assistants, and ask questions regarding the class material. Although the tutorials are not compulsory, students are encouraged to attend the tutorial.

Time and Place: Wednesday, 1:30 - 2:20 PM at ECS 125

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## Getting Help

Students are welcome to drop by my office (EOW 519) anytime for help. Alternatively, you can telephone or e-mail me to make an appointment.

Scheduled office hours: **TBD**

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## Test and Exam

There are a midterm test and a final exam:

- In the test and exam, you can bring a two-sided formula sheet (8 by 11 in); but no books, class notes, or other materials are allowed.
  - In the test and exam, only silent calculators are permitted.
  - The midterm test will be conducted on **TBD**, during the lecture period, namely, from 2:30 PM to 3:50 PM in the lecture classroom.
  - The final exam is scheduled by the Registrar's Office.
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## Textbook

- Norman S. Nise, Control Systems Engineering, Sixth Edition, Wiley.
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## **Plagiarism and Such**

The University of Victoria is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students should avoid any behavior which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offense. Academic dishonesty is a serious offense and can result in suspension or expulsion from the University.