

**SCHOOL OF ENGINEERING
UNIVERSITY OF GUELPH**
Course Description and Outline 2010

Course No.	Name	Semester	Hours
ENGG*4390	Bio-instrumentation Design	Fall	3-2 (0.75)
Prerequisite:	ENGG*3450 Electrical Devices		

Instructor: R.B. Brown Room 2340 Thornbrough Building, Ext. 53922
Teaching Assistant: Jordan Bray-Miners Room 301 Thornbrough Building Ext. 52132

Class Times: 09:30-10:20h, Monday, Wednesday, Friday, Mackinnon Building Room 314

Lab Times: 15:30-17:20 h, Thursday, Room 2196 Thornbrough

Calendar Description: Theory and selection criteria of devices used in measurements in biological systems; design of complete measurement systems including transducers, signal conditioning and recording components; error analysis. Differences between measurements in biological and physical systems.

Learning Objectives: Students who successfully complete this course will be able to:

- a) Understand principles of instrumentation used to measure factors that characterize biological systems and physical or chemical factors that have a profound effect on biological entities,
- b) Quantify the performance of bio-instrumentation systems through calibration, testing and error analysis,
- c) Design a complete instrumentation system, including the transducer, signal conditioning and recording stages to resolve particular measurement problems related to biological systems.

Textbook: The required text for this course is *The Measurement, Instrumentation and Sensors Handbook* edited by J.G. Webster (CRC Press/ IEEE Press). This is a huge, comprehensive handbook in two volumes (also available on CD) and it covers **all areas** of instrumentation technology. **Do not be intimidated by it!** It will continue to be a valuable resource for the practising engineer long after this course is completed. We will obviously not cover all material in this book, and the most significant sections are highlighted below. There are many other references that will be used as well, and these will be mentioned in class. Lecture material will be drawn from the text and from other sources as appropriate. The field of instrumentation covers many areas of engineering; measurement problems tend to share these fundamentals, but the applications are usually unique.

Laboratory: The laboratory component of the course comprises **two parts**. The first part is an assigned laboratory exercise that is completed by each student independently. The second part consists of the evaluation of **two different transducers** that is carried out by teams of 2 students working together over the semester. There is a variety of sensors available, but others can be sourced if the one you have a particular interest in is not in the initial selection. Ask the instructor. **A laboratory proposal will be required for each team laboratory** detailing the approach to be taken, the equipment requirements and safety and operational procedure. **Only when your proposal is complete and approved by the instructor can you carry out the experiments during the assigned laboratory periods (and at other times by arrangement with Ms. Hong Ma, the technician in charge of the electrical laboratory).** This will, of course, be subject to prior lab bookings and any safety concerns. Safety aspects MUST be addressed in the laboratory proposals. More details will be found in the lab handout.

Design Project: This is an **individual project** on a topic chosen by each student in consultation with the instructor. **A design proposal is required.** The project comprises a preliminary design for an instrumentation system solution in the context of a specific problem that poses biological constraints. The final design report will include the complete development of the design, with appropriate justification for the component choices. The system designed will not be constructed in most cases, although given sufficient resources students may assemble prototypes.

Evaluation:	Component	Value	Due Date
	Design Proposal	10%	Friday, October 8, 2010
	Individual Lab Report	10 %	Friday, October 15, 2010
	Team Lab Reports (3)	25 %	Friday, November 12, 2010
	Design Project	30 %	Friday, November 26, 2010
	Final Exam	25 %	Monday, December 6, 2010

Notes:

Safety in the laboratory is a prime concern. Lab proposals must include a safety section. Depending upon the experiment conducted, appropriate safety protection such as gloves and goggles must be worn. University policy forbids working alone in a lab; this will be strictly enforced.

Laboratory and design reports will be graded for grammar and writing style as well as technical content.

ENGG*4390 Course Material Covered

Sections and chapters designated refer to *The Measurement, Instrumentation and Sensors Handbook*

Section	(Chapters)	
I	(1-5)*	Introduction to Instrumentation and Measurement
XII	(80, 82, 83, 89)*	Signal Processing, Signals and Noise
IV	(20, 21, 22, 23)	Force, strain and weight measurements
V	(26, 28, 29, 30)	Fluid System Measurements
VI	(32, 34, 36)	Thermal Variables and Measurements
II	(6)	Displacement and Position
VIII	(56, 58, 61, 62)	Optical Measurements
X	(70, 71, 72)	Chemical composition, pH, humidity
XI	(74-78)*	Bio-potentials, blood pressure and flow, ventilation

+ Other Measurement Systems as time permits

* indicates material supplemental to text

Disclaimer: The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to University of Guelph Academic Regulations.

Academic Misconduct: The School operates on a zero-tolerance policy in these matters. Refer to the University of Guelph, Undergraduate Calendar (see below).

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>