PHTN4662

Photonic Networks

Term 2, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Gang-Ding Peng	g.peng@unsw.edu.au		EE419	0401710254

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

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

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)

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, 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

Course Details

Units of Credit 6

Summary of the Course

All-optical & hybrid networks, topologies; WDM; optical switching & routing, SONET; dispersion management, BER & sources of noise, power budgets; phase modulation effects & nonlinear scattering in optical links; safety, regulations & standards.

Course Aims

The course aims to understand, and become familiar with the fundamentals as well as modern techniques of optical fibre communication systems and networks.

A wide range of topics will be covered in this course, including

Optical sources and detectors

Optical fibre lasers and amplifiers, Photonic components

Multiplexing techniques and systems

Analog and digital optical communication systems

Signal-to-noise ratio in optical communication systems

Nonlinear optical effects in optical fibres

Photonic Network technologies and issues, Current topics of optical fibre systems

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Understand and explain fundamental principles & techniques of optical fibre systems	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1
2. Understand and explain photonic components in optical communication systems	PE1.1, PE1.3, PE1.5, PE1.6, PE2.1, PE2.2, PE3.3, PE3.2
3. Understand and explain optical analogue and digital modulation and demodulation techniques	PE1.1, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2
4. Understand and explain noise and signal analysis of optical communication systems	PE1.1, PE1.3, PE1.5
5. Design of various optical communication systems and explain their applications	PE1.1, PE1.3, PE1.4, PE1.5

Learning Outcome	EA Stage 1 Competencies
6. Understand and explain basic aspects of optical networks	PE1.1, PE1.3, PE3.2, PE3.3
7. Understand and explain current topics & issues in optical communication systems	PE1.1, PE2.2, PE1.3, PE3.2, PE2.3

Teaching Strategies

The course consists of the following elements: lectures, tutorials, laboratory experiments, consultations and assessments. Effective learning can be achieved when you are actively engaged in the learning process and communicating and discussing freely with the course lecturer, tutor, lab demonstrator and fellow students.

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

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

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***

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).

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Assignments	10%	11/07/2022 09:00 AM	1, 2, 3, 4, 5, 6, 7
2. Final Examination	50%	Not Applicable	1, 2, 3, 4, 5, 6, 7
3. Mid-term Examination	20%	Not Applicable	1, 2, 3, 4
4. Laboratory Work	20%	Not Applicable	1, 2, 3, 4, 5, 6

Assessment 1: Assignments

Start date: 06/06/2022 12:00 AM
Due date: 11/07/2022 09:00 AM

The assignment allows self-directed study leading to the solution of assigned problems and a survey

Assessment 2: Final Examination

Assessment length: 2 hours
Marks returned: 100

The exam in this course will be open book written examination of 2 hours. University approved calculators are allowed. The examination tests 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, unless specifically indicated otherwise by the lecture staff.

Assessment 3: Mid-term Examination

Assessment length: 1 hour

The middle-term exam will be open book written examination of 1.5 hours. University approved calculators are allowed. The examination tests general understanding of the course materials covered up to the middle-term.

Assessment 4: Laboratory Work

The student will be assessed by lab demonstrators on the preparation, performance and completion of the experiments, and on the experimental reports. Students will work in groups but report and be assessed individually.

Attendance Requirements

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

Course Schedule

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.

View class timetable

Timetable

Date	Type	Content
Week 1: 30 May - 3 June	Lecture	**Introduction to Fibre Optics** Refs: Lecture note; Senior: Ch.1-2, Keiser Ch.1-3, Ch.13: Ramaswami Ch.2-3
	Tutorial	**Questions to be distributed.**
Week 2: 6 June - 10 June	Lecture	**Optical Fibre Lasers and Amplifiers** Refs: Lecture note; Senior: Ch.6 & Ch.10, Keiser Ch.11, Ch.4; Ramaswami Ch.3
	Tutorial	**Questions to be distributed.**
Week 3: 13 June - 17 June	Lecture	None - Public Holiday
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**
Week 4: 20 June - 24 June	Lecture	**Optical Sources and Detectors** Refs: Lecture note; Senior: Ch.6-9, Keiser Ch.4, Ch.6; Ramaswami Ch.3
	Tutorial	**Questions to be distributed.**

	Laboratory	**Check lab program for details.**
Week 5: 27 June - 1 July	Lecture	**Multiplexing Technologies** **Analog & Digital Optical Communication Systems** Refs: Lecture note; Senior: Ch.11, Keiser Ch.8-10; Ramaswami Ch.2-5,7,8
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**
Week 6: 4 July - 8 July	Lecture	**None** Study - Consultation
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**
Week 7: 11 July - 15 July	Assessment	**Midterm examination**
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**
	Assessment	Assignments
Week 8: 18 July - 22 July	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
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**
Week 9: 25 July - 29 July	Lecture	**Photonic Components** Refs: Lecture note; Senior: Ch.5-10, Keiser Ch.10, Ch.4-5; Ramaswami Ch.3
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**

Week 10: 1 August - 5 August	Lecture	**System Considerations.** **Photonic Networks & Course Review** Refs: Lecture note; Senior: Ch.14, Keiser Ch.12; Ramaswami Ch.6-7, Ch.9-14
	Tutorial	**Questions to be distributed.**
	Laboratory	**Check lab program for details.**

Resources

Prescribed Resources

Course Resources

Reference books

1. J. Senior: ***Optical Fibre Communications: Principles and Practice***
2. G. Keiser: ***Optical Fibre Communications***,
3. 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).

Academic Honesty and Plagiarism

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

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.

Academic Information

COVID19 - Important Health Related Notice

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate**. We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed.

If you are required to self-isolate and/or need emotional or financial support, please contact the Nucleus: Student Hub. If you are unable to complete an assessment, or attend a class with an attendance or participation requirement, please let your teacher know and apply for special consideration through the Special Consideration portal. To advise the University of a positive COVID-19 test result or if you suspect you have COVID-19 and are being tested, please fill in this form.

UNSW requires all staff and students to follow NSW Health advice. Any failure to act in accordance with that advice may amount to a breach of the Student Code of Conduct. Please refer to the Safe Return to Campus guide for students for more information on safe practices.

Dates to note

Important Dates available at: https://student.unsw.edu.au/dates

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see https://student.unsw.edu.au/policy), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both formal classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application **prior to the start** of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. Be aware of the "fit to sit/submit" rule which means that if you sit an exam or submit an assignment, you are declaring yourself well enough to do so and cannot later apply for Special Consideration. For more information and how to apply, see https://student.unsw.edu.au/special-consideration.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies:

https://student.unsw.edu.au/guide

https://www.engineering.unsw.edu.au/electrical-engineering/resources

Disclaimer

This Course Outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies:

Image Credit

Synergies in Sound 2016

CRICOS

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Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	