ECE 4870-T01 Topics in Communication Networks
Course Outline – Winter Term 2014

Course Objectives
The objective of this course is to introduce to the senior undergraduate students some of the advanced communication networking technologies. These are on top of those they might have learnt in the course ECE 3700 (Telecommunication Network Engineering). The following topics will be covered: control of communication networks, multimedia networking, optical networks, communication network economics, network security, and performance modeling and analysis of communication networks. The course will also introduce network simulation using NS2 as part of the laboratories. At the end of the course, the students will have a good grasp of the principles of the communication networking technologies covered in this course as well as understanding of some of the basic techniques for modeling and analysis of communication networks.

Prerequisites
ECE 3700 Telecommunication Network Engineering (or permission of the instructor)

Course Content
The following topics will be covered:

- Communication network services and layered architectures (1 week): Basic network elements and mechanisms, network services and applications, layered architecture
- Congestion control and quality of service in communication networks (3 weeks): Objectives and methods of network control for circuit-switched networks and datagram networks, process to process delivery using UDP, TCP, and SCTP, Differentiated Services and Integrated Services paradigms for quality of service
- Multimedia communication over Internet (3 weeks): Audio and video compression, streaming stored audio/video, streaming live audio/video, real-time interactive audio/video, RTP, RTCP, voice over IP
- Communication network economics (1 week): Demand for network services, network charges, billing and provisioning system for Internet connections
- Optical networks (1 week): Optical links, WDM systems, optical cross-connects, optical LANs
- Network security (2 weeks): Cryptography, security services (message confidentiality, message integrity, message authentication), security in the Internet (IPSec, SSL/TLS, VPN, Firewalls)
- Performance analysis and design of communication networks (2 weeks): Traffic modeling, modeling and analysis of communication protocols

Accreditation Units
Mathematics: 0%
Natural Science: 0
Complementary Studies: 0
Engineering Science: 75%
Engineering Design: 25%

Web Page
http://ece.eng.umanitoba.ca/undergraduate/ECE4870

Textbook
Other References


Evaluation Details
The final course grade is determined by the student’s performance on quizzes, laboratories, and examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Mid-Term
The mid-term test will be on 04 March 2014 (in class).

Instructor
Prof. Ekram Hossain, P.Eng.
Room: E1-552 EITC
Telephone: (204) 474-8908
Email: Ekram.Hossain@umanitoba.ca

Office Hours
Monday and Wednesday from 11:30 AM – 12:30 PM or by appointment

Teaching Assistant
Monowar Hasan (monowar_hasan@umanitoba.ca)
Room: E1-551 EITC

Voluntary Withdrawal Date
Wednesday, March 19, 2014

Requirements/Regulations
- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

Academic Integrity
Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1,
students are reminded that plagiarism or any other form of cheating in examinations, assignments, laboratory reports or term tests is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.
Learning Outcomes

1. Understand the architecture and protocols in modern communication networks
2. Design and analysis of congestion control protocols for the Internet
3. Understand the techniques for multimedia communication over the Internet
4. Understand the basics of pricing and billing of Internet connections
5. Understand the network security techniques

Expected Competency Level **

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
<th>A7</th>
<th>A8</th>
<th>A9</th>
<th>A10</th>
<th>A11</th>
<th>A12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

*Attributes:
A1 A knowledge base for engineering
A2 Problem analysis
A3 Investigation
A4 Design
A5 Use of engineering tools
A6 Individual and team work
A7 Communication skills
A8 Professionalism
A9 Impact of engineering on society/environment
A10 Ethics and equity
A11 Economics and project management
A12 Life-long learning

**Competency Levels:
1 - Knowledge (Able to recall information)
2 - Comprehension (Able to rephrase information)
3 - Application (Able to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships)
5 - Synthesis (Able to combine separate elements into whole)
6 - Evaluation (Able to judge the worth of something)

Student Contact Time (Hrs)

Lectures: 3 hrs lecture/week × 13 weeks/term = 39 hrs
Laboratories: 3 hrs laboratory × 5 weeks = 15 hrs

Evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Methods of Feedback *</th>
<th>Learning Outcomes Evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>15</td>
<td>F, S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>Laboratories</td>
<td>15</td>
<td>F, S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>Mid-Term Test</td>
<td>20</td>
<td>F, S</td>
<td>1, 2</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50</td>
<td>S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
</tbody>
</table>

* Methods of Feedback: F - formative (written comments and/or oral discussion), S - summative (number grades)