UNSW Course Outline

PHTN4662 Photonic Networks - 2024

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General Course Information

Course Code : PHTN4662
Year : 2024
Term : Term 2
Teaching Period : T2
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

Photonic networks offer high-bandwidth high-quality optical communications with optical fibre commonly ulitised as the transmission medium. The course aims at facilitating students to understand, and become familiar with the fundamental principles, methods and techniques of

optical fibre systems and related technologies, and enabling students to carry out basic optical fibre system analysis, design and evaluation.

Course content includes optical fibres, fibre amplifiers and lasers, optical sources and detectors, photonic components, optical multiplexing technologies; nonlinear optical effects in optical fibres, noise sources and system performance assessment, system design considerations, optical communication systems and photonic networks.

Course Aims

This course is a professional elective offered to final-year undergraduate and postgraduate students. The course covers an important area in telecommunications engineering. The primary aim of this course is to help students build up a solid technical foundation in optical fibre systems and network-related technologies.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply main principles, methods and techniques for analysis and design of optical fibre systems and networks
CLO2 : Describe features and performance of optical fibre systems
CLO3 : Identify main aspects in the design and application of optical fibre systems
CLO4 : Demonstrate experimental methods and measurement techniques for optical fibre systems
CLO5 : Analyse technical issues and considerations when design and evaluation of optical fibre systems

Course Learning Outcomes	Assessment Item
CLO1 : Apply main principles, methods and techniques for analysis and design of optical fibre systems and networks	• Assignments • Final Examination • Mid-term Examination • Laboratory Work
CLO2 : Describe features and performance of optical fibre systems	• Assignments • Final Examination • Mid-term Examination • Laboratory Work
CLO3 : Identify main aspects in the design and application of optical fibre systems	• Assignments • Final Examination • Mid-term Examination • Laboratory Work
CLO4 : Demonstrate experimental methods and measurement techniques for optical fibre systems	• Assignments • Final Examination • Mid-term Examination • Laboratory Work
CLO5 : Analyse technical issues and considerations when design and evaluation of optical fibre systems	• Assignments • Final Examination • Laboratory Work

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

Other Professional Outcomes

Engineers Australia (EA), Professional Engineer Stage 1 Competencies

The Course Learning Outcomes (CLOs) contribute to your development of the following EA

competencies:

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, 4, 5
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 3, 5
PE1.5 Knowledge of engineering design practice: CLO 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 1, 2, 3, 4, 5
PE2.3 Application of systematic engineering synthesis and design processes: CLO 1, 2, 3, 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 2, 3,4,5
PE3.3 Creative, innovative and pro-active demeanour: CLO 3, 5
PE3.4 Professional use and management of information: CLO 2, 3,4,5
PE3.5 Orderly management of self, and professional conduct: n/a
PE3.6 Effective team membership and team leadership: n/a

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.

Pre-requisites: The pre-requisite for this course: TELE3113, PHTN4661 or ELEC3115.

It is essential that the students have shown competency in fundamental courses such as

mathematics, physics, electronics, signals and systems. They are strongly advised to review previous courses materials of TELE3113, PHTN4661 or ELEC3115.

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

Course Resources

Reference 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*

R. Ramaswami, K. N. Sivarajan: *Optical Networks: A Practical Perspective*

Students are encouraged to purchase one of these books as they provide the most coverage of the topics in this course. 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
Assignments Assessment Format: Individual	10%	
Final Examination Assessment Format: Individual	50%	
Mid-term Examination Assessment Format: Individual	20%	
Laboratory Work Assessment Format: Individual	20%	

Assessment Details

Assignments

Assessment Overview

Written assignments throughout the term enable students to apply various methods to qualitatively and quantitatively analyse and interpret the fundamentals of optical communication systems. The assignments will be marked and returned with feedback on students' competence in understanding and learning course materials. Note that the assignments are compulsory and contribute to 10% of the final marks.

Course Learning Outcomes

- CLO1 : Apply main principles, methods and techniques for analysis and design of optical fibre systems and networks
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- CLO4 : Demonstrate experimental methods and measurement techniques for optical fibre systems
- CLO5 : Analyse technical issues and considerations when design and evaluation of optical fibre systems

Final Examination

Assessment Overview

The final exam is a standard close-book 2-hour written examination. University-approved calculators are allowed. The examination tests your analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course (including laboratory) unless specifically indicated otherwise by the

lecturer. Marks will be awarded according to the correct fraction of your answers to the exam questions.

Course Learning Outcomes

- CLO1 : Apply main principles, methods and techniques for analysis and design of optical fibre systems and networks
- CLO2 : Describe features and performance of optical fibre systems
- CLO3 : Identify main aspects in the design and application of optical fibre systems
- CLO4 : Demonstrate experimental methods and measurement techniques for optical fibre systems
- CLO5 : Analyse technical issues and considerations when design and evaluation of optical fibre systems

Assessment Length

2 hours

Mid-term Examination

Assessment Overview

The mid-term examination tests your understanding of the course materials covered up to the mid-term. University-approved calculators are allowed. Assessment is a graded mark according to the correct fraction of your answers to the exam questions. Verbal class-wide feedback will be given.

Course Learning Outcomes

- CLO1 : Apply main principles, methods and techniques for analysis and design of optical fibre systems and networks
- CLO2 : Describe features and performance of optical fibre systems
- CLO3 : Identify main aspects in the design and application of optical fibre systems
- CLO4 : Demonstrate experimental methods and measurement techniques for optical fibre systems

Assessment Length

1 hour

Laboratory Work

Assessment Overview

Students will be assessed by lab demonstrators on their experiment preparation, performance including safety compliance, completion of the experiments, and the quality of lab reports. Students will work in groups but be assessed individually.

Course Learning Outcomes

- CLO1 : Apply main principles, methods and techniques for analysis and design of optical fibre systems and networks
- CLO2 : Describe features and performance of optical fibre systems
- CLO3 : Identify main aspects in the design and application of optical fibre systems
- CLO4 : Demonstrate experimental methods and measurement techniques for optical fibre systems
- CLO5 : Analyse technical issues and considerations when design and evaluation of optical fibre systems

General Assessment Information

The assessment scheme in this course reflects the intention to assess your learning progress throughout the term. Ongoing assessment occurs through the lab work, assignments, the mid-term and final examinations and is arranged as follows:

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	1. Lecture Introduction to Fibre Optics Refs: Lecture note; Senior: Ch.1-2, Keiser Ch.1-3, Ch.13: Ramaswami Ch.2-3 2. Tutorial
Week 2 : 3 June - 9 June	Lecture	1. Lecture Optical Fibre Lasers and Amplifiers Refs: Lecture note; Senior: Ch.6 & Ch.10, Keiser Ch.11, Ch.4; Ramaswami Ch.3 2. Tutorial 3. Lab experiment
Week 3 : 10 June - 16 June	Other	1. Lecture Public Holiday 2. Tutorial 3. Lab experiment
Week 4 : 17 June - 23 June	Lecture	1. Lecture Optical Sources and Detectors Refs: Lecture note; Senior: Ch.6-9, Keiser Ch.4, Ch.6; Ramaswami Ch.3 2. Tutorial 3. Lab experiment
Week 5 : 24 June - 30 June	Lecture	1. Lecture Multiplexing Technologies Analog & Digital Optical Communication Systems Refs: Lecture note; Senior: Ch.11, Keiser Ch.8-10; Ramaswami Ch.2-5,7,8 2. Tutorial 3. Lab experiment
Week 6 : 1 July - 7 July	Other	1. Lecture Notne for Flexibility Week 2. Tutorial None for Flexibility Week 3. Lab experiment Continued as usual 4. Consultation
Week 7 : 8 July - 14 July	Other	Midterm Exam Tutorial Lab Experiment
Week 8 : 15 July - 21 July	Lecture	1. Lecture SNR in Optical Communication Systems. Nonlinear Optical Effects in Optical Fibres Refs: Lecture note; Senior: Ch.11, Keiser Ch.7; Ramaswami Ch.2-3 2. Tutorial 3. Lab Experiment
Week 9 : 22 July - 28 July	Lecture	1. Lecture Photonic Components Refs: Lecture note; Senior: Ch.5-10, Keiser Ch.10, Ch.4-5; Ramaswami Ch.3 2. Tutorial 3. Lab Experiment
Week 10 : 29 July - 4 August	Lecture	1. Lecture System Considerations. Photonic Networks & Course Review Refs: Lecture note; Senior: Ch.14, Keiser Ch.12; Ramaswami Ch.6-7, Ch.9-14 2. Tutorial
Week 11 : 5 August - 11 August	Other	Consultation - time to be advised
Week 12 : 12 August - 18 August	Other	Consultation - time to be advised Final Examination - time to be advised

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.
- 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.

Course Resources

Prescribed Resources

Course ResourcesReference books J. Senior: Optical Fibre Communications: Principles and Practice G. Keiser: Optical Fibre Communications, R. Ramaswami, K. N. Sivarajan: Optical Networks: A Practical Perspective 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).

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Gang-Ding Peng		EE419	401710254		No	Yes

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