School of Electrical Engineering and Telecommunications

Term 3, 2020
Course Outline

TELE9756
Advanced Networking

COURSE STAFF

Course Convener: Professor Robert Malaney, Room 407, r.malaney@unsw.edu.au

Consultations: Lecturer consultation times will be advised during the first lecture. ALL enquiries regarding the course should be posted on the forum set up on the Moodle class site. Responses will be posted there so all can see.

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.

COURSE SUMMARY

Contact Hours

The course consists of 3 hours of lectures (online) each week. The content will consist of live lectures (which will be recorded), tutorial-like sessions (recorded), online quizzes (which can be taken at any time (during the week).

	Day	Time	Location
Lectures	Thursday	6pm - 9pm	Moodle Collaborate

Context and Aims

The main aim of this course is to develop amongst students from different backgrounds a solid understanding of the key concepts and principles that underpin the exciting new world of advanced communications, such as 5G, 6G, and next-generation optical communications. The course introduces the key concepts important for understanding, testing, analysing and improving the performance of advanced communication networks. It will have a focus on the use of location information as an enabler of next-generation communications. Designed from an engineering perspective the course will first introduce the basic mathematics and physical principles that underlies location information gathering in wireless networks. It will then introduce and explore the use of that information in various case-use applications within the context of emerging advanced communication networks.

Indicative Lecture Schedule

Period	Summary of Lecture Program
Week 1	Introduction to Advanced Networks (5G, 6G, and Optical)
Week 2	Determining a Location within a Wireless Network (Mobile Phone Networks)
Week 3	Determining a Location within a Wireless Network (WiFi/Bluetooth Networks)
Week 4	Routing in Advanced Networks
Week 5	Mid-term exam
Week 6	Security in Advanced Networks
Week 7	Connecting Wireless and Optical Networks
Week 8	Applications in Advanced Networks (Vehicle Networks)
Week 9	Applications in Advanced Networks (Satellite Networks)
Week 10	Applications in Advanced Networks (Covid19 Tracing) - Assignment due:

Assessment

Mid-term Exam	20%
Assignment	20%
Final Exam (2 hours)	60%

To pass course you must pass final exam

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.

COURSE DETAILS

Credits

This is a 6 UoC course and the expected workload is 15 hours per week throughout the 10-week term.

Relationship to Other Courses

This is a postgraduate course in the School of Electrical Engineering and Telecommunications.

Pre-requisites and Assumed Knowledge

It is essential that you are familiar with basic networking and communication systems, with a level of understanding equal to that obtained from the School's telecommunications undergraduate program before this course is attempted. It is further assumed that students have good computer and mathematical literacy, consistent with that found in typical undergraduate engineering programs.

Following Courses

The course is a pre-requisite for no other courses.

Learning outcomes

After successful completion of this course, you should be able to:
1. Understand the theory, concepts, and challenges of advanced communications.
2. Understand the theory of obtaining location information over a wireless network.
3. Understand how applications operate over advanced communication systems.
4. Be able to carry out calculations which determine the performance of advanced network.
5. Be able to read and understand relevant communication research papers.

This course is designed to provide the above learning outcomes which arise from targeted graduate capabilities listed in *Appendix A*. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities (listed in *Appendix B*). This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in *Appendix C*.

Syllabus

Designed from an engineering perspective the course will first introduce the basic concepts that underlies advanced networking principles. It will first introduce and explore the key concepts that allow for the location information of devices within the network to be determined. It will then show how that location information can be used and managed within a range of applications within a range of emerging new advanced mobile networks.

TEACHING STRATEGIES

Delivery Mode

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal lectures, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding.
- Tutorials will be done in class, which allow for exercises in problem solving and allow time for you to resolve problems in understanding of lecture material.
- A small online quiz will be provided each week to assess your understanding of the class material. Each quiz can may be taken at any time and are not assessed (not compulsory).

Learning in this course

You are expected to attend (virtually, as the class will be online this year) all lectures, and mid-term exams in order to maximise learning. You must prepare well for your classes In addition to the lecture notes/video, you should read relevant sections of the recommended materials. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. UNSW *assumes* that self-directed study of this kind is undertaken in addition to attending formal classes throughout the course.
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ASSESSMENT

Mid-Term Exam

The mid-term examination tests your general understanding of the course material, and is designed to give you feedback on your progress through the analytical components of the course. Questions may be drawn from any material already covered in the course schedule. It may contain questions requiring some (not extensive) knowledge of assigned reading material and will definitely contain numerical and analytical questions. Marks will be assigned according to the correctness of the responses.

Assignment

The assignment allows self-directed study leading to the solution of partly structured problems. It will be based on a coding of specific use case to be described more in class. You may use any programming language (e.g, C, C++, Java, Python) you wish, or any programming environment (e.g, Matlab) you wish. You will provide a short report for this assignment. Marks will be assigned according to how completely and correctly the problems have been addressed, the quality of the code written for the assignment (must be attached to the report, and the understanding of the course material demonstrated by the report. The assignment will be done on an individual basis. The assignment report will be due at the Thursday lecture in Week 10. *Late reports will attract a penalty of 10% per day* (including weekends).

Final Exam

The exam in this course is a two-hour written examination, comprising five compulsory questions. 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 lecturer. Marks will be assigned according to the correctness of the responses. *Please note that you must pass the final exam in order to pass the course.*

Relationship of Assessment Methods to Learning Outcomes

Assessment	1	2	3	4	5
Mid-term exam	✓	✓	✓	✓	-
Assignment	✓	✓	✓	-	✓
Final exam	✓	✓	✓	✓	-

COURSE RESOURCES

Textbooks

Prescribed textbook

- There will be no prescribed text for this course. Rather online papers and material will be pointed to as we move through the course.

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 student email address).

OTHER MATTERS

Dates to note

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

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.

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.

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.

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.

Continual Course Improvement

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 online student survey myExperience. 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. This year's course will have additional tutorial-like material included as a consequence of previous feedback.

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

APPENDICES

Appendix A: Targeted Graduate Capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;
- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural and global responsibilities of the professional engineer;
- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning.

Appendix B: UNSW Graduate Capabilities

The course delivery methods and course content directly or indirectly addresses a number of core UNSW graduate capabilities, as follows

- Developing scholars who have a deep understanding of their discipline, through lectures and solution of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing digital and information literacy and lifelong learning skills through assignment work.

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Appendix C: Engineers Australia (EA) Professional Engineer Competency Standard

	Program Intended Learning Outcomes	
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	✓
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing	✓
	PE1.3 In-depth understanding of specialist bodies of knowledge	✓
	PE1.4 Discernment of knowledge development and research directions	✓

PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	✓
	PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	
	PE3.2 Effective oral and written communication (professional and lay domains)	✓
	PE3.3 Creative, innovative and pro-active demeanour	✓

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