Course Outline (W2024)

COE865: Advanced Computer Networks

Instructor(s)	Dr. Muhammad Jaseemuddin [Coordinator] Office: EPH406A Phone: (416) 979-5000 x 556073 Email: jaseem@torontomu.ca Office Hours: Mon 2-3 pm and online upon request
Calendar Description	This is an advanced level undergraduate course in computer networking. The course is designed to include materials relevant to the industry, for example IP routing and traffic engineering. The course deals with the principles, architectures, algorithms, and protocols related to the Internet, with emphasis on routing, transport protocol design, flow control and congestion control, quality of service, traffic engineering and MPLS. It also introduces network virtualization and software-defined networking (SDN). (Formerly ELE 865.)
Prerequisites	COE 768
Antirequisites	None
Corequisites	None
Compulsory Text(s):	1. Computer Networks 5/e, A. Tanenbaum and D. Wetherall, 5nd edition, Prentice Hall, 2010.
Reference Text(s):	1. TCP/IP Illustrated Volume 1, W. Richard Stevens, Addison-Wesley, 2007. 2. Communication Networks â€" Fundamental Concepts and Key Architectures 2/e, A.Leon-Garcia and I. Widjaja, McGraw Hill, 2004.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: 1. Show the use of judgment in solving problems with uncertainty and imprecise information through designing networks for particular routing schemes and demonstrating in the lab. (**2a**) 2. Analyze, design and solve routing, transport, quality of service and traffic engineering problems. Understand, and effectively use, engineering principles and theories to generate solutions with multiple objectives and often-conflicting goals between customers and service providers. Objectively determine relative value of feasible alternatives and trade-offs. (**4b**) 3. Objectively determine relative value of feasible alternatives or proposed solutions.Analyze, design and solve routing, transport, quality of service and traffic engineering problems. Understand, and effectively use, engineering principles and theories to generate solutions with multiple objectives and often-conflicting goals between customers and service providers. Objectively determine relative value of feasible alternatives and trade-offs. (**4c**) 4. Demonstrate the main design features of the project and answer critical and project specific questions during project demo. Write a formal technical report explaining the design and test cases, where the report is assessed based on technical writing, general organization, clarity and concise presentation of information. (**7a**)

	5. Knowing safety, privacy and security concerns of customers and addressing them in making decisions for network design and ISP services. (**10a**) **NOTE:** *Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).*
Course Organization	3.0 hours of lecture per week for 13 weeks 1.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks
Teaching Assistants	Niusha Kadijani, niusha.sabrikadijani@torontomu.ca
Course Evaluation	<table><tr><td colspan="2">Theory</td></tr><tr><td>Midterm Exam</td><td>25 %</td></tr><tr><td>Quizzes</td><td>10 %</td></tr><tr><td>Final Exam</td><td>30 %</td></tr><tr><td colspan="2">Laboratory</td></tr><tr><td>Lab Reports and demo</td><td>20 %</td></tr><tr><td>Project</td><td>15 %</td></tr><tr><td>TOTAL:</td><td>100 %</td></tr></table> **Note:** In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both **"Theory and Laboratory"** components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the **"Course Evaluation"** section above for details on the Theory and Laboratory components (if applicable).
Examinations	Midterm exam on Week 7 (February 26), two hours, closed book (covers Weeks 1-6). Final exam, during exam period, three hours, closed book.
Other Evaluation Information	* Quiz-1 on Week 5 (tentative) and Quiz-2 0n Week 11 (tentative) * Laboratory and project are important components of learning and practicing the topics learnt in the class. You are expected to do your labs individually and make significant contribution to the project. You will be evaluated individually for the labs and the project. Lab manual includes details about submission, late penalty, and evaluation of the labs. * Project evaluation may consist of software code, report and project demonstration.
Teaching Methods	Class schedule: Mondays at 3pm-6pm in KHS335. Labs will be demonstrated to the TA in ENG412.
Other Information	3 hours of lecture per week for 13 weeks,

Course Content

Week	Hours	Chapters / Section	Topic, description
1	1	Chapter 5, Section 1	Introduction: Internet Architecture Overview of IP and ICMP ICMP Route Redirects
1-2	3.5	Chapter 5, Section 2	IP Routing: Distance Vector (RIP)
2-4	7	Chapter 5, Section 2	IP Routing: Link State (OSPF) and Inter-domain (BGP)
4-6	4.5	Chapter 5, Section 2	IP Routing: Multicast and IGMP
6-8	6	Chapter 6 Sections, 1-6	Transport Protocol: TCP flow control and congestion control TCP friendly congestion control
9-10	6	Chapter 5, Section 4	IP QoS: Traffic Conditioning QoS Scheduling Active Queue Management QoS models (IntServ and RSVP DiffServ) QoS applications
11-12	4.5	Chapter 5, Sections 5 and 6	Traffic Engineering: IP Traffic Engineering Constrained-based Routing MPLS
12-13	4.5		Network virtualization and SDN

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

Week	L/T/A	Description
2	ENG412	Tutorial: T1-DHCP

2	ENG412	Tutorial: T2-DNS
3-4	ENG412	Lab1: Design and Configuration of a single domain network
5-6	ENG412	Lab2: Design and Evaluation of a RIP Network
7-8	ENG412	Lab3: Design and Evaluation of an OSPF Network
9-10	ENG412	Lab4: Design and Evaluation of a BGP Network
11-12	ENG412	Project demo

University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on the Senate website

Refer to the Departmental FAQ page for furhter information on common questions.

Important Resources Available at Toronto Metropolitan University

- The Library provides research workshops and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the Library's virtual research help service to speak with a librarian.
- Student Life and Learning Support offers group-based and individual help with writing, math, study skills, and transition support, as well as resources and checklists to support students as online learners.

- You can submit an Academic Consideration Request when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the Senate website and select the blue radio button on the top right hand side entitled: **Academic Consideration Request (ACR)** to submit this request.

  For Extenuating Circumstances, Policy 167: Academic Consideration allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate Policy 167: Academic Consideration.

- If a student is requesting accommodation due to a religious, Aboriginal and/or spiritual observance, they must submit their request via the online Academic Consideration Request (ACR) system **within the first two weeks of the class or, for a final examination, within two weeks of the posting of the examination schedule**. If the required absence occurs within the first two weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these requests should be submitted with as much lead time as possible in advance of the required absence.

- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The Remote Learning Guide for students includes guides to completing quizzes or exams in D2L Brightspace, with or without Respondus LockDown Browser and Monitor, using D2L Brightspace, joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for Faculty and students.

Accessibility

- Similar to an [accessibility statement](#), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.