

**Carleton University**  
**Department of Systems and Computer Engineering**

**SYSC 5801**

**Advanced Network Routing Technologies**

**Winter 2016**

Instructor: Chung-Horng Lung

- Office: Mackenzie Building, Room 4434
  - Office hours: Monday 2:30 – 3:30, Thursday 12:30 – 1:30
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**Calendar Description:**

The course covers network routing, in-depth issues and technologies in traffic engineering, quality of service (QoS), and high-speed networks. The course addresses the following topics: basic routing, MPLS (Multiprotocol Label Switching) system components and architecture, constraint-based routing, traffic engineering, content distribution networks, network monitoring and measurements, QoS, protection and restoration, virtual private networks, cross layer interworking, software-defined networking (SDN), and special topics.

**Pre-requisites:** SYSC4602, SYSC5201/ELG6121i, EACJ5607/ELG5374 Computer Communications, or equivalent

**Grading Scheme:**

Assignments: 20%

Class participation for reading assignments and project presentation: 5%

Project and Presentation: 50%

Final Exam: 25%

Text: No single textbook was found to cover all the different topics discussed in this course. Many technical papers will be used for the course and assignments. The following is a list of suggested references for general network switching and routing technologies.

1. B. Davie and Y. Rekhter, *MPLS Technology and Applications*, 2000, Morgan Kaufmann.
2. J. Minei, *MPLS-Enabled Applications – Emerging Developments and New Technologies*, 2<sup>nd</sup> edition, Wiley, 2008.
3. E. Osborne and A. Simha, *Traffic Engineering with MPLS*, Cisco Press, 2002.
4. R. Puzmanova, *Routing and Switching Time of Convergence*, Addison-Wesley, 2002.

**Week-by-week Description:**

- Week 1: Overview of routing and MPLS components and architecture
  - Basic routing
  - MPLS framework
- Week 2 – 3: Traffic Engineering
  - Introduction to traffic engineering

- Green traffic engineering and communications
  - Network monitoring and measurements
  - Content distribution networks
  - Software-defined networking
- Week 4 – 5: Constraint-based routing
  - Constraint-based shortest path first algorithm
  - Label switched path calculation
  - Signalling protocols
  - Label switched path creation
- Week 6: Quality of Service (QoS)
  - QoS models
  - QoS routing and traffic engineering
- Week 7 – 8: Protection and restoration
  - Path protection and segment protection
  - Link and node protection
  - Protection and QoS
  - Protection for multicast
  - P-cycle
  - Network coding
- Week 9: Virtual private networks
  - VPN models
  - Layer 3 BGP/MPLS VPNs
  - Layer 2 VPNs
- Week 10: Special topics
- Week 11 – 12: Project Presentations

***Note that the schedule is subject to change due to the large number of students, especially Project Presentations weeks. Changes, if necessary, will be announced in class and posted on the course website.***

**Cheating and plagiarism:** Suspected cheating or plagiarism will be investigated and will be reported to the Associate Dean, see General Regulation 14.

Cheating includes (i) submitting someone else's assignment as your own, (ii) allowing someone else to submit your solution as his/her own, and (iii) submitting your own project that was submitted for another related course.

Plagiarism is "unauthorized use or close imitation of the language and thoughts of another author and the representation of them as one's own original work, as by not crediting the author" (from Dictionary.com).

**Health and Safety information:** Here is the link to the health and safety manual [www.sce.carleton.ca/courses/health-and-safety.pdf](http://www.sce.carleton.ca/courses/health-and-safety.pdf).