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

Spring 2016
Course Information

INSTRUCTOR

Dr. Xiaodong Lu, Kaiser 3103; XDLU@mech.ubc.ca

TEACHING ASSISTANTS

Jian Gao <j.gao@alumni.ubc.ca>
TA office hours: 12-1pm Thursday in Kaiser 1230.

LECTURES

- Wed&Fri 3-4pm, 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 GRADING

Prelabs(15%)+Lab (20%)+Homeworks(10%)+Mid-term exam(25%)+ Final exam(30%)

LABS

Lab is a major component of MECH 421. Lab work will be performed in groups of 4~5 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.
- Each group member need to turn in individual prelab report. Your prelab should include your individual solution and the group discussion. Prelab report is due at the beginning of the lab. WITHOUT PRELAB REPORT, YOU 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: 3-4pm on Feb 24th. 1 sheet of note (Letter-size, double-sided) allowed.
- Final exam: 2.5hrs. 2 sheets of note allowed (Letter-size, double-sided).

Lecture notes will be handed out in class. There is no required text book.
All deadlines can be changed only for medical reasons.

TENTATIVE SCHEDULE

Week	Date	Lecture	Lab	Assignment
1	Jan 06/08	Introduction; Motor modeling; Block diagram; Laplace transform; Impulse response; Frequency response;		HW1
2	Jan 013/15	Bode plots; Step response; F-T domain relation; 1st order system.		HW2
3	Jan 20/22	2nd order system; General rules for Bode plot; Electrical network; Superposition;		HW3
4	Jan 27/29	Operational amplifier; Voltage follower; Non-inverting input circuit; Gain-bandwidth product; Closed-loop bandwidth; Loop transmission; Crossover frequency;		HW4
5	Feb 03/05	Feedback controller design; Nyquist stability criteria;		HW5
6	Feb 10/12	PI current controller design and implementation;	Lab 1: Voltage stage design for motor driving;	Hw6
Spring Break: Feb 15-19				
7	Feb 24/26	Mid-term exam; Motion loop shaping techniques Lead compensation for pure mass; Lead-lag compensation;	Lab 2: Motor current loop compensation;	
8	Mar 02/04	Two-wheeled robot demo; Control system prototyping; Model identification; PID controller design for robot wheel tracking; Anti-windup implementation; Aliasing;		
9	Mar 9/11	Discrete equivalence and simulation stability; Impedance modeling;		HW7
10	Mar 16/18	Impedance intuition on 2-Mass system; Physical intuition on control system design;	Lab 3: Motor position servo loop design;	HW8
11	Mar 23	Digital design using VHDL;		HW9
12	Mar 30, April 01	Digital design using VHDL;	Lab 4: Conveyer belt control;	HW10
13	April 06/08	Power electronics;		