UNSW Course Outline

BIOM9811 Applications of Light in Engineering, Technology and the Life Sciences - 2024

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General Course Information

Course Code : BIOM9811
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 : Postgraduate, Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Can you imagine the world, nature and humanity without light? Would the economy even exist

without light? How can light save lives?

Light plays a central role in human activity and it provides solutions to current global challenges. Light is ubiquitous in our daily lives: from technologies that improve vision and power the smartphones in our hands, to state-of-the-art technologies that provide us with tools to explore space and better understand our planet, and fibre optics that help us communicate via the Internet. They have revolutionized society through medicine, communications, entertainment and culture. Industries based on light are major economic drivers, and light-based technologies directly respond to the needs of humankind by providing access to information, promoting sustainable development, and increasing societal health and well-being.

Welcome to “Applications of light in engineering and life sciences”. This course aims to provide you with a perspective on the real-world applications of light technologies which have shaped our society and will continue to act as key enabling technologies of the future.

It will cover technologies such as lasers, light emitting diodes (LEDs), digital cameras, optical fibres and more. You will learn about the application of light to monitor industrial processes and light-based imaging and image analysis in industrially relevant areas ranging from satellite imaging through to microscopy. You will gain an appreciation of current and future commercial opportunities offered in this area.

The course will culminate in a design project where you will learn how to design, build and test diverse light based detection, sensing and imaging systems. On the completion of the course you will be able use light to measure, probe and interrogate diverse effects in various industrial and clinical scenarios and in the environment.

The course is self-contained and it provides all the required fundamentals. All assessments are open-book. The course is suitable for students from diverse backgrounds.

Course Aims

The goal of this course is to provide the students with insights into the broad perspective of applications of light technologies in the life sciences and in the industry. It will focus on the interaction between light and various systems as well as various optical imaging and light-based therapeutic techniques.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the foundational concepts and methods from the science of light
CLO2 : Apply these concepts to the operation of light-based systems detecting, sensing, measuring and quantifying physical and life science phenomena.
CLO3 : Conduct and explain practical investigations related to light detection, sensing and imaging.
CLO4 : Design and evaluate a simple light-based measurement system and communicate how to solve practical issues arising in the system application.
CLO5 : Review and assess potential commercial opportunities provided by light technologies.
CLO6 : Explain the safety constraints of using light in the industry and the life sciences and medicine

Course Learning Outcomes	Assessment Item
CLO1 : Describe the foundational concepts and methods from the science of light	• Midterm Online Test • Final Exam
CLO2 : Apply these concepts to the operation of light-based systems detecting, sensing, measuring and quantifying physical and life science phenomena.	• Design Task • Final Exam
CLO3 : Conduct and explain practical investigations related to light detection, sensing and imaging.	• Lab practical • Design Task
CLO4 : Design and evaluate a simple light-based measurement system and communicate how to solve practical issues arising in the system application.	• Design Task
CLO5 : Review and assess potential commercial opportunities provided by light technologies.	• Final Exam
CLO6 : Explain the safety constraints of using light in the industry and the life sciences and medicine	• Midterm Online Test

Learning and Teaching Technologies

Moodle - Learning Management System

Additional Course Information

Some mathematics background is essential. You should have prior exposure to algebra (equivalent to completion of 1st year mathematics – Maths 1A and 1B). It is helpful but not essential that you have some knowledge of first year physics (optics) or electrical circuits and systems. The essential material will be reviewed during the course.

The course is independent from other BIOM courses and can be taken in isolation.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Lab practical Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Not Applicable
Design Task Assessment Format: Group	30%	
Midterm Online Test Assessment Format: Individual	20%	
Final Exam Assessment Format: Individual	30%	

Assessment Details

Lab practical

Assessment Overview

Students will apply concepts in the class to relevant experimental challenges.

Lab work will be assessed by individual reports

Course Learning Outcomes

- CLO3 : Conduct and explain practical investigations related to light detection, sensing and imaging.

Detailed Assessment Description

Students will apply concepts in the class to relevant experimental challenges through Lab practicals.

The required content of practical reports is accessible from Moodle from the beginning of the course. They should be read before the class, so that practical time can be used efficiently.

Assessment length: Each student will spend 5x2 = 10 hours carrying out scheduled practicals.

Submission deadline: Students will work on their practicals in pairs but will submit individual reports at the end of each completed practical.

Deadline for absolute fail: Students who do not complete selected practicals and submit reports by the end of Week 10 will have failed these selected practicals.

Marks returned: Lab work will be assessed by individual reports, which will be marked during the practicals.The outcome of marking will be communicated to the students during the practical.

Assessment criteria:

1. Completeness of the report tasks.
2. Correctness of the completion of the report tasks.

Assessment Length

In 2023 each student will spend 5x2 = 10 hours carrying out scheduled practicals.

Submission notes

Students will work on their practicals in pairs but will submit individual reports at the end of each completed practical.

Assessment information

Practicals can be taken in arbitrary order. Student pairs will be assigned to the practicals as rostered by unit convenors. Students may request to swap the day and time of the assigned practical, subject to the other student involved in the swap agrees and approval is obtained from the unit convenor. However, this request must be made no later than end of Week 1, by using the form available from the main Moodle page of the course. A roster with individual allocations of practicals will be available on Moodle.

Assignment submission Turnitin type

Not Applicable

Design Task

Assessment Overview

Students will work on a group project designing an optical system similar to those taught in the course.

30% includes: 10% peer reflection; 20% group report.

Students are asked to spend more time on their design task in weeks when they have no pracs

Groups to choose their design task no later than Week 3

Course Learning Outcomes

- CLO2 : Apply these concepts to the operation of light-based systems detecting, sensing, measuring and quantifying physical and life science phenomena.
- CLO3 : Conduct and explain practical investigations related to light detection, sensing and imaging.
- CLO4 : Design and evaluate a simple light-based measurement system and communicate how to solve practical issues arising in the system application.

Detailed Assessment Description

Students will work on a group project designing an optical system similar to those taught in the course.

Students will initially be assigned to groups of 4 - 5 members. While collaboration within these groups is encouraged, students may request to swap groups, subject to groups agreeing and approval from the unit convenor. Groups are encouraged to choose their design task in Week 1, but this must be finalised no later than Week 3.

Assessment criteria: Instructions to the Design Task and assessment criteria are available on Moodle.
The student will prepare a formal report from their design task that will include results, discussion,
error sources and reference to relevant literature. The objectives of this major report are to consolidate information learned in the course and to develop critical data analysis and literature research skills.

30% of the total mark includes: 20% for the quality of the group report. 10% of marks for the quality of individual peer reflection;

Related graduate capabilities include:
Capable of independent and collaborative inquiry Capable of effective communication
Information literate
Enterprising, innovative and creative
Collaborative and effective team workers
Understanding of the discipline in its interdisciplinary context Rigorous in analysis, critique and reflection
Able to apply knowledge and skills to solving problems Capable of independent, self-directed practice
Capable of lifelong learning

Midterm Online Test

Assessment Overview

Midterm exam - 1 hour.

Exam is open book.

Course Learning Outcomes

- CLO1 : Describe the foundational concepts and methods from the science of light
- CLO6 : Explain the safety constraints of using light in the industry and the life sciences and medicine

Detailed Assessment Description

Start date: 02/04/2024 10:00 AM

Assessment length: One hour

Submission notes: This exam will be administered through Moodle. A trial mock up exam will be available on Moodle, to test if students are able to make an online submission within the required timescale.

Due date: 02/04/2024 11:00 AM

Deadline for absolute fail (to account for any residual IT challenges): 02/04/2024 11:10 AM

Marks returned: Yes.

Assessment criteria: The exam may be made up of any of the following: true/false, multiple choice, matching, problem solving, short answer and essay questions. The aims of this assessment are to encourage students to review the lectures and tutorials for the first half of the course. This assessment is a direct test of the degree to which the knowledge-based learning outcomes have been achieved.

Assessment Length

One hour

Submission notes

This exam will be administered through Moodle. A trial mock up exam will be available on Moodle, to test if students are able to make an online submission within the required timescale.

Final Exam

Assessment Overview

Final open book exam will assess the theoretical content of the course

Course Learning Outcomes

- CLO1 : Describe the foundational concepts and methods from the science of light
- CLO2 : Apply these concepts to the operation of light-based systems detecting, sensing, measuring and quantifying physical and life science phenomena.
- CLO5 : Review and assess potential commercial opportunities provided by light technologies.

Detailed Assessment Description

Start date: To be announced, during exam period.

Assessment length: Two hours

Due date: To be announced, during exam period.

Deadline for absolute fail (to account for any residual IT challenges): To be announced, during exam period.

Marks returned: Marks will be communicated together with the term evaluations.

Final open book exam will assess the theoretical content of the course. Submission will be via Moodle.

Assessment criteria: The final exam may contain a mixture of questions for which descriptive answers will be required. It will also contain specific problems to solve. These will be closely related to problems solved during the course. To complete the exam problems, students will use fundamental material from the lectures.

Assessment Length

Two hours

General Assessment Information

Weekly quizzes are also available on Moodle. These are not formally assessed, but they are provided as a study aid. Students are encourages to do these quizzes regularly.

Grading Basis

Standard

Course Schedule

Attendance Requirements

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

General Schedule Information

All lectures are pre-recorded and there are no face-to-face lectures. Tutorials are only face to face and are not recorded. Practical classess are only face to face.

Course Resources

Recommended Resources

We recommend the following three open access books:

1. Fundamentals of Photonics Modules (SPIE)
2. Photonics: Technical Applications of Light (Wenko Suptlitz)
3. Discovering Light: Fun Experiments with Optics (Maria Vinas Pena)

Course Evaluation and Development

Informal student feedback is welcome throughout the course. Formal evaluations will be sought upon the conclusion of the course.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Ewa Goldys		E26 L1	421318145	Reach out by email to make an appointment about BIOM9811 or during scheduled tutorial sessions (Tues 10 AM - 12 PM, Samuels 518) or use the Moodle Discussion Board.	No	No
	Akanksha Bhargava		E26 L1		Please reach out by email to make an appointment about BIOM9811 or during scheduled tutorial sessions (Tues 9 AM - 1 PM, Samuels 518) or use the Moodle Discussion Board.	No	Yes
Demonstrator	Adnan Agha				Please reach out to Adnan during scheduled practicals, Wed 4 pm - 6 pm, Thurs 2 pm – 4 pm (Samuels 518) or through the Moodle Discussion Board.	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 Plagarism

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.