



### **ELEC 360: Control Theory and Systems: I**

**Term – Spring 2018 (21108)**

#### **Instructor**

Dr. Stephen W. Neville

E-mail: sneville@ece.uvic.ca

#### **Office Hours**

Days: Wed.

Time: 2:30 pm to 3:20 pm (or by appointment)

Location: EOW 441 or ELW A228

Note: All course emails **MUST** have "Elec360:" in the subject line and **MUST** be sent from UVic email accounts.

Emails without proper subject lines or sent from off-campus email accounts will likely be dropped by UVic's email spam filters or be automatically redirected to junk email folders.

#### **Course Objectives**

Characterization of systems; linearity, time invariance and causality. General feedback theory; time and frequency domain analysis of feedback control systems; Routh-Hurwitz and Nyquist stability criteria; root locus methods; modeling of dc servo; design of simple feedback systems; introduction to state-space methods.

#### **Learning Outcomes**

1. Apply Laplace transforms to solve linear differential equations describing linear systems
2. Give examples of physical systems, block diagrams and state-space description
3. Analyse transient and steady state system response of linear continuous systems
4. Assess closed-loop system performance using Root-Locus analysis
5. Assess closed-loop system performance using frequency response
6. Evaluate closed-loop stability using the Nyquist method
7. Design of PID controllers, lead and lag compensators

#### **Syllabus**

1. Linear Systems, Laplace Transforms, and System Analysis
2. Modeling of Dynamic Systems
3. Transient Response Analysis
4. Stability Analysis of Linear Systems
5. Steady-state Error Analysis
6. Root Locus
7. Closed Loop Systems
8. Frequency Response Methods
9. Nyquist Stability Criterion
10. Compensation Techniques
11. Implementation of Control Systems

**Lectures:****A-Section(s):** A01/ CRN 21108**Days:** **Tues. and Wed.****Time:** 9:30 am - 10:20 am**Location:** ECS Building Rm 124**Days:** **Fri.****Time:** 9:30 am - 10:20 am**Location:** Elliot Building 062**Labs:**

B01 Tue 12:30-15:20 ELW A317

B02 Tue 12:30-15:20 ELW A317

B03 Wed 12:30-15:20 ELW A317

B06 Wed 15:30-18:20 ELW A317

Lab manual pdf is available from the course website.

**Dates for Labs:**Section B01: Jan. 23<sup>rd</sup>, Feb. 6<sup>th</sup>, Feb. 27<sup>th</sup>, and Mar. 13<sup>th</sup>Section B02: Jan. 30<sup>th</sup>, Feb. 20<sup>th</sup>, Mar. 6<sup>th</sup>, and Mar. 20<sup>th</sup>Section B03: Jan. 24<sup>th</sup>, Feb. 7<sup>th</sup>, Feb. 28<sup>th</sup>, and Mar. 14<sup>th</sup>Section B06: Jan. 31<sup>st</sup>, Feb. 21<sup>st</sup>, Mar. 7<sup>th</sup>, and Mar. 21<sup>st</sup>

Full details of all official course locations and times are available from UVic's Timetable web page ([https://www.uvic.ca/BAN2P/bwckschd.p\\_disp\\_dyn\\_sched](https://www.uvic.ca/BAN2P/bwckschd.p_disp_dyn_sched)). In the case of any discrepancies between the above denoted times and places and the official UVic timetable web page, the official UVic web page is authoritative.

**Required Text****Title:** Modern Control Engineering (5<sup>th</sup> Edition)**Author:** Katsuhiko Ogata**Publisher:** Prentice Hall**Year:** 2009

Note: All assignments will come from the North American edition of this text and expressly not from any International additions. The end-of-chapter questions may be different between North American and International editions. It is solely the students' responsibility to ensure that they are doing the correct questions from the correct North American edition.

**Course Web Site:** <http://www.ece.uvic.ca/~sneville/> then select "Teaching" tab, then "Elec 360" tab.

**Assessment:**

Assignments: 10%

Due Dates: One week after assignment date – all late assignments will not be marked and will receive a zero grade.

Labs 10%

Mid-term 30%

Date: **Fri., Feb. 23<sup>rd</sup>**

Final Exam 50%

**Note:**

- Failure to complete and pass all laboratory requirements will result in a grade of N being awarded for the course.
- Failure to pass the final exam will result in a failing grade for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/grading.html>

**There will be no supplemental examination for this course.**

**Note to Students:**

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

**Accommodation of Religious Observance:**

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/religious-observanc.html>

**Policy on Inclusivity and Diversity:**

<https://web.uvic.ca/calendar2018-01/general/policies.html>

**Standards of Professional Behaviour:** You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities. <https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.

<https://web.uvic.ca/calendar2018-01/undergrad/info/regulations/academic-integrity.html>

**Equality:** This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building. The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

**Course Lecture Notes**

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may constitute a breach of academic integrity as defined in the UVic Calendar as well as the Standards of Professional Behaviour required of all Faculty of Engineering students.