UNSW Course Outline

PHTN4661 Optical Circuits and Fibres - 2024

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General Course Information

Course Code : PHTN4661
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Electrical Engineering & Telecommunications
Delivery Mode : In Person
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

This course provides students with foundational knowledge in optical fibres and waveguide technologies which play an important role in modern telecommunications applications, e.g., high-bandwidth high-quality optical communication networks.

Course content includes: Basics of optical fibres and waveguides; Waveguide analysis and optical modes; Single-mode and multimode fibres; Optical waveguides; Optical transmission properties: attenuation, dispersion and bandwidth; Optical coupling and connection; Optical components and circuits; Fibre and waveguide fabrication; Fibre and waveguide measurement; Advanced topics; Recent research and developments.

Course Aims

The primary aim of this course is to provide students with a solid foundation in optical fibre and waveguide technologies. The course helps students understand, and become familiar with the fundamental principles, theoretical methods and experimental techniques of optical fibres and related technologies and enables them to carry out basic optical fibre and waveguide-related analysis, design and measurement.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Identify and apply main theoretical methods for modelling and analysing optical fibres and waveguides
CLO2 : Identify, interpret and assess properties of optical fibres and waveguides
CLO3 : Differentiate and interpret main aspects of design, manufacture and application of optical fibres, waveguides and circuits
CLO4 : Apply and report experimental methods and measurement techniques of optical fibres and waveguides
CLO5 : Recognise and analyse technical issues and considerations when using optical fibres / waveguides in optical circuits and systems

Course Learning Outcomes	Assessment Item
CLO1 : Identify and apply main theoretical methods for modelling and analysing optical fibres and waveguides	• Final Examination • Mid-term Examination • Lab experiments and reports
CLO2 : Identify, interpret and assess properties of optical fibres and waveguides	• Final Examination • Mid-term Examination • Lab experiments and reports
CLO3 : Differentiate and interpret main aspects of design, manufacture and application of optical fibres, waveguides and circuits	• Final Examination • Mid-term Examination • Lab experiments and reports
CLO4 : Apply and report experimental methods and measurement techniques of optical fibres and waveguides	• Final Examination • Mid-term Examination • Lab experiments and reports
CLO5 : Recognise and analyse technical issues and considerations when using optical fibres / waveguides in optical circuits and systems	• Final Examination • Mid-term Examination • Lab experiments and reports

Learning and Teaching Technologies

Moodle - Learning Management System

Other Professional Outcomes

	Program Intended Learning Outcomes	Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	CLO:1,2,3
PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing		CLO:1,2,3
PE1.3 In-depth understanding of specialist bodies of knowledge		CLO:1,2,3,4,5
PE1.4 Discernment of knowledge development and research directions		CLO:1,2,3,4,5
PE1.5 Knowledge of engineering design practice		CLO:2,3,4,5
PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice		N.A.
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	CLO:1,2,3,4,5
PE2.2 Fluent application of engineering techniques, tools and resources		CLO:3,4,5
PE2.3 Application of systematic engineering synthesis and design processes		CLO:3,4,5
PE2.4 Application of systematic approaches to the conduct and management of engineering projects		N.A.
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	N.A.
PE3.2 Effective oral and written communication (professional and lay domains)		CLO:3,4,5
PE3.3 Creative, innovative and pro-active demeanour		CLO:3,5
PE3.4 Professional use and management of information		CLO:3,5
PE3.5 Orderly management of self, and professional conduct		CLO:3,5
PE3.6 Effective team membership and team leadership		CLO:4

Additional Course Information

Relationship to Other Courses

The course is a professional elective offered to undergraduate (4th year) and postgraduate students in the School of Electrical Engineering and Telecommunications at UNSW. The course builds the foundation of knowing optical fibres and waveguides and using them to construct optical circuits and systems.

Pre-requisites: The pre-requisite for this course is ELEC3115, Electromagnetic Engineering.

Assumed knowledge: It is essential that the students are familiar with the fundamentals of electromagnetic theory (e.g. Maxwell's equations), engineering mathematic methods and communication system theory. It is further assumed that the students have satisfactorily completed undergraduate courses in electrical engineering or physics. If you feel you don't have the appropriate background, then these books will help:

B.P. Lathi, Modern Digital & Analog Communication Systems

D.K. Cheng, Field & Wave Electromagnetics

Following courses: This course is followed by the undergraduate (4th year) and postgraduate course PHTN4662, Photonics Networks.

Course ResourcesReference books

We do not prescribe a textbook. We recommend you have either of these as the main reference book:

J. Senior: Optical Fibre Communications: Principles and Practice

G. Keiser: Optical Fibre Communications

Students are encouraged to purchase one of these books as they provide the most coverage of the topics in this course and also the following course: PHTN4662. There are also quite a few copies of them in the UNSW library.

On-line resources

Moodle: As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Mailing list: Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your UNSW email address).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Final Examination Assessment Format: Individual	50%	
Mid-term Examination Assessment Format: Individual	25%	
Lab experiments and reports Assessment Format: Individual	25%	

Assessment Details

Final Examination

Assessment Overview

The final exam will be a standard closed-book 2-hour written examination. University-approved calculators are allowed. The examination tests analytical and critical thinking and understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course unless specifically indicated otherwise by the lecture staff. Assessment is a graded mark according to the correct fraction of the answers to the exam questions.

Course Learning Outcomes

- CLO1 : Identify and apply main theoretical methods for modelling and analysing optical fibres and waveguides
- CLO2 : Identify, interpret and assess properties of optical fibres and waveguides
- CLO3 : Differentiate and interpret main aspects of design, manufacture and application of optical fibres, waveguides and circuits
- CLO4 : Apply and report experimental methods and measurement techniques of optical fibres and waveguides
- CLO5 : Recognise and analyse technical issues and considerations when using optical fibres / waveguides in optical circuits and systems

Assessment Length

2 hours

Mid-term Examination

Assessment Overview

The mid-term exam will be a closed-book written examination of 1 hour. University-approved calculators are allowed. The examination tests the student's understanding of the course

materials covered up to the mid-term. Marks will be given according to the correct fraction of answers to the questions.

Course Learning Outcomes

- CLO1 : Identify and apply main theoretical methods for modelling and analysing optical fibres and waveguides
- CLO2 : Identify, interpret and assess properties of optical fibres and waveguides
- CLO3 : Differentiate and interpret main aspects of design, manufacture and application of optical fibres, waveguides and circuits
- CLO4 : Apply and report experimental methods and measurement techniques of optical fibres and waveguides
- CLO5 : Recognise and analyse technical issues and considerations when using optical fibres / waveguides in optical circuits and systems

Assessment Length

1 hour

Lab experiments and reports

Assessment Overview

Lab experiments and laboratory reports must be completed as required. There are 4 experiments in total. You must submit your individual lab report for each experiment. Assessment is based on the performance of laboratory experiments and reports, against the specific requirements set in the lab notes.

Course Learning Outcomes

- CLO1 : Identify and apply main theoretical methods for modelling and analysing optical fibres and waveguides
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General Assessment Information

Grading Basis

Standard

Course Schedule

Attendance Requirements

Please note that lecture recordings are not available for this course. Students are strongly encouraged to attend all classes and contact the Course Authority to make alternative arrangements for classes missed.

General Schedule Information

Please note:

- You are expected to prepare the course study by reading the course outlines carefully in O-Week.
- You are expected to attend all lectures, tutorials, labs, exams in order to maximise learning.
- Self-directed study and self-organised group learning are strongly encouraged, in addition to the class contact hours throughout the course.
- You must prepare well for your laboratory classes and your lab work will be assessed.
- Reading additional texts will further enhance your learning experience. Besides the lecture and lab notes, you are encouraged to read reference texts if feel needed.

Timetable

Week1: Lec - Basics of optical fibres and waveguides **Tut** - Yes **Lab** - No

Week2: Lec - Waveguide analysis and optical modes **Tut** - Yes **Lab** - Yes

Week3: Lec - Optical waveguide properties **Tut** - Yes **Lab** - Yes

Week4: Lec - Optical fibre and waveguide fabrication **Tut** - Yes **Lab** - Yes

Week5: Lec - Optical coupling and connection **Tut** - Yes **Lab** - Yes

Week6: Lec - Consultation **Tut** - Consultation **Lab** - Yes

Week7: Lec - Midterm Exam **Tut** - Yes **Lab** - Yes

Week8: Lec - No (Public Holiday) **Tut** - Yes **Lab** - Yes

Week9: Lec - Optical components and circuits **Tut** - Yes **Lab** - Yes

Week10: Lec - Advanced topics and course review **Tut** - No **Lab** - No

Week11: Lec - Consultation **Tut -** Consultation **Lab -** No

Course Resources

Prescribed Resources

Moodle: As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: https://moodle.telt.unsw.edu.au/login/index.php.

Mailing list: Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your UNSW email address).

Course Evaluation and Development

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via the Course and Teaching Evaluation and Improvement Process. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Gang-Ding Peng		EE419	401710254		No	Yes
Lab staff	Yingge (Lucy) Chen		EEG15			No	No
Demonstrator	Jiaying Wang		EE422			No	No
	Qinqing Han		EE422			No	No
	Guanghao Li					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-specific Information

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Use of AI for assessments

Your work must be your own. If you use AI in the writing of your assessment, you must acknowledge this and your submission must be substantially your own work. More information can be found on this website.

Workplace Health & Safety (WHS)

WHS for students and staff is of utmost priority. Most courses involve laboratory work. You must follow the rules about conduct in the laboratory. About COVID-19, advice can be found on this website.

School Contact Information

Consultations: Lecturer consultation times will be advised during the first lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course and can also provide you with consultation times. ALL email enquiries should be made from your student email address with ELEC/TELExxxx in the subject line; otherwise they will not be answered.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via online learning and teaching platforms – in this course, we will use Moodle https://moodle.telt.unsw.edu.au/login/index.php. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

Student Support Enquiries

For enrolment and progression enquiries please contact Student Services

Web

Electrical Engineering Homepage