



Course Brief and Outline – 2015

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1 Course Background and Purpose

Networks constitute an *integral* component of our daily lives. Whether, it's the *internet (World Wide Web)* for web-browsing, the local **LAN** network at our offices, schools and homes or the **cellular** network that we use to make mobile-calls, we make use of different type of networks all the time and thus is an **important** field of study/work especially for electrical and computer engineers/scientists/programmers. Networking is also playing a crucial role in emerging areas of research e.g. High Performance Computing, Cloud Computing etc.

Each network is built by making use of certain principles and methodologies and the aim of this course is to introduce to students the basic of networking principles. This will involve learning about the basics of networking technology, types of networks, network protocol layers, specific algorithms at each protocol layer and the use of tools to monitor networks and basics of how to use programming to create networking applications e.g. email, web-browser, chatting and social- networking applications etc.

2 Course Outcomes

On successful completion of this course, the student is able to:

1. Describe the important components of a network and differentiate between different types of networks. (**Week 1 – Chap1- 1.1 to 1.3**)
2. Use different parameters of networks to model and solve network problems. (**Week 2 – Chap1-1.4**)
3. Model a problem in terms of a protocol structure and describe internet protocol layers. (**Week 2 – Chap1 - 1.5**)
4. Describe the need for Application Layer and explain services provided by Application Layer. (**Week 3 – Chap2 – 2.1**)
5. Demonstrate the protocol structure and working of the application-layer protocol used for web-browsing i.e. HTTP (**Week 3 – Chap2 - 2.2**)

6. Demonstrate the protocol structure and working of other commonly used application-layer protocols e.g. FTP for file exchange, POP/SMTP for email. (**Week 4 - Chap 2 – 2.3 and 2.4**)
7. Demonstrate the working mechanism of DNS which is behind the working of web addresses. (**Week 4 – Chap2 – 2.5**)
8. Do socket programming with TCP and/or UDP. (**Week 5 – Chap2 – 2.7-2.8**)
9. Describe the need for Transport layer and explain services provided by Transport Layer. (**Week 5 – Chap3 – 3.1-3.2**)
10. Create and Perform different Reliable Data Transfer Protocols with respect to different set of requirements. (**Week 6 – Chap3 – 3.4**)
11. Describe the working mechanism of two important transport layer protocols i.e. UDP and TCP and their associated pros and cons. (**Week 5 and 7 – Chap3 – 3.3 and 3.5**)
12. Explain the need for congestion control and perform congestion control. (**Week 8 – Chap3 – 3.6**)
13. Describe the need for Network layer and explain services provided by Network Layer. (**Week 9 – Chap4 – 4.1**)
14. Demonstrate the working of two important types of packet networks i.e. 1) Virtual Circuits and 2) Datagram networks and explain the associated pros and cons (**Week 9 – Chap4 – 4.2**)
15. Describe how a router works. (**Week 9 – Chap4 – 4.3**)
16. Demonstrate the structure and working of a Network layer protocol i.e. IP Protocol and understand the difference between IPv4 and IP v6. (**Week 9 and 10– Chap4 – 4.4**)
17. Perform IP addressing/subnetting with respect to a particular set of requirements. (**Week 10– Chap4 – 4.4**)
18. Perform 2 important types of routing protocols i.e. 1) Link-State Routing and 2) Distance Vector Routing and describe their pros and cons. (**Week 10 and 11 – Chap4 – 4.5**)
19. Demonstrate the working of important routing protocols for Internet. (**Week 11 – Chap4 – 4.6**)
20. Describe the working of broadcast and multicast routing. (**Week 12 – Chap4 – 4.7**)
21. Describe the need for Data-link layer and explain services provided by Data-link Layer. (**Week 12 – Chap5 – 5.1**)

3 Course Content

The content of this course is as per *Rules & Syllabuses: Faculty of Engineering and the Built Environment*. It states:

This course will explore the concepts, principles and architecture of communication networks, making reference to appropriate examples from the internet and public telephony networks (PSTN).

The ISO reference model will be used to discuss each of the layers and the functionality it performs. Application layer discussions will focus on standardized protocols that support many application types. Transport layer discussions will focus on achieving reliable transfer over an unreliable channel, flow and congestion control. Network layer discussions will cover global hierarchical addressing and the operation of routing. The data link layer will cover local area networks and their operation.

4 Prior knowledge Assumed

All third year courses, ELEN 3024 (Communication Fundamentals) mandatory as per *Rules & Syllabuses: Faculty of Engineering and the Built Environment*.

5 Assessment

All submissions must be in strict accordance with the guidelines contained in the *School's Blue Book* and the rules contained in the *School's Red Book*. No exceptions will be considered.

5.1 Components of the Assessment

The components of the assessment, as given below, are in accordance with the School's document entitled *Application of Rule G.13 and Calculator Requirements*.

1. Labs (10%)

- Each lab session will be **marked**.
- Total number of labs = 5

2. Project (30%)

- A project based on Socket Programming will be given.
- To help build basics for the project, lab sessions on basic socket programming will be conducted.
- Exact details of the project i.e. what is required in each deliverable, how to submit them and exact dates etc. will be posted later but you can start to polish your network programming skills right from the beginning.

3. Final Exam (60%)

- Syllabus – All Material (Class Discussions, Kurose Book Chapters, Kurose Book End Chapter Problems, Tutorials/Homeworks etc.) covered in the course.
- Closed-Book

5.2 Assessment Criteria

1. Labs:

- Marks for each lab session will be given based on attendance and effort to perform the lab by oneself.
- ***These are probably the easiest marks to get amongst all the assessments. Do not lose them!***

2. Project:

- The project must be submitted before the deadline otherwise it will be penalized as per the school's late submission policy.
- A demo based on the submitted codes will be done during which questions will be asked from the code as well as the concepts involved. It might be asked to perform a small modification in the code as well during the demo. Marks allocation will be based on the understanding of the code and the concepts involved.
- ***To score well you need to do the project yourself!***

3. Final Exam:

- Questions in the Final Exam will be based on the content of book chapters covered in the class and the end-problems. Some of these end-problems will also be given as part of tutorials.
- Marking will be done based on the ability to answer/solve the given problem. Emphasis will be on the understanding/solving methodology of the given problem.

To score well in the Final Exam you need to thoroughly read Kurose book chapters covered in the class and perform the problems given in the tutorial/homework by yourself.

5.3 Satisfactory Performance (SP) Requirements

Rule G.13 and the School's documents entitled *Application of Rule G.13 and Calculator Requirements* and the *School's Red Book* (see the School notice board) apply.

5.4 Calculators in Examinations

Engineering Calculator permitted as per School's document entitled *Application of Rule G.13 and Calculator Requirements* on the School notice board.

6 Teaching and Learning Process

6.1 Teaching and Learning Approach

The course will strictly follow selected chapters of the prescribed textbook for content. Basics of the concepts will be discussed and explained in the lectures. However, the course requires significant amount of self-study of the prescribed textbook so as to gain a good understanding of the details. It is thus highly recommended that students do a regular study of the book as otherwise it becomes very difficult to read everything near exams.

Lectures are supplemented with a tutorial each week. The aim of the tutorial is to make students work on the end-problems. Solving the end-problems is

mostly essential to have an understanding of the theoretical concepts in the book. Students are expected to solve the tutorial questions themselves as a good portion of the final exam questions will be based on the questions given in tutorial handouts.

Finally, the students are given a hands-on experience of the concepts via the labs. A project based on these concepts is then given to the students that run over a good portion of the course. The goal is to build a real world networking application based on the concepts studied in the course. Students are advised to invest time and effort in the project because of its heavy weightage. Marks for the project are allocated based on the student's understanding of the code and the concepts involved.

6.2 Arrangements

1. Lectures:

- There will be 2 consecutive lectures per week. Students are expected to attend all lectures and to make their own notes.
- Tuesday 10:15am – 12.
Venue = CM1

2. Tutorials:

- There will be a fortnightly tutorial session. A tutorial hand-out will be given containing mostly problems from the end of book chapters.
- Alternate Tuesdays 12:30pm – 13:15pm.
Venue = A3 (John Moffett Building)

3. Labs:

- There will be 5 laboratories in total on selected Tuesday afternoons. (Please refer to the weekly activity table at the end of this document for lab schedule)
- Selected Tuesdays 2pm – 5pm.
Venue = Computer Laboratory / D-Lab

4. Project:

- Details on the course project will be provided in the form of a handout. Instructions within the handout must be adhered to during completion and submission of the project.
- The course project submission deadline for our course for 2015 is **18th May, 2015** as per the school document of '4th Year Courses - Project Hand-In Dates'.

Late submissions will be penalized as per the School policy.

5. Consultation:

You are welcome to call/send emails/ come to my office anytime during the working hours for small queries. I will attend to them if I am not in a meeting. For detailed discussions please take an appointment via email.

7 Information to Support the Course

7.1 Prescribed Text/Reading

- James F. Kurose, and Keith W. Ross, "Computer Networking: A Top-Down Approach" 5th Edition (2010).

7.2 Other References

- Behrouz A. Forouzan, "Data Communications and Networking", 5th edition, (2012). McGraw Hill
- Andrew S. Tanenbaum, "Computer Networks", 5th Edition, (2010). Prentice Hall

8 Other Information

8.1 Expectation from the Students

- Read thoroughly first 4-5 chapters (depending upon how much is covered during the course) of Kurose Textbook. Everything including Final Exam will be made from the book.
- Do the project yourself. It is of heavy weightage and marks will be given based on the student's understanding of the submitted code and the concepts involved via individual Q&A session.
- Attend labs so as to not to lose the *easy* marks.
- Please do not make noise during lectures. It results in loss of concentration of the lecturer and makes it difficult for other students to concentrate.
- Take interest in developing your networking skills beyond the course requirements. It is not only fun but also a valuable skill for job market.
- Most importantly, do not be shy to ask the most basic/simple questions in or out of the class. Sometimes the simplest of questions are the most important ones.

8.2 Weekly Schedule

Week No.	Activity
Week 1 (16 th Feb - 22 nd Feb)	1) Lecture 1 - (Tue) 10:15am - 12 Chapter 1 (Intro to Networking)
Week 2 (23 rd Feb - 1 st Mar)	1) Lecture 2 - (Tue) 10:15am - 12 Chapter 1 (Intro to Networking) 2) Tutorial 1 - (Tue) 12:30pm - 1:15pm

Week 3 (2 nd Mar – 8 th Mar)	<ul style="list-style-type: none"> 1) Lecture 3 – (Tue) 10:15am – 12 Chapter 2 (Application Layer) 2) Lab 1 - (Tue) 2pm – 5pm
Week 4 (9 th Mar – 15 th Mar)	<ul style="list-style-type: none"> 1) Lecture 4 – (Tue) 10:15am – 12 Chapter 2 (Application Layer) 2) Tutorial 2 - (Tue) 12:30pm – 1:15pm
Week 5 (16 th Mar -22 nd Mar)	<ul style="list-style-type: none"> 1) Lecture 5 – (Tue) 10:15am – 12 Chapter 2 (Application Layer) + Chapter 3 (Transport Layer) 2) Lab 2 - (Tue) 2pm – 5pm
Week 6 (23 rd Mar – 29 th Mar)	<ul style="list-style-type: none"> 1) Lecture 6 – (Tue) 10:15am – 12 Chapter 3 (Transport Layer) 2) Tutorial 3 - (Tue) 12:30pm – 1:15pm
Break (30 th Mar – 5 th April)	Break
Week 7 (6 th April - 12 th April)	<ul style="list-style-type: none"> 1) Lecture 7 – (Tue) 10:15am – 12 Chapter 3 (Transport Layer) 2) Lab 3 - (Tue) 2pm – 5pm
Week 8 (13 th April – 19 th April)	<ul style="list-style-type: none"> 1) Lecture 8 – (Tue) 10:15am – 12 Chapter 3 (Transport Layer) 2) Tutorial 4 - (Tue) 12:30pm – 1:15pm
Week 9 (20 th April – 26 th April)	<ul style="list-style-type: none"> 1) Lecture 9 – (Tue) 10:15am – 12 Chapter 4 (Network Layer) 2) Lab 4 - (Tue) 2pm – 5pm
Week 10 (27 th April – 3 rd May)	<ul style="list-style-type: none"> 1) Lecture 10 – (Tue) 10:15am – 12 Chapter 4 (Network Layer) 2) Tutorial 5 - (Tue) 12:30pm – 1:15pm
Week 11 (4 th May – 10 th May)	<ul style="list-style-type: none"> 1) Lecture 11 – (Tue) 10:15am – 12 Chapter 4 (Network Layer) 2) Lab 5 - (Tue) 2pm – 5pm

Week 12 (11 th May – 17 th May)	<ul style="list-style-type: none"> 1) Lecture 12 – (Tue) 10:15am – 12 Chapter 4 (Network Layer) 2) Tutorial 6 - (Tue) 12:30pm – 1:15pm
Week 13 (18 th May – 24 th May)	<ul style="list-style-type: none"> 1) Lecture 13 – (Tue) 10:15am – 12 Chapter 5 (Data-Link Layer) 2) Tutorial 7 - (Tue) 12:30pm – 1:15pm 3) Submission of Project Deadline = (Mon) 7:50 am
Week 14 (25 th May – 31 st May)	<ul style="list-style-type: none"> 1) Lecture 14 – (Tue) 10:15am – 12 Chapter 5 (Data-Link Layer) + Discussion for Final Exam
Final Exam (Date To Be Announced Later)	Final Exam