1. **Course number and title:** CS553A Introduction to Networking Technologies

2. **Instructor’s name:** Dr. Vladimir V. Riabov, Associate Professor; Office: STH-312; Tel: (603) 897-8613; E-mail: vriabov@rivier.edu; Web site: http://www.rivier.edu/faculty/vriabov/

3. **Course description:** A survey of the technologies available for network solutions to distributed processing problems. Topics include: layered network architectures, signal transmission analysis, transmission media, data encoding, local and wide area networks, communications architecture and protocols, modeling techniques with OPNET software. **Prerequisite:** CS250 Data Abstraction.

4. **Course objectives:**
   This course attempts to provide an overview of the rapidly growing field of networking technologies, data and computer communications, and encourage students to develop a solid foundation and on-hand experience in these areas. Topics to be covered include data communication networking models, protocols (TCP/IP, IPv4, IPv6, OSPF, BGP, and others), standards, analog and digital data transmission, transmission media (twisted pair wires, coaxial cables, fiber optics, and satellite communications), broadband technologies, multimedia communications, ISDN, xDSL, SONET, packet switching, ATM, LAN systems (Ethernet, CSMA/CD, Token Ring, Fibre Channel, Wireless LANs), switching and routing networks, and network security.

   Upon completion of this course, the student should learn:
   - Layered network architectures, OSI Reference Model, and TCP/IP protocol suite
   - The Internet Organizations and some RFC Publications
   - Networking Protocol categories (Transmission services, Addressing, Flow and Error Control, Multiplexing, Segmentation and Reassembly, Routing, Encapsulation, etc.)
   - Applications (SMTP, FTP, TELNET, HTTP, and others)
   - Analog and Digital Data Transmission Methods
   - Difference between synchronous and asynchronous communications
   - Signal transmission analysis, its strength and delay distortion, bandwidth limitations (Nyquist and Shannon theories), International Reference Alphabet, Fourier concepts
   - Guided transmission media (twisted pair, coaxial cable, optical fiber), wireless transmission technologies (microwave, infrared, radio), and satellite systems
   - Modulation theory and modems
   - Data Communication Interfaces and standards, line configurations (topology, full/half duplex)
   - Data link control principles: Logical Link Control (LLC), Asynchronous Transfer Mode (ATM)
   - Multiplexing techniques (Frequency-Division, Time-Division)
   - Digitization techniques (Pulse Code Modulation), digital transmission technologies (T1 and T3)
   - Broadband technologies (ISDN, ASDN, xDSL, and cable modem)
   - Fiber optic transmission systems and SONET
   - Wide-Area Networks (Circuit-Switching, Packet-Switching, Frame Relay, ATM, Broadcast networks topologies, such as bus, ring, and star)
   - Routing Strategies and Protocols
   - Asynchronous Transfer Mode (ATM)
   - LAN Technology (BUS, Ring, Star, Wireless, and Bridges)
   - LAN Systems (Ethernet, CSMA/CD, Token Ring, FDDI, Fiber Channel, Wireless LANs)
   - Internetworking Protocols (IPv4, IPv6, ICMP, IGMP)
   - Routing Protocols (BGP, OSPF, RSVP)
   - Transport Protocols (TCP, UDP)
   - Network Security (Encryption, Digital Signature, IPSec)
   - Networking simulation and modeling techniques with OPNET software.
5. **Class Dates and Time:** September 8, 2005 – December 15, 2005
   Thursdays: 5:30 PM - 7:30 PM

   (ISBN: 0-13-148252-1) [optional].

7. **Recommended books:**
   - *Articles* published in IEEE and other Technical Journals.
   - *Technical information and white papers* published on the Internet.

**Partial List of Excellent Reference Sources for Classes and Project 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;
- Lightware, The Journal of Fiber Optics (technical journal);
- Data Communications (trade magazine – O.K. for technical reference);
- Telecommunications (trade magazine – O.K. for technical reference);
- Byte (trade magazine – O.K. for technical reference);
- Embedded Systems (trade magazine – O.K. for technical reference);
- Communications Week (weekly newspaper – NOT for technical reference);
- Network World (weekly newspaper – NOT for technical reference).
8. **Classroom Policies:**

a) **Attendance:** Active participation requires attendance and arrival to class in time to be prepared for work when the class period begins. You are expected to attend all classes. Much of the learning will take place in classroom activities that cannot be duplicated easily outside of class. If you miss class, you are responsible for doing all classroom activities you missed, getting the notes from a classmate, and turning in all work on the day it is due. If you miss more than two classes, your absences will be reported to the registrar and you must meet with the professor to discuss the advisability of your remaining in the course for the remainder of the semester. Students who miss three classes may be withdrawn from the course and receive disciplinary action from the college (see Rivier College attendance policy). If you anticipate that job-related duties or prior commitments will cause several absences, please discuss the matter with the instructor outside of class.

b) **Honesty policy:** All work turned in on tests and the final must be entirely your own. Behavior contrary to this will result in a grade of F on the test. Serious infractions may result in an F for the course. Similarly, the paper you write for your project must not be plagiarized. See library discussion on plagiarism. Regarding homework, the instructor will not give you credit for any work that is copied from another source (from a classmate, instructor, a text, the answer key, web assistance, tutor, etc.). Take notes while getting help, but put aside the notes as you attempt to do the problems on your own.

c) **Project Assignment** (individual project): 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 networking 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;
- Voice over IP;
- 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 15 typed pages plus illustrations, bibliography, and appendices (if necessary). A minimum of six technical articles and/or books must be used as sources for your paper. At least thirty percent of your reference materials should be technical articles published within two years.

You **must** submit your 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 your 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. **The Project Paper is due on December 8, 2005.**

d) **FOUR homework assignments** are scheduled (September 22, October 6, November 10, and December 1).

e) **FOUR in-class labs** are scheduled (September 29, October 13, November 3, and November 17).
9. **Americans With Disabilities Act (Ada):**
Rivier College wants to provide reasonable accommodations to students with disabilities. To accomplish this goal effectively and to ensure the best use of our resources, timely notice of a disability must be provided to the Office of Special Services for verification and for evaluation of available options. Any student whose disabilities fall within ADA should inform the instructor within the first two weeks of the term of any special needs or equipment necessary to accomplish the requirements for the course. To obtain current information on this procedure, contact the Office of Special Services at telephone extension 8497.

10. **Evaluation Mechanism:**
Students are required to pass all exams and complete all assignments. Exams will be based on textbooks, lecture material, and handouts. All exams will be comprehensive, closed book and open notes, and will be conducted in-class. See "**Project Assignments**" for detailed project assignment requirements. Grades for all exams and assignments will not be determined by curves. Letter grades submitted to the Registrar’s Office would 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>
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<tbody>
<tr>
<td>A</td>
<td>4.0</td>
<td>94-100</td>
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<tr>
<td>AB</td>
<td>3.5</td>
<td>90-93</td>
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<tr>
<td>B</td>
<td>3.0</td>
<td>84-89</td>
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<tr>
<td>BC</td>
<td>2.5</td>
<td>80-83</td>
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<td>C</td>
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<td>73-79</td>
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<td>F</td>
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<td>Below 73</td>
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The grade is made up of your performance on your homeworks, labs, project, midterm and final exams. Approximate weightings are as follows:

- Homeworks: 10%
- Labs: 10%
- Midterm Exam: 25%
- Final Exam: 30%
- Project: 25%

11. **Due Dates:**
- Homeworks #1-4: September 22, October 6, November 10, and December 1, 2005
- Labs #1-4 (in-class): September 29, October 13, November 3, and November 17, 2005
- Project Proposal: October 6, 2005
- Midterm Exam: October 20, 2005
- Project due: December 8, 2005
- Final Exam: December 15, 2005

12. **Topic Outline:**

<table>
<thead>
<tr>
<th>SESSION</th>
<th>TOPIC</th>
<th>READING</th>
<th>HOMEWORKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (09/08)</td>
<td>Basic Communication Concepts</td>
<td>Ch. 1</td>
<td></td>
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<tr>
<td></td>
<td>Layered Network Architectures</td>
<td>Chs. 1, 2</td>
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<td></td>
<td>Protocols</td>
<td>Ch. 2</td>
<td></td>
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<tr>
<td>2 (09/15)</td>
<td>Analog and Digital Data Transmission. Lab00.</td>
<td>Ch. 3, OPNET</td>
<td>Homework #1 due</td>
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<td></td>
<td>Channel Bandwidth. Transmission Impairments.</td>
<td>Ch. 3</td>
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<tr>
<td>3 (09/22)</td>
<td>Guided and Wireless Transmission Media.</td>
<td>Ch. 4</td>
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<tr>
<td></td>
<td>Signal Encoding Techniques</td>
<td>Ch. 5</td>
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<tr>
<td>SESSION</td>
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<td>HOMEWORKS</td>
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<tr>
<td>4 (09/29)</td>
<td>Asynchronous &amp; Synchronous Transmission. Line Configurations. Interfacing. Lab01. Flow Control, Error Detection, HDLC</td>
<td>Ch. 6, OPNET Ch. 7</td>
<td>In-class Lab01 due</td>
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<tr>
<td>5 (10/06)</td>
<td>Data Link Control Protocols. Asynchronous Transfer Mode (ATM). Frequency-Division Multiplexing</td>
<td>Ch. 7, Ch. 7 Ch. 8</td>
<td>Homework #2 due</td>
</tr>
<tr>
<td>6 (10/13)</td>
<td>Synchronous Time-Division Multiplexing, SONET/SDN, ISDN. Lab02. Asymmetric Digital Subscriber Line. xDSL</td>
<td>Ch. 8, OPNET Ch. 8</td>
<td>In-class Lab02 due</td>
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<td>7 (10/20)</td>
<td>[MID-TERM EXAM]</td>
<td>[MID-TERM EXAM]</td>
<td>Chs. 1-8</td>
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<td>8 (10/27)</td>
<td>WAN: Circuit-Switching Networks &amp; Routing Control Signaling Packet-Switching Principles &amp; Routing X.25; Frame Relay.</td>
<td>Ch. 10 Ch. 10 Ch. 10</td>
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<td>9 (11/03)</td>
<td>Asynchronous Transfer Mode (ATM). Lab03.</td>
<td>Ch. 11, OPNET Ch. 10</td>
<td>In-class Lab03 due</td>
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<td>10 (11/10)</td>
<td>Routing in Switched Networks. List-Cost Algorithms. Congestion &amp; Traffic Management</td>
<td>Ch. 12 Ch. 13</td>
<td>Homework #3 due</td>
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<td>11 (11/17)</td>
<td>Local Area Networks. Lab04. High-Speed LAN (Ethernet, Token Ring, Fiber Channel)</td>
<td>Ch. 15, OPNET Ch. 16</td>
<td>In-class Lab04 due</td>
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<td>12 (11/24)</td>
<td>NO CLASSES (Thanksgiving)</td>
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<td>13 (12/01)</td>
<td>Internetwork Protocols (IPv4, IPv6, ICMP, IGMP)</td>
<td>Ch. 18</td>
<td>Homework #4 due</td>
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<td>14 (12/08)</td>
<td>Routing Protocols (BGP, OSPF, RIP) Transport Protocols (TCP, UDP)</td>
<td>Ch. 19 Ch. 20</td>
<td>Final Exam Preparation</td>
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<tr>
<td>15 (12/15)</td>
<td>[FINAL EXAM]</td>
<td>[FINAL EXAM]</td>
<td>Chs. 9-13, 15, 16, 18-20</td>
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