

THE UNIVERSITY OF BRITISH COLUMBIA
Department of Mechanical Engineering
MECH 421 Mechatronic System Instrumentation

Spring 2008
Course Information

INSTRUCTOR

Dr. Xiaodong Lu, Kaiser 3103; Office hours: Thursday 4-5pm.

TEACHING ASSISTANTS

Matthew Paone (matthewpaone@hotmail.com); Darya Amin-Shahidi (das@mech.ubc.ca);
TA office hours: 3-5pm Tuesday.

LECTURES

- Mon, Wed 8-9am, CEME 1204.
- Learn a systematic way of integrating together what you have learned in previous courses, such as mechanical system, dynamics, vibration, electronics, motors, controls, and software. Design, implement, and have fun.

COURSE WEB: www.mech.ubc.ca/~mech421

COURSE GRADING

Prelabs(15%)+Lab (20%)+Homeworks(25%)+Mid-term exam(15%)+ Final exam(25%)

LABS

Lab is a major component of MECH 421. Lab work will be performed in groups of 3~4 students. Each student will be assigned to one of the four lab sessions: Tue 8am-10am, Tue 10am-12pm, Thur 8am-10am, and Thur 10am-12pm. Lab place is Kaiser Room 1210. Lab manuals will be handed out in lectures and will also be posted on the web. Students have access to computers in Kaiser 1220 to prepare the pre-lab.

- Each group member should read the prelab and lab manual individually, think individually, and come up with individual solution.
- In a group meeting, each solution should be discussed, and the cons and pros should be identified. On the basis of individual solution and group discussion, a best solution/approach should be decided, and will be implemented in the lab. If something is unclear, bring it to the lab and test them to improve your understanding.
- Each group member need to turn in individual pre-lab report. Your prelab should include your individual solution and the group discussion. Prelab-report is due at the beginning of the lab. Without pre-lab report, students will be refused to do the lab. Lab report is due at the beginning of the next lab, except the last one. Each group member should turn in individual lab report.

EXAMS

- Mid-term exam: Feb 13. 1 page of note allowed, in CEME 1204.
- Final exam: 2.5hrs, scheduled in the final exam week. 2 pages of note allowed.

POLICY

All deadlines are non-negotiable, and there is no extension except for medical reasons.

TENTATIVE SCHEDULE

Week	Date	Lecture	Lab	Assignment
1	Jan 06	Introduction; Motor modeling; Block diagram; Laplace transform; Impulse response; Frequency response;	No lab. 420 Lab1	Prelab 1; HW1;
2	Jan 13	Bode plots; Step response; F-T domain relation; 1 st and 2 nd order;	Lab 1: Sensor fusion;	HW2
3	Jan 20	Electrical network; operational amplifier; Closed-loop bandwidth; Loop transmission; Crossover frequency; Nyquist stability criteria; Voltage amplifier design for DC motor driving;	No Lab. 420 Lab2	Prelab 2; HW3
4	Jan 27	Stability; Current controller design;	Lab 2: Voltage stage design for motor driving;	Prelab 3; HW4
5	Feb 3	motion loop shaping techniques: theory 1;	No Lab. 420 Lab3	HW5
6	Feb 10	motion loop shaping techniques: theory2; Mid-term exam (Feb 11);	Lab 3: Motor current loop compensation;	HW6/Lab5
Spring Break				
7	Feb 24	Model identification; Control system prototyping;	No Lab.	Prelab 4 HW7
8	Mar 2	real-time workshop and xPC Target;	Lab 4: Motor position servo loop design;	HW8
9	Mar 9	Physical intuition on mechanical systems and control	HW6/Lab5: take home lab check-off; 420 Lab4	Prelab 6 HW9
10	Mar 16	Digital design using VHDL;	Lab 6: Conveyer belt controller design;	HW10
11	Mar 23	Mar. 24 holiday; FPGA-based for digital system synthesis;	No Lab 420 Lab5	Prelab 7 HW11
12	Mar 30	Power electronics;	Lab 7: FPGA and encoder interface design;	HW12
13	April 6	Nonlinearity and linearization;		