TELE3118
Network Technologies

Course Outline – Summer 2014

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

Course Staff

Course Convener: Dr. Tim Moors, Room EE341, t.moors@unsw.edu.au
Course Mentor: Dr. Syed Imtiaz Hussain, imtiaz_h_syed@yahoo.com
Course Tutor: Dr. Syed Imtiaz Hussain, imtiaz_h_syed@yahoo.com
Laboratory Coordinator: Dr. Syed Imtiaz Hussain, imtiaz_h_syed@yahoo.com

Consultations: You are encouraged to ask questions on the course material after going through the video lectures each week. Consultation times with the Course Mentor will be announced during the first introductory lecture. You are welcome to email the tutor or laboratory demonstrator, who can answer your questions on this course or lab exercises and can also provide you with consultation times. ALL email enquiries should be made from your student email address with TELE3118 in the subject line, otherwise they will not be answered.

Course Details

Credits

This is a 6 UoC course and the expected workload is 15-20 hours per week throughout the 8 weeks semester.

Contact Hours

The course consists of a 2 hour introductory lecture and a series of pre-recorded on-line lectures. It also contains tutorials during weeks 3, 4 and 8, and laboratory sessions during weeks 4 and 8.

	Day	**Time**	**Location**
Intro. Lecture	Monday 01/12/2014	10 am – 12 pm	Quad G032
Tutorials	Thursday 18/12/2014	10 am – 12 pm	EE 224
	Monday 05/01/2015	10 am – 12 pm	EE 224
	Thursday 08/01/2015	10 am – 12 pm	EE 224
	Friday 09/01/2015	12 pm – 2 pm	EE 224
	Monday 02/02/2015	10 am – 12 pm	EE 224
	Thursday 05/02/2015	10 am – 12 pm	EE 224
	Friday 06/02/2015	12 pm – 2 pm	EE 224
Labs	Monday 05/01/2015	2 pm – 5 pm	EE 343
	Tuesday 06/01/2015	2 pm – 5 pm	EE 343
	Thursday 08/01/2015	2 pm – 5 pm	EE 343
	Monday 02/02/2015	2 pm – 5 pm	EE 343

	Tuesday 03/02/2015	2 pm – 5 pm	EE 343
	Thursday 05/02/2015	2 pm – 5 pm	EE 343

Context and Aims

TELE3118 provides a foundation for understanding telecommunication networks, and so is core to the Bachelor of Engineering (Telecommunications) program and is a commonly chosen elective in other Engineering programs, including Bachelor of Engineering (Electrical), Master of Engineering and Master of Engineering Science.

This course aims to develop a fundamental understanding of the architecture of communication networks such as the Internet. It will introduce students to the layered communication protocol stack (referred to as the TCP/IP stack in the Internet context), and progressively work through the functions and technologies at the various layers. Topics covered will include the physical medium, medium access mechanisms, IP addressing and routing, TCP congestion control, and applications such as the web, streaming media and DNS.

Relationship to Other Courses

This is a 3rd year course in the School of Electrical Engineering and Telecommunications. This course provides an introduction to data networking, and establishes the foundation for subsequent courses such as TELE3119 "Trusted Networks" which covers the security aspects of data networks, and TELE4642 "Network Performance" which studies tools and techniques to analyze the performance of data networks. Postgraduate courses that delve deeper into these topics include TELE9751 Switching Systems Design (about the internal operation of network devices such as routers and switches), TELE9752 Network Operations and Control (about managing and running networks), and TELE9756 Advanced Networking (about selected network research topics)

Pre-requisites and Assumed Knowledge

It is essential that you are familiar with computer architecture and organization before this course is attempted. It is further assumed that students are familiar with some computer programming techniques and have good computer literacy.

Following Courses

The course is a pre-requisite for TELE3119 Trusted Networks, TELE4642 Network Performance, TELE9751 Switching Systems Design, TELE9752 Network Operations and Control, and, TELE9756 Advanced Networking.

Learning outcomes

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

- Describe the role of layers in the architecture of a communication system.
- Evaluate medium access mechanisms suitable to different physical media.
- Design simple data networks by constructing appropriate IP addresses and routes.
- Analyse mechanisms for reliability and congestion-control in the Internet.
- Recognise the steps by which applications such as the web operate.
- Construct client-server applications that operate over the Internet.

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 attributes (listed in ***Appendix B***). This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in ***Appendix C***.

Syllabus

Network architectures in terms of topology, role (client/server, peer-to-peer), and layered specification. Packet and circuit switching. Physical characteristics of network transmission links. Medium access control protocols for wired links (e.g. Ethernet) and wireless links (e.g. 802.11). Protocols for error and flow control and their link layer application. Interconnection of networks using bridges, switches and routers. Routing techniques, including Dijkstra's algorithm, distance vector and link state routing. Addressing and naming. Network congestion control. End-to-end protocols for matching applications to networks, including TCP and UDP. Network applications, such as web (HTTP), email (SMTP, POP, IMAP), and streaming media (e.g.VOIP).

Teaching Strategies

Delivery Mode

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

- One formal face-to-face lecture gives you an overview of the course,
- Tutorials, which allow for exercises in problem solving and allow time for you to resolve problems in understanding of lecture material;
- Laboratory sessions, which support the formal lecture material and also provide you with practical construction, measurement and debugging skills;
- Video lectures, which provide you with a focus on the core analytical material in the course, together with qualitative, alternative explanations to aid your understanding.

Learning in this course

You are expected to attend <u>all</u> lectures, tutorials, labs, and mid-semester exams in order to maximise learning. You must prepare well for your laboratory classes and your lab work will be assessed. In addition to the lecture notes/video, 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.

Indicative Lecture Schedule

Period	Summary of Lecture Program
Week 1	Introduction, Protocols and layering, Physical layer (Intro. Lecture and Video Lectures 1-1 to 2-5)
Week 2	Link layer (Part A and B, Video Lectures 3a-1 to 3b-8)
Week 3	Packet forwarding and internetworking (Video Lectures 4-1 to 4-10)
Christmas Break	
Week 4	Routing (Video Lectures 5-1 to 5-12)
Week 5	**Mid Session Test (15/01/2015) covering Week 1-4 topics**

	Transport layer, Reliable transport (Video Lectures 6-1 to 6-8)
Week 6	Congestion control (Video Lectures 7-1 to 7-8)
Week 7	Web and content distribution (Video Lectures 8-1 to 8-9)
Week 8	Quality of service (Video Lectures 9-1 to 9-7). **Project due**

Tutorial classes

You should attempt all of your problem sheet questions in advance of attending the tutorial classes. The importance of adequate preparation prior to each tutorial cannot be overemphasized, as the effectiveness and usefulness of the tutorial depends to a large extent on this preparation. Group learning is encouraged. Answers for these questions will be discussed during the tutorial class and the tutor will cover the more complex questions in the tutorial class. These questions and solutions may not be made available on the web, so it is worthwhile for you to attend your tutorial classes to gain maximum benefit from this course.

Laboratory program

The laboratory schedule is deliberately designed to provide practical, hands-on exposure to the concepts conveyed in lectures soon after they are covered in class. You are required to attend laboratory in Weeks 4 and 8. Laboratory attendance WILL be kept, and you MUST attend at least 80% of labs.

Indicative Laboratory Schedule

Period	Summary of Laboratory Program
Week 4	Monday 05/01/2015 Cabling Tuesday 06/01/2015 Switches Thursday 08/01/2015 IP and ICMP
Week 8	Monday 02/02/2015 Routing Tuesday 03/02/2015 TCP Thursday 05/02/2015 Project

Laboratory Exemption

There is no laboratory exemption for this course. Regardless of whether equivalent labs have been completed in previous courses, all students enrolled in this course for Summer semester 2014 must take the labs. If, for medical reasons, (note that a valid medical certificate must be provided) you are unable to attend a lab, you will need to apply for a catch-up lab during another lab time, as agreed by the laboratory coordinator.

Assessment

The assessment scheme in this course reflects the intention to assess your learning progress through the semester. Ongoing assessment occurs through the lab checkpoints (see lab manual), lab exams and the mid-semester exam.

Laboratory Practical Experiments	**20%**
Mid-Semester Exam	**30%**
Project	**10%**
Final Exam (3 hours)	**40%**
Bonus for course improvement	**≤10%**

Laboratory Assessment

It is essential that you complete the laboratory preparation before coming to the lab.

After completing each experiment, your work will be assessed by the laboratory demonstrator.

Assessment marks will be awarded according to your preparation (completing set preparation exercises and correctness of these or readiness for the lab in terms of pre-reading), how much of the lab you were able to complete, your understanding of the experiments conducted during the lab, the quality of the code you write during your lab work (according to the guidelines given in lectures), and your understanding of the topic covered by the lab.

Mid-Semester Exam

The mid-session examination tests your general understanding of the course material, and is designed to give you feedback on your progress through the course. Questions may be drawn from any course material up to the end of week 4. It may contain questions requiring some (not extensive) knowledge of laboratory material. Marks will be assigned according to the correctness of the responses.

Project

The project allows self-directed study leading to the solution of partly structured problems. Marks will be assigned according to how completely and correctly the problems have been addressed, the quality of the code written for the project. **The project involves some non-trivial (but not difficult) programming, so if your programming skills are weak or you haven't programmed for a while then you should develop those skills from the beginning of session.** The lab session provides an opportunity to test your project program in the lab setting where it will be assessed, but you should not expect to start and complete your project during the project lab session, but rather should start developing your program before the project lab session.

The assignment report will be due by the end of Week 8. *Late reports will attract a penalty of 10% per day* (including weekends).

Final Exam

The exam in this course is a standard closed-book 3 hour written examination. 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 (including laboratory), unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses.

Relationship of Assessment Methods to Learning Outcomes

	Learning outcomes						
Assessment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Laboratory practical assessments	✓	✓	-	✓	✓	✓	-
Mid-semester exam	-	✓	✓	-	✓	✓	✓
Project	✓	✓	✓	-	✓	-	-
Final exam	-	✓	✓	✓	✓	-	✓

Course Resources

Textbooks

Prescribed textbook

- Tanenbaum and D. Wetherall: "Computer Networks", 5th Edition, Pearson, 2011. Information about this book is available at:

http://www.pearsonhighered.com/educator/product/Computer-Networks5E/9780132126953.page

This course will also use lecture videos that accompany the book and are available from:

http://media.pearsoncmg.com/ph/streaming/esm/tanenbaum5e_videonotes/tanenbaum_videoNotes.html

Reference books

- James F. Kurose and Keith W. Ross Computer Networking: A Top-Down Approach, 5th edition, Addison Wesley, 2009.

On-line resources

Mailing list

Announcements concerning course information will be given in the lectures and/or via email (which will be sent to your student email address) which you should check at least weekly.

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 http://www.lc.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://my.unsw.edu.au/student/atoz/ABC.html), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **fifteen to twenty hours per week** studying a 6 UoC course over a shortened summer session, 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.

Keeping Informed

Announcements may be made during classes, via email (to your student email address) or via online learning and teaching platforms like Moodle. From time to time, UNSW will send important announcements via these media without providing any paper copy. Please note that you will be deemed to have received this information, so you should take careful note of all announcements.

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://my.unsw.edu.au/student/atoz/SpecialConsideration.html.

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.

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 Attributes

The course delivery methods and course content addresses a number of core UNSW graduate attributes, 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.

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	✓