CARLETON UNIVERSITY
Department of Systems and Computer Engineering
SYSC5303 / BIOM 5402
Interactive Networked System and Telemedicine –Winter 2012

Calendar Description

Advanced Topics in Biomedical Engineering: Interactive Networked Systems and Telemedicine
Telemanipulator, networked mobile robot, human motoring and sensory capability, typical interface device, visual and haptic rendering, remote control scheme, predictive technique, delay compensation, force feedback, stability and transparency, fusion of human and machine intelligence, real-time protocols and networking, data transmission and compression, history and challenges of telemedicine, and telemedicine applications: telesurgery, tele-monitoring, tele-diagnosis and tele-homecare .

Lectures: three hours a week.

Course Website

www.sce.carleton.ca/faculty/liu/sysc5303/win12

Professor

Name	E-Mail	Telephone	Office	Office Hours
Dr. Peter X. Liu	xpliu@sce.carleton.ca	520-2600x1774	4252 ME	MW13:00 ~ 14:00

Textbook and References

There is no assigned textbook for this course. Some lecture notes and materials will be provided or posted on the course website.

Marking Scheme

Midterm Exam	Paper Presentation	Project	Final Exam
30%	10%	20%	40%

Important Dates

- Thursday February 16th 6:05pm- 8:55 pm: In-class Midterm Exam
- Thursday March 8th: Paper Presentation
- Thursday March 22nd: Taken-home Final Exam Distributed to Students in Class
- Thursday March 29th: Project Presentation
- **Thursday April 05th 11:59pm: Project Report and Final Exam Due (ME4252)**

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term because of disability, pregnancy or religious obligations. Please review the course outline promptly and

write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

Students with disabilities requiring academic accommodations in this course are encouraged to contact a coordinator at the Paul Menton Centre for Students with Disabilities to complete the necessary letters of accommodation. After registering with the PMC, make an appointment to meet and discuss your needs with me at least two weeks prior to the final exam. This is necessary in order to ensure sufficient time to make the necessary arrangements. Please note the following deadlines for submitting completed forms to the Paul Menton Centre: *March 7, 2012* for the Winter Term.

Notes

The final examination and project report are for evaluation purposes only and will not be returned to the students. Students who miss the final exam may be granted permission to write a deferred examination (see the Graduate Calendar for regulations on deferred exams). These students have additional months to study and a less crowded examination schedule compared to their colleagues who write the final exam in April. As such, it is only fair to expect substantially better performance from these students on the deferred examination than on the final exam.

Every student should have a copy of our Health and Safety Manual. An electronic version of the manual can be found at: http://www.sce.carleton.ca/courses/health-and-safety.pdf

Students who miss the in-class test must contact the professor with a valid medical report or an equivalent paper within one week; otherwise, they will get zero from the missed test. Students who have missed the in-class test for reasons that have been deemed valid by the professor will have the portion of their final grade that was allocated to the in-class exam, reallocated to the course project. There is no make-up midterm test.

Plagiarism and cheating at the graduate level are viewed as being particularly serious and the sanctions imposed are accordingly severe. Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy (See http://www2.carleton.ca/graduate-studies/policies-and-guidelines). The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

Course Outline

Introduction (Week 0)
History of interactive networked and telemedicine systems; teleoperators and telehaptics, current research status and challenges

Human-Machine Interface (Week 1 and Week 2)

Human factors: perception and motoring capabilities; command generation techniques; cross-modal interactions and sensory substitution; visual and haptic rendering; force-reflection and haptic interface devices; requirements on haptic interfaces and design challenges

Kinematics of Haptic Interfaces and Haptic Rendering (Week 3 and Week 4)

Spatial descriptions; mappings; translation, rotation and transformations; Static force and moments propagation from link to link; haptic rendering through manipulator

Master-Slave Teleoperator and Haptic Feedback (Week 5 to Week 7)
Two-port network modelling; force and tactile feedback; time delay and discretization issues; wave-variables and passivity theorem; stability and transparency; impedance control; optimization for fidelity; control schemes and intelligence integration for telerobotics

Paper Presentation (Week 8)

Data Transmission and Networking (Week 9)
QoS issues; modeling of time delays; real-time and TCP-friendly protocols; the trinomial protocol; synchronization of multiple-streams; IntServ and DiffServ networks; next generation Internet.

Telemedicine Applications (Week 10)
Origins and development; technologies, challenges and obstacles; on-going telemedicine projects; robotic surgery; minimally invasive surgery; and telesurgery.

Project Presentation (Week 11-12)