Western University
Faculty of Engineering
Department of Electrical and Computer Engineering

ECE 9303: Networking: Principles, Protocols and Architectures

Course Outline 2017-18

Description: This course introduces the fundamental concepts of communication networks. Specifically, it is concerned with network architectures and protocols. The objective of the course is to allow students to develop a thorough understanding of the architectures of networks and the basic principles that allow the transmission of data over the networks.

Instructor: Dr. Abdallah Shami, P.Eng.
TEB 337, 519-661-2111 ext. 81259, ashami2@uwo.ca
Consultation hours: Wednesday 9:30 am – 11:30 am

Academic Calendar Copy:

Contact Hours: 3 lecture hours/week, 0.5 course.

Antirequisite: ECE 4436 a/b, CS 3357a/b

Prerequisites: ES 1036A/B or the former Computer Science 036a/b or Computer Science 1026A/B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

CEAB Academic Units: Engineering Science 75%, Engineering Design 25%.

Required Textbook: James F. Kurose & Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 7th Edition, ISBN-10: 0133594149 , 2016.

Recommended References:

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks (5th Edition), Prentice Hall, 2010
2. W. Stallings, Data and Computer Communications, Prentice Hall, 2002.
3. Leon-Garcia and I. Widjaja, Communication Networks: Fundamental Concepts and Key Architectures, McGraw-Hill, 2000.

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	2/2	Use of Engineering Tools	3/3	Impact on Society and the Environment	
Problem Analysis	2/2	Individual and Team Work	2/2	Ethics and Equity	
Investigation	2/2	Communication Skills		Economics and Project Management	
Design	3/2	Professionalism		Life-Long Learning	

Notation: *x*/*y*, where *x* is the cognitive level (1: Remember, 2: Understand, 3: Apply) at which the attribute is assessed and *y* is the academic level (1: Beginner, 2: Intermediate, 3: Advanced) at which the attribute is assessed.

Topics and Specific Learning Objectives

1. **Computer Networks and the Internet**

   At the end of this section, students will be able to:

   a. Demonstrate an understanding of the Internet
   b. Demonstrate knowledge of the Network Edge.
   c. Demonstrate knowledge of the Network Core.
   d. Demonstrate knowledge of the Network Access and Physical Media
   e. Demonstrate an understanding of ISPs and Internet Backbones.
   f. Demonstrate an understanding of Delay and Loss in Packet-Switched Networks.
   g. Demonstrate an understanding of Protocol Layers and Their Service Models.

2. **Application Layer**

   At the end of this section, students will be able to:

   a. Demonstrate an understanding of the Principles of Application Layer Protocols.
   b. Demonstrate an understanding of the Web, HTTP, FTP, DNS, and DNS-The Internet's Directory Service protocols.
   c. Understand and apply Socket Programming with TCP.
   d. Understand and apply Socket Programming with UDP.
   e. Design and build a Simple Web Server.
   f. Demonstrate an understanding of Content Distribution

3. **Transport Layer**

   At the end of this section, students will be able to:

   a. Demonstrate an understanding of Transport-Layer Services.
   b. Demonstrate an understanding of Multiplexing and De-multiplexing.
   c. Demonstrate an understanding of Connectionless Transport: UDP.
   d. Demonstrate an understanding of the Principles of Reliable Data Transfer.
   e. Build and apply the Principles of Reliable Data Transfer.
   f. Demonstrate an understanding of Connection-Oriented Transport: TCP.
   g. Design and apply the Principles of Congestion Control.
   h. Demonstrate an understanding of TCP Congestion Control

4. Networking Layer & Routing

At the end of this section, students will be able to:

a. Demonstrate an understanding of Network Service Model.
b. Build and apply the Routing Principles.
c. Demonstrate an understanding of Hierarchical Routing.
d. Demonstrate an understanding of The Internet Protocol.
e. Demonstrate an understanding of Routing and the Internet.
f. Demonstrate an understanding of what's Inside a Router.
g. Demonstrate an understanding of IPv6.
h. Demonstrate an understanding of Multicast Routing.
i. Demonstrate an understanding of Mobility and the Network Layer
j. Software Defined Networking (SDN)
k. Simple Network Management Protocol (SNMP)

5. Link Layer

At the end of this section, students will be able to:

a. Demonstrate an understanding of Data Link Layer Services.
b. Demonstrate an understanding of Multiple Access Protocols.
c. Demonstrate an understanding of LAN Addresses and ARP.
d. Demonstrate an understanding of Ethernet.
e. Demonstrate an understanding of Hubs, Bridges and Switches functionalities.
f. Design and build Local Area Networks.
g. Design and build Wireless Local Area Networks
h. Demonstrate an understanding of PPP: The Point-to-Point Protocol.
i. Data Centre Networking

6. Cloud Networking

At the end of this section, students will be able to:

a. Demonstrate an understanding of data center network stack specifics
b. Demonstrate an understanding of management and sharing of network infrastructure in cloud data centers.
c. Demonstrate an understanding of inter-data center WAN connectivity

7. Wireless & Mobility

At the end of this section, students will be able to:

a. Demonstrate an understanding of Wireless and Mobility.
b. Build and design of Wi-fi networks.

Evaluation

Course Component	Weight
Homework Assignments	30
Midterm Test	20%
Final Examination	50%

To obtain a passing grade in the course, a mark of 50% or more must be achieved on the final examination. A final examination mark < 50% will result in a final course grade of 48% or less.

Homework Assignments: All homework assignments have equal weights. Homework assignments will involve heavy programming. Python programming language will be used in this course.

Midterm Test: There will be no rescheduling of the midterm test. If a student misses the midterm test, the weight assigned to the final examination may be adjusted accordingly; please read the ***Missed Midterm Examinations*** section below for more information. During exams/tests/quizzes all electronic devices must be powered down and stored out of reach. The only exception is a simple scientific non-programmable, which is permitted. Other devices capable of substituting for a simple calculator (e.g. a phone, laptop, iPad), are not permitted.

Final Examination: The final examination will be take place during the regular examination period.

Late Submission Policy: Assignments should be submitted by **5:00 pm** on the specified due date. Late assignment submissions will be penalized 10% per day.

Assignment Submission Locker: A Locker located on the second floor of TEB will be assigned to this course.

Use of English: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance: Any student who, in the opinion of the instructor, is absent too frequently from class will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Absence Due to Illness or Other Circumstances: Students should immediately consult with the instructor or department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached

"Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled"). The student should seek advice from the instructor or department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Missed Midterm Examinations: If a student misses a midterm examination, the exam will not be rescheduled. The student must follow the Instructions for Students Unable to Write Tests and provide documentation to their department within 24 hours of the missed test. The department will decide whether to allow the reweighting of the test, where reweighting means the marks normally allotted for the midterm will be added to the final exam. If no reasonable justification for missing the test can be found, then the student will receive a mark of zero for the test.

If a student is going to miss the midterm examination for religious reasons, they must inform the instructor in writing within 48 hours of the announcement of the exam date or they will be required to write the exam.

Cheating and Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Use of Electronic Devices: In-class use of electronic devices, i.e., laptops, iPods, … is strongly discouraged, while the use of headphones and/or phones is not permitted. Any student who, in the opinion of the instructor, is too much distracted by the electronic devices may be asked to

leave the current lecture and/or reported to the Dean. In the case of repeated behavior, on the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.
During exams/tests/quizzes all electronic devices must be powered down and stored out of reach. The only exception is a simple scientific non-programmable, which is permitted. Other devices capable of substituting for a simple calculator (e.g. a phone, laptop, iPad), are not permitted.

Use of Personal Response Devices ("Clickers"): Clickers are not used in this course.

Policy on Repeating All Components of a Course: Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted by the student for grading in subsequent years.

Internet and Electronic Mail: Students are responsible for regularly checking their Western e-mail and the course web site (https://owl.uwo.ca/portal/) and making themselves aware of any information that is posted about the course.

Accessibility: Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

Support Services: Office of the Registrar, http://www.registrar.uwo.ca/
Student Development Centre, http://www.sdc.uwo.ca/
Engineering Undergraduate Services, http://www.eng.uwo.ca/undergraduate/
USC Student Support Services, http://westernusc.ca/services/

Students who are in emotional/mental distress should refer to Mental Health @ Western, http://www.health.uwo.ca/mental_health/, for a complete list of options about how to obtain help.