PHTN221

Introduction to Optical Science and Technology

S1 Day 2014

Physics and Astronomy

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
Michael Withford
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E6B 2.707

Credit points
3

Prerequisites
(MATH135(P) or MATH132(P) or MATH136 or MATH133) and [(PHYS140(P) and PHYS143(P)) or (PHYS106(P) and PHYS107(P)) or PHYS149(P)]

Corequisites

Co-badged status

Unit description
Optical technology is widely used in industry, telecommunications and modern consumer devices, ranging from the tiny lasers in many disc drives to the thousands of kilometres of optical fibres carrying signals between continents. This unit offers an overview of these technologies, and the science underlying their operation. Topics include: light sources, optical fibres and semiconductor devices. A laboratory program develops experimental and optical fibre handling skills.

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 establishes the broad background of Optical Technology. This background covers optics, optical instruments and devices, materials, semi-conductor devices,

propagation and detection. At the conclusion of the unit students are expected to know basic characteristics of selected light sources and detectors and the key features of optical fibres. They are also expected to understand the origins of these characteristics and their application in fields such as astronomy, defense, telecommunications and medicine. The Unit establishes the foundation for more detailed study of specialised topics in subsequent units. In addition, the laboratory introduces students to experimental techniques mainly connected with optical fibres and their applications in systems and sensors.

In addition to introducing students to basic topics in the study of photonic technology, this unit develops experimental skills in handling delicate optical components. It also develops students' knowledge of safe-working practices in a laboratory environment.

Ability to effectively communicate by using a suitable technical language.

During report writing activities the students practice data analysis and the application of methods both discussed in the class and integrated form other reference sources.

Assessment Tasks

Name	Weighting	Due
Exam	40%	As per exam timetable
Mid-semester Test	20%	Week 6 (1 h)
Laboratory reports	20%	A week after each prac.
Assignments	10%	As indicated
Students' talks	10%	Week 7 and 13
Overview	0%	End of 1st semester

Exam

Due: **As per exam timetable**
Weighting: **40%**

Mid-semester Test

Due: **Week 6 (1 h)**
Weighting: **20%**

Covers material form first half of the unit.

On successful completion you will be able to:

- This Unit establishes the broad background of Optical Technology. This background covers optics, optical instruments and devices, materials, semi-conductor devices, propagation and detection. At the conclusion of the unit students are expected to know basic characteristics of selected light sources and detectors and the key features of optical fibres. They are also expected to understand the origins of these characteristics and their application in fields such as astronomy, defense, telecommunications and medicine. The Unit establishes the foundation for more detailed study of specialised topics in subsequent units. In addition, the laboratory introduces students to experimental techniques mainly connected with optical fibres and their applications in systems and sensors.
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Laboratory reports

Due: **A week after each prac.**
Weighting: **20%**

There is seven three hours laboratory sessions in the first half year and six in the second half-year . Laboratory classes begin in Week 1. The reports are due in a week after completing each experiment.

On successful completion you will be able to:

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- During report writing activities the students practice data analysis and the application of methods both discussed in the class and integrated form other reference sources.

Assignments

Due: **As indicated**
Weighting: **10%**

Assignments will be set approximately fortnightly. They provide essential practice for questions in tests and examinations. Due dates as indicated on each assignment.

On successful completion you will be able to:

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- Ability to effectively communicate by using a suitable technical language.
- During report writing activities the students practice data analysis and the application of methods both discussed in the class and integrated form other reference sources.

Students' talks

Due: **Week 7 and 13**
Weighting: **10%**

Every student is expected to give 2 talks illustrated by powerpoint presentaions or similar visual aids. Each talk will be about 20 minutes long which includes 4 minutes for questions from the audience. (depending on the size of the class) . The talk subjects are selected from a list. Talks are given in Week 7 and 13 during practical classes.

On successful completion you will be able to:

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- Ability to effectively communicate by using a suitable technical language.

Overview

Due: **End of 1st semester**
Weighting: **0%**

Students must demonstrate satisfactory performance in all parts of the unit assessment in order to pass the unit

Delivery and Resources

The unit is delivered on-campus in a day mode. Students are also taken on a tour to see University research labs to see demonstrations of key photonic concepts discussed during lectures.

Reference texts:

Some material will be drawn from Optoelectronics (3rd edition) by J. Wilson and J. Hawkes, published by Prentice-Hall. The latter book is out of print, so you will receive handouts based on this material. Other texts you may want to consult are:

R.P. Khare ”Fiber optics and optoelectronics” Oxford, ISBN 0-19-566930-4

S.O. Kasap, “Optoelectronics and Photonics” Prentice Hall ISBN 0-201-61087-6

The popular first year text “University Physics” by Young and Friedman, (editions with Modern Physics, 11 and above, ISBN 0-8053-8684-X) may also be useful, as an adjunct to Halliday and Resnick.

Additional material will be available for downloading on http://ilearn.mq.edu.au

Unit Schedule

PHTN221 Lecture content and timing	Topics	Comments

Week 1 and 2	Optical fibres	
Week 3	Atoms, light	Assignment 1 due date 15 March
Weeks 4-6	Lasers	Assignment feedback week 4
Weeks 7-9	Background of solid state physics	Talk 1 in week 7
Week 10 -11	Semiconductor devices	Week 10 Assignment 2 due date 24 May
Week 12	Other light detectors	
Week 13	Revision (both lecturers)	Talk 2 in Week 13

Comments: Week 1-6 lecturer - Michael Withford, Week 7-12 –Andrei Zvyagin, week 13 - both.

Mid semester test in Week 8 (30 April 2013).

Test feedback in Week 9.

Assignment feedback in week 4 and 11.

Learning and Teaching Activities

Lectures

There are two lecture sessions per week. The timetable and location of classes are on the website www.timetables.mq.edu.au. sessions in the second half-year.

Laboratory work

The laboratory work will involve experiments in optoelectronics. A separate sheet will give you the laboratory schedule. There are seven 3-hour laboratory sessions in the first half-year and six 3-hour laboratory You will be given a handout on safe working practice in the laboratory, and asked to sign that you have read it. Laboratory classes begin in week 1.

Student talks

Student talks are scheduled during practical time on Tuesday 2-5 in Week 7 and Week 13. Every student is expected to give two talks, which will be illustrated by powerpoint slides or similar visual aids. Each talk will be about 20 minutes long which includes 4 minutes for questions from

the audience. Talks will be assessed.

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.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/

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://informatics.mq.edu.au/help/.

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

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

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Assessment tasks

- Mid-semester Test
- Laboratory reports
- Assignments
- Students' talks

Learning and teaching activities

- There are two lecture sessions per week. The timetable and location of classes are on the website www.timetables.mq.edu.au. sessions in the second half-year.
- The laboratory work will involve experiments in optoelectronics. A separate sheet will give you the laboratory schedule. There are seven 3-hour laboratory sessions in the first half-year and six 3-hour laboratory You will be given a handout on safe working practice in the laboratory, and asked to sign that you have read it. Laboratory classes begin in week 1.
- Student talks are scheduled during practical time on Tuesday 2-5 in Week 7 and Week 13. Every student is expected to give two talks, which will be illustrated by powerpoint slides or similar visual aids. Each talk will be about 20 minutes long which includes 4 minutes for questions from the audience. Talks will be assessed.

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

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Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

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Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and

systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

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13. Every student is expected to give two talks, which will be illustrated by powerpoint slides or similar visual aids. Each talk will be about 20 minutes long which includes 4 minutes for questions from the audience. Talks will be assessed.

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

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Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcome

- Ability to effectively communicate by using a suitable technical language.

Assessment tasks

- Laboratory reports
- Assignments
- Students' talks

Learning and teaching activities

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Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Ability to effectively communicate by using a suitable technical language.
- During report writing activities the students practice data analysis and the application of methods both discussed in the class and integrated form other reference sources.

Assessment tasks

- Laboratory reports
- Assignments
- Students' talks

Learning and teaching activities

- The laboratory work will involve experiments in optoelectronics. A separate sheet will give you the laboratory schedule. There are seven 3-hour laboratory sessions in the first half-year and six 3-hour laboratory You will be given a handout on safe working practice in the laboratory, and asked to sign that you have read it. Laboratory classes begin in week 1.
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Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

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topics in subsequent units. In addition, the laboratory introduces students to experimental techniques mainly connected with optical fibres and their applications in systems and sensors.

- Ability to effectively communicate by using a suitable technical language.

Assessment task

- Students' talks

Learning and teaching activity

- Student talks are scheduled during practical time on Tuesday 2-5 in Week 7 and Week 13. Every student is expected to give two talks, which will be illustrated by powerpoint slides or similar visual aids. Each talk will be about 20 minutes long which includes 4 minutes for questions from the audience. Talks will be assessed.

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

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Assessment task

- Students' talks

Learning and teaching activity

- There are two lecture sessions per week. The timetable and location of classes are on

the website www.timetables.mq.edu.au. sessions in the second half-year.

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