



COURSE OUTLINE

MECH 458 Mechatronics

Spring 2014

Course Web Site <http://www.me.uvic.ca/~mech458>

Instructor

Bingxian Mu

Phone: **(250) 721-6293**

Email **bxmu@uvic.ca**

Office Hours

Days: **TBD**

Time: **TBD**

Location: **ELW A240**

Lectures

A – Section(s): A01

Days: **Monday and Thursday**

Time: **10:00 am-11:20 am**

Location: **ECS 124**

Labs

B – Section(s)

B01	W	01:00 pm- 03:50 pm	<u>ELW</u> <u>B232</u>
B02	M	04:00 pm- 06:50 pm	<u>ELW</u> <u>B232</u>
B03	W	04:15 pm- 07:05 pm	<u>ELW</u> <u>B232</u>
B04	F	01:00 Pm- 03:50 pm	<u>ELW</u> <u>B232</u>

Tutorials

T – Section(s)
N/A

Days

Time

Bldg/Rm

Required Text Not required

Title:
Author:
Publisher:
Year:

Optional Text Not required

Title:
Author:
Publisher:
Year:

Other Reference Material:

- David G. Alciatore and Michael B. Hstand, *Introduction to Mechatronics and Measurement Systems*, 2nd Ed., McGraw Hill, 2003.
- Robert H. Bishop, *Mechatronics: An Introduction*, CRC Press, 2006.
- Irene J. Busch-Vishniac, *Electromechanical Sensors and Actuators*, Springer, 1998.
- P. Cross and F. Ebel, *Pneumatics: Basic Level*, 2001.
- Clarence W. de Silva, *Mechatronics: An Integrated Approach*, CRC Press, 2005.
- Dan Neculescu, *Mechatronics*, Prentice Hall, 2001.
- Andrzej. M. Pawlak, *Sensors and Actuators in Mechatronics*, CRC Press, 2007.

- Online materials from various manufactures of sensors and actuators (some of these will be posted on the course website as supplementary materials).

Assessment

Assignments	5	%		
Labs ^{1,2,3,4}	45	%		
Module I Exam ²	25	%	Date:	TBD soon
Module II Exam ²	25	%		

NOTES: ¹If a student is unable to attend a lab session due to illness (or any other acceptable reasons as specified in the UVic 2013/2014 Calendar), its contribution to the final grading will be transferred to the module exam component.

²If a student misses an exam or a lab, without an acceptable reason, he/she will lose the percentage for that component.

³If a student is late to a lab by more than 30 minutes, he/she will lose the percentage for that component.

⁴No late lab reports will be accepted. Typically, lab reports are to be submitted at the beginning of next lab, except the last report which is to be submitted in class on a scheduled due date.

Additional Notes:

- The instructor has the right to change the grading scheme, and any changes will be announced in a lecture hour in advance.
- All examinations are closed-book, unless stated otherwise by the instructor.
- Self-contained calculators are allowed in all exams.

Final Grade

The final grade obtained from the above marking scheme will be based on the following percentage-to-grade point conversion:

90 ≤	A+ ≤	100	
85 ≤	A <	90	
80 ≤	A- <	85	
75 ≤	B+ <	80	
70 ≤	B <	75	
65 ≤	B- <	70	
60 ≤	C+ <	65	
55 ≤	C <	60	
50 ≤	D <	55	
35 ≤	E <	50	Fail, conditional supplemental exam* - <u>for undergraduate courses only.</u>
	F <	35	Fail, no supplemental exam.
	N		Fail, did not write examination or otherwise complete course requirements by the end of the term or session; no supplemental exam.

- * The rules for supplemental examinations are found on page 81 of the current 2009/10 Undergraduate Calendar.

Term in which E Grade was obtained:	Application Deadline for Supplemental Exam	Supplemental Exam Date
First term of Winter Session (Sept – Dec)	Following February 28	First week of following May
Second term of Winter Session (Jan – Apr)	Following June 30	First week of following September
Summer Session (May – Aug)	Following October 31	First week of following January

Deferred exams will normally be written at the start of the student's next academic term; i.e., approximately 4 months following the deferral of the exam.

Syllabus

- **Course Objective**

The main objective of this course is to introduce the rapidly developing, multidisciplinary field of Mechatronic Engineering, which deals with the development of “smart” electromechanical products, through an integrated design approach and a multidisciplinary point-of-view. This course particularly focuses on providing an overview of embedded controllers (microprocessors/microcontrollers) and sensor and actuator technologies that are key components of mechatronic systems.

- **Course Description**

Introduction to mechatronic systems; modeling of mixed mechatronic systems; microcontroller programming and interfacing; theory, selection and implementation of sensors and actuators commonly used in mechatronic systems; control architectures and case studies in mechatronic systems.

- **Course Outline** (may be subject to changes)

Module I: Embedded Systems in Mechatronics

- I.1. Introduction to embedded systems in mechatronics
- I.2. Number systems, digital arithmetic, Boolean logic and finite state machines
- I.3 Overview of C programming
- I.4. Interface circuitry
- I.5. Microcontroller: physical hardware overview and limitations
- I.6. Communications

Module II: Sensors and Actuators in Mechatronics

- II.1. Introduction to Mechatronics: definition of mechatronics, mechatronic design approach, sensors and actuators in mechatronic systems, system models, mechanical components, review on electrical components and magnetisms, component matching and performance specifications
- II.2. Sensors: potentiometers; variable-inductance transducers (mutual-induction, self-induction, permanent-magnet) – LVDTs, proximity probes, eddy current sensors, etc.; variable-capacitance transducers (capacitive sensors); piezoelectric transducers; fiber optic sensors; laser (Doppler) interferometers; laser photoelectric sensors; ultrasonic sensors; linear variable differential transformers (LVDT); digital optical encoders; fiber optics; hall effect sensors; digital sensors (optical encoders, magnetic encoders, tachometer); etc.
- II.3. Actuators: electric motors (DC, stepper, brushless and AC), servo motors, hydraulics, pneumatics, solenoid, voice-coil, etc.

- **Lab and Equipment Requirements**

These time slots will be used for hands-on labs, which will be a significant portion of the course. The labs will start in the third week of classes in January (TBD), and will run each week. The exact dates/times will be announced soon as they become available. Attending the labs is compulsory.

The following five milestones must be completed during the scheduled lab times:

- Milestone 1: Introduction to the microcontroller
- Milestone 2: C programming and basic micro-controller functions
- Milestone 3: Sensors and actuators
- Milestone 4: Inspection system design and documentation
- Milestone 5: Inspection system implementation

Students *are required to* purchase the low cost Mechatronics Student Kit to keep. The cost of the student kits have been subsidized by the Department of Mechanical Engineering and allow each student

unlimited access to the microcontrollers. Further information will be given in class.

- **Teaching Assistants**

- Mingxi Liu (mxliu@uvic.ca)
- Yuanye Chen (yuanye@uvic.ca)

Guidelines on Religious Observances

1. Where classes or examinations are scheduled on the holy days of a religion, students may notify their instructors, at least two weeks in advance, of their intention to observe the holy day(s) by absenting themselves from classes or examinations.
2. Instructors will provide reasonable opportunities for such students to make up work or missed examinations.
3. Students will cooperate by accepting the provision of reasonable opportunities for making up work or missed examinations.
4. The University Secretary's Office will distribute a multi-faith calendar to each academic unit annually.

Commitment to Inclusivity and Diversity

The University of Victoria is committed to promoting, providing and protecting a positive, supportive and safe learning and working environment for all its members.

Standards of Professional Behaviour

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour at <http://www.engr.uvic.ca/policy/professional-behaviour.php> which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult

<http://web.uvic.ca/calendar2009/FACS/UnIn/UARe/PoAcI.html> for the UVic policy on academic integrity. *"The University reserves the right to use plagiarism detection software programs to detect plagiarism in essays, term papers and other assignments."* Pg 32, University Calendar

Late Assignments: No late assignments will be accepted unless prior arrangements have been made with the instructor at least 48 hours before the assignment due date.

Coursework Mark Appeals: All marks must be appealed within 7 days of the mark being posted.

Attendance: We expect students attend all lectures and labs. It is entirely the students' responsibility to recover any information or announcements presented in lectures from which they were absent.

Electronic Devices: No unauthorized *audio* or video recording of lectures is permitted. Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests *unless explicitly authorized*.