



UNSW Course Outline

BIOM9650 Biosensors and Transducers - 2024

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General Course Information

Course Code : BIOM9650

Year : 2024

Term : Term 1

Teaching Period : T1

Is a multi-term course? : No

Faculty : Faculty of Engineering

Academic Unit : Graduate School of Biomedical Engineering

Delivery Mode : Multimodal

Delivery Format : Standard

Delivery Location : Kensington

Campus : Sydney

Study Level : Undergraduate, Postgraduate

Units of Credit : 6

Useful Links

[Handbook Class Timetable](#)

Course Details & Outcomes

Course Description

This course serves as an introduction to physiological measurement using biosensors and transducers. This course deals primarily with gaining an understanding of the physical principles which govern the measurement of a biological variable or system, by a transducer which

converts the variable into an electrical signal. By the end of the course you should understand various measurement devices and approaches including the underlying biological process that generates the quantity to be measured or controlled. The basic biosensors and transducers used to measure pressure, flow, volume and kinematics are examined along with aspects of electrical safety and imaging instrumentation.

Course Aims

The aims of this course are to:

1. introduce the student to different sensor applications in biomedical instrumentation;
2. impart an understanding of the mechanisms which govern the acquisition and processing of physiological signals recorded from a human subject, both *in vivo* and *in vitro*;
3. empower the student to critically evaluate sensor and transducer options for a particular biomedical application.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements
CLO2 : Explain fundamental biosensing and transduction principles
CLO3 : Apply electrical, mechanical and chemical engineering concepts to a range of problems and medical applications
CLO4 : Compute simple biosensing and transduction problems
CLO5 : review the literature in the biosensing and transduction application area

Course Learning Outcomes	Assessment Item
CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements	<ul style="list-style-type: none">• Laboratory Attendance• Mid Semester Quiz• Homework Questions• Final Exam• Major Laboratory Report
CLO2 : Explain fundamental biosensing and transduction principles	<ul style="list-style-type: none">• Laboratory Attendance• Mid Semester Quiz• Homework Questions• Final Exam
CLO3 : Apply electrical, mechanical and chemical engineering concepts to a range of problems and medical applications	<ul style="list-style-type: none">• Laboratory Attendance• Homework Questions• Final Exam
CLO4 : Compute simple biosensing and transduction problems	<ul style="list-style-type: none">• Major Laboratory Report
CLO5 : review the literature in the biosensing and transduction application area	

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams | Blackboard Collaborate

Other Professional Outcomes

Graduate capabilities: These learning outcomes relate most strongly to the following UNSW graduate outcomes: scholarly enquiry capable of independent and collaborative enquiry; understanding of their discipline in its interdisciplinary context; able to apply their knowledge and skills to solving problems, and; collaborative and effective team workers.

Additional Course Information

Presumed knowledge

A good background in mathematics and physics is essential. Basic knowledge of chemistry is assumed. Some knowledge of electrical engineering would also be extremely advantageous, although the basics will be covered in the early lectures. The MATLAB programming environment will be used in the laboratories and as part of some homework exercise, so familiarity with MATLAB or some other programming language will be helpful; if you enrol in this course, an additional Moodle module will be made available to you which contains some MATLAB tutorial material, videos and quizzes to help bring you up to speed.

How this course relates to other courses

"BIOM9640: Biomedical Instrumentation" is a complementary course to BIOM9650, and deals with the genesis of electrical biosignals in the body and how to design measurement electronics to record these signals, which are robust against noise. It is not necessary to have completed BIOM9640 to take BIOM9650, but the background knowledge in mathematics, electrical engineering, and amplification provided by BIOM9640 will be beneficial. However, some introductory electrical engineering topics will also be revised in the first lecture of BIOM9650.

"BIOM9660: Implantable Bionics", is also related to this course and expands on aspects of bioelectrodes, biopotentials and neural stimulation from the perspective of designing and manufacturing an implantable therapeutic device.

"BIOM9711: Modelling Organs, Tissues and Devices" provides a practical overview of computational modelling in bioengineering, focusing on a range of applications including electrical stimulation of neural and cardiac tissues. The knowledge gained in BIOM9650 will assist in understanding these processes.

"BIOM9621: Biological Signal Analysis", provides an understanding of linear systems and signals and knowledge of these topics is useful for understanding the response and limitations of biosensors and transducers.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Laboratory Attendance	10%	
Mid Semester Quiz	20%	
Homework Questions	15%	
Final Exam	40%	
Major Laboratory Report	15%	

Assessment Details

Laboratory Attendance

Course Learning Outcomes

- CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements
- CLO2 : Explain fundamental biosensing and transduction principles
- CLO3 : Apply electrical, mechanical and chemical engineering concepts to a range of problems and medical applications

Assignment submission Turnitin type

This is not a Turnitin assignment

Mid Semester Quiz

Course Learning Outcomes

- CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements
- CLO2 : Explain fundamental biosensing and transduction principles

Assessment Length

2 hours

Assignment submission Turnitin type

This is not a Turnitin assignment

Homework Questions

Course Learning Outcomes

- CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements

- CLO2 : Explain fundamental biosensing and transduction principles
- CLO3 : Apply electrical, mechanical and chemical engineering concepts to a range of problems and medical applications

Assessment information

1. Homework Assignment 1: Displacement	issued on: 14th Feb	due on: 21th Feb
2. Homework Assignment 2: Flow	issued on: 21th Feb	due on: 28th Feb
3. Homework Assignment 3: Volume	issued on: 28th Feb	due on: 7th Mar
4. Homework Assignment 4: Pressure	issued on: 7th Mar	due on: 14th Mar

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Exam

Course Learning Outcomes

- CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements
- CLO2 : Explain fundamental biosensing and transduction principles
- CLO3 : Apply electrical, mechanical and chemical engineering concepts to a range of problems and medical applications

Assessment Length

3 hours

Major Laboratory Report

Course Learning Outcomes

- CLO1 : Describe the applications of various sensors and transducers available for physiological and cellular measurements
- CLO4 : Compute simple biosensing and transduction problems

Assignment submission Turnitin type

This is not a Turnitin assignment

General Assessment Information

There will be hand-in homework assignments, a mid-session quiz, and a major laboratory report. There will also be a final examination consisting of both qualitative and quantitative long-answer questions. In addition, your attendance and completeness of your laboratory notebook will also

be assessed. The following criteria will be applied in assessing your work:

- evidence of critical understanding of the concepts developed in the course;
- ability to apply these concepts to a range of bioinstrumentation problems;
- clarity of description, explanation and attention to the focus of the assessment task;
- degree to which the material submitted for assessment addresses the specified requirements.

Grading Basis

Standard

Course Schedule

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

1. Homework Assignment 1: Displacement	issued on: 12th Feb	due on: 19th Feb
2. Homework Assignment 2: Flow	issued on: 19th Feb	due on: 26th Feb
3. Homework Assignment 3: Pressure	issued on: 26th Mar	due on: 4th Mar
4. Homework Assignment 4: Volume	issued on: 4th Mar	due on: 11th Mar
5. Lab Book	Start from 11-Mar	due on: 29th Apr

Course Resources

Prescribed Resources

Online course material can be accessed through Moodle, which is managed by the UNSW Technology Enabled Learning and Teaching unit: <https://moodle.telt.unsw.edu.au>. Once you are enrolled in the course, BIOM9650 will be visible to you after the session starts, when you log into Moodle using your zPass.

Tutorial tasks, group discussions, lecture notes and resource materials will be made available on this site during session. Announcements made on Moodle will be forwarded to your student email; you are required to check your student email frequently for updates.

Some useful reference books that are held in the UNSW Library are:

- Medical Instrumentation – Application and Design, edited by J.G. Webster (Wiley, 4th ed., 2010).
- Introduction to Biomedical Engineering, edited by J. D. Enderle, J. D. Bronzino. (Academic Press (Elsevier) 3rd ed., 2011).
- Biomedical Transducers and Instruments, T. Togawa, T. Tamura and P.Å. Öberg (CRC Press, 2nd ed., 2011).
- The Art of Electronics - Paul Horowitz (Winfield Hill, 3rd ed., 2015).

Course Evaluation and Development

Student feedback on the course and the lecturers in the course is gathered at the end of each session using the university's MyExperience survey. Your feedback is much appreciated and taken very seriously. Furthermore, your feedback is completely anonymous; while lecturers can see an aggregated view of student responses, and can read your comments, they cannot see who provided the feedback. Continual improvements are made to the course based in part on such feedback, and this helps us to improve the course for future students.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Thanh Nho Do		Room 1003, Level 1, E26 Biological Sciences South			No	Yes
Lecturer	Nigel Lovell					No	No
Demonstrator	James Davies					No	No
	Emanuele Nicotra					No	No
	Bibhu Sharma					No	No
	Chi Cong Nguyen					No	No
	Adrienne Ji					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or

within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the

University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way

through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School Contact Information

Student Services can be contacted via [unsw.to/webforms](#).