CS553 Introduction to Network Technology

Syllabus

Instructor: Alan Wu

Objectives:
The sophistication of data communications and computer networks is growing rapidly. New technologies, standards, and systems are emerging each day to meet the requirements of new applications. It is essential for computer engineers and technical professionals to develop a solid foundation as well as state-of-the-art expertise in data communications and computer networks in order to face these challenges.

This course provides an introduction to the concepts, protocols, technologies, standards, and applications of data communications and computer networks for both LANs and WANs. It provides the foundation and background necessary for Advanced WAN and LAN classes. Signal transmission analysis, modulation concepts, modems, multiplexers, digital technologies, transmission impairments, and various transmission media will be extensively discussed. Network protocols will be presented based on the OSI Reference Model, TCP/IP protocol suite, and IEEE 802 standards. Network technologies such as ISDN, DSL, SONET, packet switching networks, LAN technologies, Internet and TCP/IP, and ATM will also be discussed.

Upon completion of this 3-credit course, you will learn:
- Layered network architectures, OSI Reference Model, and TCP/IP Protocol suite
- Difference between asynchronous and synchronous communications
- Signal transmission analysis, signal distortion, bandwidth limitations, Nyquist and Shannon theories, as well as Fourier concepts
- Transmission media and transmission technologies such as twisted-pair wires, coaxial cables, fiber optics, microwave systems, and satellite communications systems
- Modulation theory and modems
- Different multiplexing techniques such as frequency-division, time-division, and statistical time-division multiplexing
- Digitization techniques such as Pulse Code Modulation and digital transmission technologies such as T1, T3, ISDN, and SONET
- Broadband technologies, multimedia communications, DSL and Cable Modem technologies
- Protocols such as HDLC and PPP that control the transmission of data over a communications link as well as for Internet access
- Introduction to local area networks and Ethernet
- Different switching technologies and packet switched networks
- What is the difference between virtual circuit and datagram packet switching networks
- Internet and TCP/IP protocols
- Basic concepts of ATM technology

Methodology and Course Format:
Classes will be held in lecturing format including class discussions. Visual aid will be used for the presentation. A minimum of 30 contact hours is required for the semester. Some class materials are put on a Web site for you to access. This Web site is setup at URL http://briefcase.yahoo.com/rivernh at this time. I need your Yahoo ID to allow you to access the files. You need to get a Yahoo ID. It’s free.

Evaluation:
- Midterm Exam----------------------------------------------- 25%
- Final Exam--------------------------------------------------------------- 35%
- Projects/Research Papers/Study Reports/Assignments---------------------- 35%
- Exam on Research Papers/Assignments------------------------------------- 5%
- Total ------------------------------------------------------------- 100%
Textbook:

References:
3. Freeman: Practical Data Communications 1995 Wiley
9. Articles published in IEEE and other Technical Journals
10. Technical information and white papers published on the Internet

Partial List of Excellent Reference Sources for Classes and Assignments:
- IEEE Communications Magazine (technical journal)
- IEEE Journal on Selected Areas in Communications (technical journal)
- IEEE Network (technical journal)
- IEEE Spectrum (technical journal)
- IEEE Transactions on Communications (technical journal)
- Computer Communications (technical journal)
- Computer Networks and ISDN Systems (technical journal)
- Bell System Technical Journal (technical journal)
- Lightwave, The Journal of Fiber Optics (technical journal)
- Network Magazine (trade magazine -- OK for technical reference)
- Telecommunications (trade magazine -- OK for technical reference)
- Byte (trade magazine -- OK for technical reference)
- Communications Week (weekly newspaper -- not for technical reference)
- Network World (weekly newspaper -- not for technical reference)

Course Requirements:
Students are required to pass all exams and complete all assignments. Exams will be based on the textbooks, lecture material, and handouts. All exams will be comprehensive (questions and answers), closed book and closed notes, and will be conducted in-class. See "Assignments" for detailed assignment requirements. Grades for all exams and assignments will not be determined by curves. Letter grades submitted to the Registrar’s Office will be based on the Rivier College grading system. The conversion from numerical grade to letter grade will be based on the following table:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Honor Points</th>
<th>Numerical Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
<td>92 – 100</td>
</tr>
<tr>
<td>AB</td>
<td>3.5</td>
<td>84 -- 91</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>76 – 83</td>
</tr>
<tr>
<td>BC</td>
<td>2.5</td>
<td>68 - 75</td>
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<tr>
<td>C</td>
<td>2.0</td>
<td>60 - 67</td>
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<tr>
<td>F</td>
<td>0.0</td>
<td>Below 60</td>
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Assignment:
Your assignment is to write a study report or a research paper. The purpose of writing the report/paper is for you to gain an in-depth understanding of a particular topic that you are interested, or the technical knowledge that you learned will benefit you for your work or for your career development. It also gives you an opportunity to learn how to do independent research work as well as how to write a technical report/paper.
The potential topics for your report/paper are listed as follows:

- Compare state-of-the-art high speed intelligent modem to cable modem in technologies and applications
- Fiber optic technologies and multimedia data communications
- Satellite technology for data communications
- Waveform digitization and audio/video compression techniques for multimedia communications
- Broadband technologies and multimedia applications
- T1/T3/SONET technology for data communications
- Compare xDSL to cable modem in technologies and applications
- Frame Relay and ATM Technologies
- Fast Ethernet and Gigabit Ethernet technology
- Wireless communications technologies
- A Topic of your own selection (may be related to your work)

The paper should consist of about 12 typed pages (single space with font size 12) plus illustrations, bibliography, and appendices (if necessary). A minimum of eight technical articles and/or books must be used as sources for your paper. Thirty percent of your reference material should be technical articles published within two years. The quality of references is an important part in deciding what grade you will get. Other universities may have similar topics assigned to their students as research paper assignments. Your paper will be rejected if these papers are used as your references.

You must submit a one-page outline and discuss it with me before you start writing the paper or start your project. If you need advice regarding the topic to select, the format of the paper, the contents of the paper, or reference material, you should discuss it with me. Discussing the same with classmates is also encouraged. The outline discussion process is very important, because, only through this process, I may help you to organize your paper, advise you on the contents of the paper, advise you on where to find references, and guide you to the right direction. Since training you to do independent research is one of the reasons for this assignment, you need to try your own effort first before you ask for any help.

There is no special format for the outline. Since you need to show me how your paper will be organized and what will be discussed in your paper, it will be easier for you to format your outline similar to the table of contents of a book. The outline will include the title of the paper, number of sections in the paper, the subtitle for each section, a few lines describing the what will be discussed in each section, and references found so far to be used for writing your paper.

Since this is a research paper written by you, you must understand everything you wrote in the paper. Since we don't have time for every one of you to present your paper to the class and subject to my oral test, there will be a written test to your paper. The written test will be taken at the same time of your final exam.

Class Schedule:

<table>
<thead>
<tr>
<th>SESSION</th>
<th>DATE</th>
<th>TOPIC</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1/15</td>
<td>Basic Communications and LAN/WAN Concepts, Layered Network Architectures (Ch.1 &amp; 2)</td>
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<tr>
<td>2</td>
<td>1/22</td>
<td>Data Transmission, Signal Analysis, and Channel Bandwidth (Sec. 6.1, 5.1, and Ch. 3)</td>
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<tr>
<td>3</td>
<td>1/29</td>
<td>Signal Transmission and Transmission Impairments (Ch. 3)</td>
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<tr>
<td>4</td>
<td>2/5</td>
<td>Transmission Media (Ch. 4)</td>
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<tr>
<td>5</td>
<td>2/12</td>
<td>Modulation Theory, Modems, and Multiplexing (Sec. 5.2, 5.4, 8.1, 8.2, and 8.3)</td>
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<tr>
<td>6</td>
<td>2/19</td>
<td>Digitization and Digital Transmission Technologies (Sec. 5.3, 8.2)</td>
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<tr>
<td>7</td>
<td>3/5</td>
<td>Midterm Exam (25%)</td>
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<tr>
<td>8</td>
<td>3/12</td>
<td>Assignment Outline Due, ISDN, SONET and DSL Technologies (Sec. A1, A2, A3, A4, 8.2, 8.4, and 8.5)</td>
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<tr>
<td>9</td>
<td>3/19</td>
<td>Data Link Control Protocols (Sec.7.4, 7.1, and 7.3)</td>
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<tr>
<td>10</td>
<td>3/26</td>
<td>Switching Technologies (Sec. 9.1, 9.2, and 10.1)</td>
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<td>11</td>
<td>4/2</td>
<td>Packet Switching Networks (Sec. 10.1)</td>
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<tr>
<td>Date</td>
<td>Day</td>
<td>Assignment</td>
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<tr>
<td>12</td>
<td>4/9</td>
<td>Introduction to LAN and Ethernet (Sec. 13.2, 13.3, 13.5, and 14.1)</td>
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<tr>
<td>13</td>
<td>4/16</td>
<td>Internet and TCP/IP Protocols (Sec. 15.1, 15.2, and 15.3)</td>
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<tr>
<td>14</td>
<td>4/23</td>
<td>Assignment Due (35%) more TCP/IP Protocols, and ATM (Sec. 17.1, 17.2, 11.1, 11.2, and 11.3)</td>
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<tr>
<td>15</td>
<td>4/30</td>
<td>Final Exam (35%) and Research Paper Written Test (5%)</td>
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Notes:

1. Class will meet for 2 hours each session for a total of 15 sessions (30 contact hours)
2. Reading Assignment is assigned each week. Students are required to read related topics in the textbook before each class.