SCHOOL OF ENGINEERING
UNIVERSITY OF GUELPH
Course Description and Outline 2007

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 Assistants:	Albert Brooks	Room 320 Thornbrough Building	Ext. 56661
	Wade Milton	Room 320 Thornbrough Building	Ext. 56661

Class Times: 08:30-09:20h, Monday, Wednesday, Friday, Mackinnon Building Room 121

Lab Times: 12:30-14:20 h, Monday and Friday, Room 1126 Thornbrough (Electrical Lab)

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) Describe measurement devices for the determination of important factors that characterize biological systems or physical and 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 (also available on CD-ROM) 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 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. The field of instrumentation covers many areas of engineering; measurement problems tend to share these fundamentals, but the applications are usually unique. The best approach to solving instrumentation problems is to pose questions to yourself, to your classmates and to the instructor.

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 three different transducers that is carried out by teams of 3 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 proposal will be prepared for each team laboratory outlining 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 Mr. A. Miller, 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. The project comprises a preliminary design for an instrument system to carry out measurements required to solve a specific biological system problem. The report will include a problem statement and the 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 some students may assemble prototypes.

Evaluation:	**Component**	**Value**	**Due Date**
	Individual Lab Report	**10 %**	**Friday, October 19, 2007**
	Team Lab Reports (3)	**25 %**	**Friday, November 16, 2007**
	Problem Assignments	**10%**	**Friday, November 16, 2007**
	Design Project	**30 %**	**Friday, November 23, 2007**
	Final Exam	**25 %**	**Thursday, December 6, 2007**

Notes:

Please refer to the University of Guelph, Undergraduate Calendar regarding academic misconduct. The School is operating on a zero-tolerance policy in these matters.

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

Safety in the laboratory is a prime concern. Lab proposals must include a safety section. Depending upon the experiment, proper protection such as gloves and goggles must be worn. The University policy forbidding working alone will be strictly enforced.

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)*	Biopotentials, blood pressure and flow, ventilation

+ Other Measurement Systems as time permits

* indicates material supplemental to text