PHYS704

Nanobiophotonics

S2 Day 2016

Dept of Physics and Astronomy

Contents

General Information

Unit convenor and teaching staff
Unit Coordinator
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Credit points
4

Prerequisites
Admission to MRes

Corequisites

Co-badged status

Unit description
This unit covers the current research directions at the interface of nanotechnology and biophotonics, addressing a common gap in the physics/engineering undergraduate curriculum. You will learn about the principal types of nanomaterials and nanostructures with the underpinning physics and chemistry. You will gain familiarity with photonics techniques that relate to biological applications such as advanced microscopy and image analysis. There is an emphasis on applications and significance of nanomaterials in the life sciences. We will discuss various Nanosafety, instrumentation and core measurement techniques which are applicable in nanotechnology and biophotonics will also be discussed.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

This unit covers the current research directions at the interface of nanotechnology and biophotonics, addressing a common gap in the physics/engineering undergraduate curriculum. The learning outcomes include gain knowledge-base on the following topics: 1. Principal types of nanomaterials and nanostructures with the underpinning physics and chemistry. 2. Synthesis, fabrication and characterisation of various nanostructures and nanomaterials. The characterisation focuses on the application of electromagnetic fields, but also covers other forms of advanced microscopy. At the conclusion of the unit students are expected to know basic characteristics of selected nanostructures and nanoparticles, and the key features of their applications. 3. The student will gain familiarity with photonics techniques that relate to biological applications such as advanced microscopy and image analysis. 4. Applications and significance of nanomaterials in the life sciences. 5. Undertanding and appreciation of Nanosafety issues, including nanoparticle interaction with cells and biological tissue; measurement approaches of nanomaterial impacts, and ways to remedy hazards. 6. Instrumentation and core measurement techniques, which are applicable in nanotechnology and biophotonics will also be discussed.

Assessment Tasks

Name	Weighting	Due
Final Examination	40%	Exam session
Assignments	20%	Weeks 3, 5, 7, 9, 11
Major essay	15%	week 12
Laboratory practical	10%	weeks 3 and 7
Presentations	15%	week 4 and 8

Final Examination

Due: **Exam session**
Weighting: **40%**

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in draft form approximately 8 weeks before the commencement of the examinations and in Final form approximately four

weeks before the commencement of the examinations. http://www.timetables.mq.edu.au/exam.

All students are expected to ensure that they are available until the end of the teaching semester, ie the final day of the official examination period.

The final examination is a hurdle requirement. You must obtain a mark of at least 40% to pass the unit. If your mark in the final examination is between 30% and 39% inclusive then you will be a given a second and final chance to attain the required level of performance.

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Assignments

Due: **Weeks 3, 5, 7, 9, 11**
Weighting: **20%**

Assignments will be set approximately fortnightly and we remind you that the questions they contain provide essential practice for the types of questions you may meet in tests and examinations.

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Major essay

Due: **week 12**
Weighting: **15%**

The student is expected to compile a literature-based essay addressing the unit-related method, technology or major research direction. This essay must contain an abstract, introduction, description of the method, technology or major research direction, critical discussion of its pros and cons and prospects of its development, conclusion and at least 10 references, including at least 5 references from scientific journals.

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Laboratory practical

Due: **weeks 3 and 7**
Weighting: **10%**

Two laboratory practicals are set up to consolidate the students' practical hands on skills and techniques related to the unit. Each practical duration is 3 hours and expected 3 hours for result analysis and report writing. The students will be supervised by lab demonstrators during the experiments.

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Presentations

Due: **week 4 and 8**
Weighting: **15%**

Two presentations prepared by the students are based on their own critical reading and analysis of a scientific paper given by the lecturers. A short powerpoint presentation should address the critical points of this paper, including main aims, motivation, significance, methods; and also discuss strong and weak points.

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Delivery and Resources

Since this unit is based on hot topics in the new discipline NanoBioPhotonics, the main resource is a lecture notes compiled by the lecturers, with a number of references.

Two books are recommended:

J.R. Lakowicz. Principles of fluorescence spectroscopy. Springer, 3 edition, 2006.

E. M. Goldys. Fluorescence Applications in Biotechnology and Life Sciences. Wiley-Blackwell. 2009.

Unit Schedule

Week 1-6 lecturer – Andrei Zvyagin

Weeks 1-4 Light interactions with nanomaterials Weeks 5-6 Making and moving nanostructures with light

Week 7-12 lecturer -- Ewa Goldys Weeks 7-9 Production and characterisation of biocompatible optically active nanomaterials Weeks 10-12 Optically active nanomaterials in cells and biological tissues Week 13 Revision Student presentations in week 13. Major essay due in week 13

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

Learning outcome

- This unit covers the current research directions at the interface of nanotechnology and biophotonics, addressing a common gap in the physics/engineering undergraduate curriculum. The learning outcomes include gain knowledge-base on the following topics: 1. Principal types of nanomaterials and nanostructures with the underpinning physics and chemistry. 2. Synthesis, fabrication and characterisation of various nanostructures and nanomaterials. The characterisation focuses on the application of electromagnetic fields, but also covers other forms of advanced microscopy. At the conclusion of the unit students are expected to know basic characteristics of selected nanostructures and nanoparticles, and the key features of their applications. 3. The student will gain familiarity with photonics techniques that relate to biological applications such as advanced microscopy and image analysis. 4. Applications and significance of nanomaterials in the life sciences. 5. Undertanding and appreciation of Nanosafety issues, including nanoparticle interaction with cells and biological tissue; measurement approaches of nanomaterial impacts, and ways to remedy hazards. 6. Instrumentation and core measurement techniques, which are applicable in nanotechnology and biophotonics will also be discussed.

Assessment tasks

- Major essay

- Laboratory practical

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcome

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Assessment tasks

- Final Examination
- Assignments
- Major essay
- Laboratory practical
- Presentations

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based

critique of practice and theory.

This graduate capability is supported by:

Learning outcome

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Assessment tasks

- Final Examination
- Assignments
- Major essay
- Laboratory practical
- Presentations

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcome

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Assessment tasks

- Final Examination
- Assignments
- Presentations

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcome

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Assessment tasks

- Assignments
- Major essay
- Laboratory practical
- Presentations

PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

Learning outcome

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biophotonics will also be discussed.

Assessment task

- Laboratory practical

Changes from Previous Offering

An additional laboratory practical is added aiming to introduce basics of fluorescence microscopy and biological specimen preparation methodology.

Assignments are corrected to improve clarity and optmise matching to the overall study load.