# Course Outline Public

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## Course Details

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|---|---|
| **Course Code** | COMP3331/9331 |
| **Course Title** | Computer Networks and Applications |
| **Units of Credit** | 6 |
| **Lecturer** | Mahbub Hassan |
| **Admin** | Ayda Valinezhad Orang |
| **Classes** | Lectures: Wed 15:00 -17:00 Hrs, Thu 15:00 -17:00 Hrs, Science Theatre, F13-G09, ( Campus Map (https://ibb.co/qrMb2F2) )<br>Timetable (/COMP3331/20T1/timetable) for all classes. |
| **Consultations** | Wednesday 11:30 -12:30, Friday 11:30 - 12:30<br>Venue: Room 607, Level 6, CSE (K17) |
| **Course Website** | https://webcms3.cse.unsw.edu.au/COMP3331/20T1 (https://webcms3.cse.unsw.edu.au/COMP3331/19T2) |
| **Course Contact Email** | cs3331@cse.unsw.edu.au (mailto:cs3331@cse.unsw.edu.au) |

| | |
|---|---|
| **Handbook Entry** | http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP3331.html (http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP3331.html) |

# Course Summary

This course is an introductory course on computer networks, aimed at students with a background in computer science / electrical engineering. We will focus on common paradigms and protocols used in present data communication. Through lectures, in-class activities, labs and assignments, you will learn the theory and application of:

(1) Medium access control, congestion control, flow control, and reliable transmission,

(2) Addressing and naming,

(3) Routing and switching,

(4) Widely used protocols such as Ethernet, IP, TCP, UDP, HTTP, etc.

(5) Security threats and common defensive techniques, and

(6) Special purpose networks such as content delivery networks, peer-to-peer networks and wireless networks.

This is a combined undergraduate and postgraduate course.

# Course Timetable

There will be 4 hours of lectures every week:

(i) 2-hour lecture on Wednesday 15:00 - 17:00 and

(ii) 2-hour lecture on Thursday 15:00 - 17:00

Both in Science Theatre.

There will be 2-hour labs during 9 weeks (starting in Week 2). The detailed lab schedule will be posted on The detailed course timetable is available here (/COMP3331/20T1/timetable) (/COMP3331/19T2/timetable)
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- To build the necessary foundational knowledge required in subsequent networking courses (COMP4335-4337, COMP9332-9337).

# Student Learning Outcomes

**After completing this course, students will:**

- Have a working knowledge of computer networks, and will be able to demonstrate by describing aspects of the topics and by solving problems related to the topics
- Have a solid understanding of the current architecture of the Internet and the entities involved in its operations
- Be able to identify soundness or potential flaws in proposed protocols
- Be equipped with the necessary skills to design networked applications and protocols
- Implement and write protocols and applications in C, Java or Python
- Analyze and evaluate the performance of computer networks
- Be able to capture and network traffic
- Be able to understand and explain security and ethical issues in computer networking

**This course contributes to the development of the following graduate capabilities:**

| Graduate Capability | Acquired in |
|---|---|
| Scholarship: of their discipline in its interdisciplinary context | Lectures, labs, assignment |
| Scholarship: Capable of independent and collaborative | Labs, assignment |
| Scholarship: rigorous in their analysis, critique, and reflection | Lectures, labs, exams, sample problems |
| Scholarship: able to apply their knowledge and skills to solving problems | Labs, assignment, exams, sample problems |
| Scholarship: capable of effective communication | Labs, assignment, lectures, exams |
| Scholarship: digitally literate | All aspects of the course |
| Scholarship: information literate | All aspects of the course |
| Leadership: collaborative team workers | Labs, assignment |
| Professionalism: capable of independent, self-directed practice | All aspects of the course |
| Professionalism: capable of lifelong learning | All aspects of the course |
| Professionalism: capable of operating within an agreed Code of Practice | Labs, assignment |
| Global citizens: culturally aware and capable of respecting diversity and acting in socially /responsible ways | Labs, course forums |

**Assumed Knowledge**

Before commencing this course, students should:

- **Have a good understanding of data structures and algorithms, basic probability theory.**
- **Be able to write working programs in C, Java or Python. The course will include programming assignment and labs.**

# Teaching Rationale

This course takes a top-down approach to teaching computer networks. The rationale behind this is that most students have first-hand experience using applications running over the Internet. This allows them to relate to each layer of stack as we travel down the layers. Once they are committed, they participate in appropriate cognitive aspects such as learning the details with a focus to understand them. Students get mentally prepared to answer questions very often there is no single answer or the answers can be unexpected. This results in deep learning and gives students a sense of accomplishment and confidence.

Learning will be largely facilitated through the delivery of lectures. The hands-on laboratories will provide an opportunity to gain deeper understanding of the concepts discussed in the lectures. The sample problems, homework problem set and tutorials will help in the development of problem-solving skills and in preparing for the exams. The programming assignments are mainly geared to allow students to gain familiarity with basic network programming and designing network protocols.

# Teaching Strategies

- **Lectures:** introduce theory demonstrate how they apply in practice
- **Lab Work:** reinforce concepts taught in lectures by conducting hands-on experiments and network performance
- **Assignment:** allow students to design and implement network evaluate network performance
- **Homework Problems:** allow students to solve problems based on content from lectures, develop problem-solving skills, assist with exam preparation
- **Consultations, Tutorials and Course Forum:** allow students an opportunity to ask questions and seek help.

# Assessment

There will be four assessment components as listed below:

| Component | Weight |
|---|---|
| Lab Exercises | 20% |
| Programming Assignment | 20% |
| Mid-term Test | 20% |
| Final Exam | 40% |

To pass the course a student MUST receive at least 40% marks in the final exam. The following formula outlines precisely how the final mark will be computed:

```
lab = marks for lab exercises (scaled to 20)
assign = marks for the programming assignment (out of 20 marks)
midTerm = mark for the mid-term exam (out of 20 marks)
finalExamScaled = scaled mark for the final exam (out of 40 marks)
mark = lab + assign + midTerm + finalExamScaled
grade = HD|DN|CR|PS if mark >= 50 && finalExamScaled >= 16
      = FL          if mark < 50
      = UF          finalExamScaled < 16
```

**Plagiarism** is defined as (https://student.unsw.edu.au/what-plagiarism) *using the words or ideas of others and presenting them as your own* UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)
- Essential Advice for CSE students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are responsible for the of your assignment files such that they are not accessible by anyone but you by setting proper permissions on your CSE home directory and/or on online code repositories. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

# Course Schedule

The following table lists the tentative weekly schedule. Students will be informed of any changes during the lecture and by announcements on the notices page.

| Week | Lecture Dates | Lecture Topics | Labs | Assessment Tasks |
|---|---|---|---|---|
| 1 | 19&20 Feb 2020 | Course Logistics<br>Introduction:<br>• What is the Internet?<br>• Network edge and core<br>• Performance of networks | Self-Study of Lab resources and tools (no submission and no marks) | |
| 2 | 26 & 27 Feb 2020 | Introduction:<br>• Layering and Encapsulation<br>Application Layer:<br>• Principles of networked applications<br>• The Web & HTTP<br>• Email<br>• Domain Name Service (DNS) | Lab 1 | Lab 1 submission deadline: 12 Noon Monday 2nd of March 2020<br>**Assignment Specs Released (Expected)** |

| Week | Lecture Dates | Lecture Topics | Labs | Assessment Tasks |
|---|---|---|---|---|
| 3 | 4 & 5 Mar 2020 | Application Layer:<br>• Peer-to-Peer Networks and DHT<br>• Content Distribution Networks<br>• Socket Programming | Lab 2 | Lab 2 submission deadline: 12 Noon Monday 9th March 2020 |
| 4 | 11 & 12 Mar 2020 | Transport Layer:<br>• Transport services<br>• Multiplexing & Demultiplexing<br>• UDP<br>• Principles of reliable data delivery | Lab 3 | Lab 3 submission deadline: 12 Noon Monday 16th March 2020 |
| 5 | 18 & 19 Mar 2020 | Transport Layer:<br>• Pipelined Protocols<br>• TCP<br>• Connection management & flow control | Tutorial 1 | |
| 6 | No lecture | No lecture | Lab 4 | **Mid-Exam on 25 March 2020**<br><br>Lab 4 submission deadline: 12 Noon Monday 30th March 2020 |
| 7 | 1 & 2 Apr 2020 | Transport Layer:<br>• Congestion control<br>• Fairness<br><br>Network Layer, Data Plane:<br>• Overview | Lab 5 | Lab 5 submission deadline: 12 Noon Monday 6th April 2020 |
| 8 | 8 & 9 Apr 2020 | Network Layer, Data Plane:<br>• IP<br>• Addressing<br>• NAT<br>• IPv6 | Lab 6 | Lab 6 submission deadline: 12 Noon Tuesday 14th April 2020 |

| Week | Lecture Dates | Lecture Topics | Labs | Assessment Tasks |
|---|---|---|---|---|
| 9 | 15 & 16 Apr 2020 | Network Layer, Control Plane:<br>• Routing algorithms<br>• Link State and Distance Vector<br>• Hierarchical routing<br>• ICMP<br><br>Link Layer:<br>• Error detection | Lab 7 | Lab 7 submission deadline: 12 Noon Monday 20th April 2020 |
| 10 | 22 & 23 Apr 2020 | Link Layer:<br>• Multiple Access Protocols<br>• Link Layer Addressing and ARP<br>• Ethernet<br>• Switches<br><br>Wireless Networks<br>• Wireless characteristics<br>• 802.11<br>• CSMA/CA<br><br>A day in the life of a web request<br>Network Security<br>• Basic Cryptography<br>• Message integrity & Digital signatures<br>• Authentication | Tutorial 2 | **Assignment Due** |
| Exam Period | 2 - 15 May 2020 | Exam Period | | **Final Exam** |

# Resources for Students

**Course Textbook:**

- Computer Networking - A Top-Down Approach Featuring the Internet, J. Kurose and K. Ross, Pearson, 7th Edition, 2017 (Sixth edition will suffice for most parts).

**Reference Texts:**

- Unix Network 1 - Networking APIs: Sockets and XTI, W. Richard Stevens, Prentice Hall, Second Edition, 1998.

- Java Network Programming, E. R. Harold, O'Reilly, Third Edition, 2004.
- Learning Python, Mark Lutz, O'Reilly, Fifth Edition, 2013.
- Computer Networks: A Systems Approach, Larry Peterson and Bruce Davie, Morgan Kaufmann, Fifth Edition, 2011.
- Introduction to Computer Networks and Cybersecurity, John Wu and J. David Irwin, CRC Press, 2013.
- Computer Networks, Andrew Tanenbaum and David Wetherall, Fifth Edition, Pearson, 2010.

Links to additional reading material will be available on the lecture notes page.

**Software:**

For the labs, we will be using several Unix-based network utility programs. The purpose of these programs and information on how to use them will be provided in the lab handouts. We will also use a packet sniffing tool called Wireshark which has been widely deployed on CSE machines. In addition, we will also use Ns-2 a widely used network simulator for a few labs. Ns-2 is installed on the CSE lab machines. The simulator is written in C++. However, it uses OTcl (https://en.wikipedia.org/wiki/OTcl) as its command and configuration interface. In the lab exercises, we will use scripts written in OTcl. We will provide some of the scripts for the lab exercises. You will be expected to run the scripts, make some changes in the scripts, and certain performance metrics. You will not be required to write C++ code. Detailed resources for all tools used will be made available on the lab page.

Programming assignment is expected to be developed in C, Java or Python. Students are assumed to have sufficient expertise in one of these programming languages. Links to network programming in C, Java and Python will be available under the assignment link the course Sample code demonstrating a simple client/server application will be supplied as a starting point for students..

# Course Evaluation and Development

Student feedback on this course, and on the effectiveness of lectures in this course, is obtained via electronic survey () at the end of each term. Student feedback is taken seriously, and continual improvements are made to the course based in part on this feedback. Students are strongly encouraged to let the lecturer in charge know of any problems as soon as they arise. Suggestions and criticisms will be listened to openly, and every action will be taken to correct any issue or improve the students' learning experience.

# Special Consideration

You can view the Special Consideration policy at the link here (https://student.unsw.edu.au/special-consideration) (https://student.unsw.edu.au/special-consideration) (https://student.unsw.edu.au/special-consideration)

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Contacting LiC and Course Admin: No personal emails please.

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