TELE9756
Advanced Networking

Course Outline – Semester 2, 2016

Never Stand Still | Faculty of Engineering | School of Electrical Engineering and Telecommunications

Course Staff

Course Convener: A/Prof Robert Malaney, Room 747 E10, r.malaney@unsw.edu.au

Consultations: You are encouraged to ask questions on the course material, after the lecture class times in the first instance, rather than via email. Lecturer consultation times will be advised during lectures. ALL email enquiries should be made from your student email address with TELE9756 in the subject line, otherwise they will not be considered. Technical questions by email are encouraged but will not be answered by email. Rather they will be answered and/or discussed at the next class.

Keeping Informed: Announcements may also be made during classes, via email (to your student email address) and/or via online learning, class website, and teaching platforms – in this course, we will use Moodle to post marks https://moodle.telt.unsw.edu.au/login/index.php. Please check the class web site prior to sending a general administrative email as this website is updated weekly and important administrative matters will be posted there (https://subjects.ee.unsw.edu.au/tele9756).

Course Summary

Contact Hours

The course consists of 3 hour time slots.

Lectures	Day	Time	Location
	Thursday	6pm - 9pm	Mathews 228

Context and Aims

This course is for 6 Units of Credit and aimed at Graduate Engineers and wishing to understand topical research issues in communication networks. This course largely focuses on new wireless telecommunication networks currently being deployed or likely to be deployed in the future. Course material will be drawn from the recent research literature in the following areas - (i) advanced wireless quality of service; (ii) advanced routing in mobile networks, (iii) advanced authentication issues in wireless networks; and (iv) the control and management of mobility in wireless networks. To provide some application focus an underlying theme of the course will be applications of the above technologies to the emerging Intelligent Transport Systems (ITS). The course will largely follow the class text - see below, but will also have some specialized individual lectures not directly covered by that text. Student participation is required in all aspects of this course.

Indicative Syllabus:

The course will largely cover areas of research related to advanced knowledge of wireless telecommunication networks currently being deployed or likely to be deployed in the future. Times below are not firm.

1. Introductory overview. This is a short lecture (1 hour), which provides an overview of the course. There will be plenty of time for you to ask your questions all aspects of the course.
2. Wireless Mesh Networks and Wireless Location Technologies
3. Emerging Wireless Access and QoS Standards

   Note Weeks 3-11. Two separate and individual student presentations, each on a chapter of the class text, will be given each week (week 3 onwards). All of class will be expected to have read the two chapters being presented before each class. Following each presentation we will have a class-wide discussion on the relevant chapter. The level of your participation in all of these class discussions will form part of your assessed "participation mark" - see below.

   Note this class will be using one of UNSW's new Active Learning Space classrooms. This will be the first time this course is taught in this new format. We will be trying various new teaching models during this class, so **do not** expect a traditional 3 hour lecture by power-point. **Do expect** to be working more interactively with other students in this class on direct problem solving and creative designs related to the class material.

Assessment

Mid-Semester Exam	15%
Project	25%
Presentation	15%
Participation	10%
Final Exam	35%

Course Details

Credits

This is a 6 UoC course and the expected workload is 10–12 hours per week throughout the 13 week semester.

Relationship to Other Courses

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

Pre-requisites and Assumed Knowledge

There are no perquisites for this course. It is assumed that all students have qualifications equivalent to an Electrical Engineering undergraduate degree from UNSW. This course is related to other communication courses offered by Electrical Engineering in that it builds on concepts and principles introduced in *all* the undergraduate and graduate course in

computer networking, and applies them to topical research issues. This course assumes that you already have an understanding of computer networks consistent with that possessed by a student who has a BE in Telecommunications from EE&T at UNSW.

Following Courses

The course is a not pre-requisite for any other course.

Learning outcomes

After successful completion of this course, you should be able to:

1. Understand the theory, concepts and challenges of research in telecommunication networks
2. Understand the theory, concepts and challenges of emerging wireless networks
3. Understand how applications actually operate over communication networks
4. Be able to design and simulate the behavior of communication networks
5. Be able to carry out calculations which determine the performance of a communication network
6. Be able to read and understand telecommunications research papers appearing in engineering journals.

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 technologies that will underpin emerging wireless communication systems, such as vehicular networks and 5G networks. The course will then use these technologies to address fundamental issues that remain the focus of current research activities.

Teaching Strategies

Delivery Mode

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

- Formal face-to-face 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 (during regular class), which allow for exercises in problem solving and allow time for you to resolve problems in understanding of lecture material;
- Group participation in applying knowledge gained in the course to unresolved issues facing emerging wireless networks

Learning in this course

You are expected to attend all lectures and mid-semester exams in order to maximise learning. You must prepare well for your classes and your work will be assessed. In addition to the lecture notes, you should read relevant sections of the recommended text. 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 face-to-face classes throughout the course.

Class attendance is especially important for this class as you will be presented with brand new challenges faced in emerging wireless networks that you have likely never come across before. This makes the class very interesting for you – but it does require your participation in class. There will be no formal notes handed out that covers all the class material in detail, There will be power-points put on the class web site for download but these will not be sufficient for you to cover the class material. The lectures will consist of some power-point presentations, discussion of material in prescribed texts, and discussion of case studies. You are strongly encouraged to participate in class by interacting through questions and discussions of class material, and to prepare before class by reading relevant work packages ahead of time.

Tutorials

During the course you will likely be asked to hand in your answers to a short tutorial problem sets. Some of the tutorial set may be given to you during the class and gathered from you during the same class. Your effort at these problem sets will form part of my own appraisal of how well you and the class are doing. These tutorials are not compulsory, will not be marked and do not form any part of the final class mark. However, they will be used to gauge your class participation and may be used when forming any judgement on possible bonus marks (see below). You are strongly encouraged to attempt these tutorials -if you do not you will likely struggle in this class.

Assessment (details)

- **Final Examination (35%):** The examination is of two-hour duration, covering all aspects of the course that have been presented in lectures. This exam will assess both understanding and analytical skills. You must pass this exam to pass course.
- **Mid-Session Test (15%):** The mid-session test will be held in week 6. It will cover material covered in the course in week 1 to 6, and will test your conceptual understanding of this material, as well as your ability to apply the concepts to solving problems. This is compulsory test. There are zero marks for non-attendance at the mid-term.
- **Project (25%):** Each student will undertake a project related to some aspect of the course. This will largely entail each student reproducing some numerical aspects of a research paper (or class text), or modelling the performance of some design aspect of a system related to the course material (e.g. an advanced MAC protocol), or producing their own mathematical analysis of the chosen paper (or class text). The project will require some computer coding and can be done in any program language of your choice, or can be done in Matlab, or involve the use of some 3rd party simulation tool (e.g, ns2). More detail on these projects will be discussed in class. You can be provided with feedback on your project at the end of each lecture. A written report of your project will be due week 13. You may be asked to present your report outcome to the class.
- **Class Presentations (15%)** Each student will be charged with at least one presentation of some issue related to the class material (approx 20 slides) – details in class.
- **Class Participation (10%)** Students not presenting that week will be expected to have read the appropriate work being presented by other students, **and** to then participate in class discussions of this work each week.

- There may be additional bonus marks up to a max of 5% - details in class

Final Exam

The exam in this course is a standard closed-book 2 hour written examination, comprising compulsory questions. Calculators are not 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

	Learning outcomes						
Assessment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Mid-semester exam	☐	☐	☐	-	-	☐	☐
Project	-	-	-	☐	☐	-	☐
Presentation	-	-	-	☐	☐	-	☐
Final exam	☐	☐	☐	-	-	☐	-

Course Resources

Textbooks

Prescribed textbook

After the initial lectures, the class follow the recent text book on vehicular networks. "Vehicle Safety Communications: Protocols, Security, and Privacy," by Tao Zhang and Luca Delgrossi ISBN: 978-1-118-13272-2, Wiley 2012. This book is available online (free) through the UNSW Library online database. You must login to the UNSW library with your unipass to access this service. Once online search the database to find the link to above book.

It will be assumed that you are already *very* familiar with standard networking material such as that given in classic networking text books such as
J. Kurose & K. Ross: Computer Networking: 3rd (or 4th or 5th) Edition. A Top-Down Approach Featuring the Internet, Publisher: Addison-Wesley, 2007.

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

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/guide), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **ten to twelve hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both face-to-face classes and *independent, self-directed study*. In periods where you need to 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 should seek assistance early if you suffer illness or misadventure which affects your course progress. All applications for special consideration must be **lodged online through myUNSW within 3 working days of the assessment**, not to course or school staff. For more detail, consult 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 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.
Based on feedback from last year, additional in class tutorial material has been added to this years course.

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:
http://www.engineering.unsw.edu.au/electrical-engineering/policies-and-procedures
https://my.unsw.edu.au/student/atoz/ABC.html

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 digital and information literacy and lifelong learning skills through assignment work.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.

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	☐
	PE1.5 Knowledge of engineering design practice	☐
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice	
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	☐
	PE2.3 Application of systematic engineering synthesis and design processes	
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
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	☐
	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	☐