

Electrical, Computer And Systems Engineering Department
ESCE-6600 Internet Protocols
Spring 2007 Syllabus

Course Description

The Internet has revolutionized communications. This course will equip you with a deep knowledge of protocols that make it work, help you develop critical insight into their design, and obtain a first hand feel for implementation through lab exercises. Another key goal is to prepare you for doing research in the field of networking. Protocols from the OSI and telecommunications/ATM world will also be featured to provide in-depth comparative studies.

Specifically, we will start with a review of basic networking ideas and then study topics such as:

- Network layer addressing and forwarding (IP, IPv6, ATM, IPX, CLNP, Appletalk),
- Intra-domain routing (RIP, OSPF, EIGRP, PNNI, IS-IS),
- Inter-domain routing (BGP, EGP, Nimrod),
- Transport layer (TCP, UDP),
- Congestion control techniques (TCP, Frame-relay, ATM networks)
- IP multicast (IGMP, MBONE, Multicast Routing/Transport/Congestion Control),
- Network management, Auto-configuration (SNMP, DHCP, ICMP, ICMPv6),
- IPv6 design, comparative critique, deployment issues, NAT
- QoS mechanisms, protocols and architectures (scheduling, shaping, RTP, Int-serv, Diff-serv, RTP, RSVP),
- Naming (DNS), Overlay & Peer-to-Peer Networks

Optional topics: (time permitting)

- High-speed router design
- High-speed networks (Metro-area GbE, SONET, Optical Networks)
- Traffic engineering (IP-over-ATM, MPLS, OSPF-extensions, VPNs)
- Network security (IPSEC and firewalls),
- Measuring and Instrumenting the Internet
- Internet Telephony

Prerequisites:

Required (no exceptions):

ESCE-4670 Computer Communication Networks or equivalent

C programming knowledge

Desirable:

Operating Systems

Computer Architecture (ECSE-4730 or equivalent)

Instructor

Prof. Shivkumar Kalyanaraman. (Call me “**Shiv**”).

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{Note: use course bulletin board (see below) for any query that may be of interest to others}

Office Hours: Tue: 4:00 pm - 6:00 pm or by email appointment

Course Secretary [for all administrative requests]

Audrey Hayner

Office JEC 6003

Phone: 276-6019

Teaching Assistants:

TBA

Required Text

1. **An Engineering Approach to Computer Networking, Srinivasan Keshav**, 660 pages 1st edition (January 15, 1997), Addison-Wesley Pub Co; ISBN: 0201634422

[Note: Since this is an advanced graduate class, the textbook (though older) is only the starting point for a majority of topics that we will cover. The slides used will cover ideas from a broad range of sources including other books, papers, RFCs etc. The WebCT page and a backup page of the instructor will have online links to resources.]

Recommended Resources:

1. **“Internetworking with TCP/IP Vol. I: Principles, Protocols, and Architecture”**; 5th edition, Douglas Comer, (June 30, 2005), Prentice Hall. ISBN #: 0131876716
2. **TCP/IP Illustrated, Vol 1**; W.R. Stevens, Addison-Wesley professional computing series, ISBN: 0-201-63346-9.

Tentative Grading Percentages

Exams (Quizzes)	50%
(Test 1: 15 points;	
Test 2: 15 points;	
Test 3 (COMPREHENSIVE): 20 points)	
2 Labs: (10 points each)	20%
In-Class Informal Quizzes + Paper Summaries	10%
- Done each week	
- Submitted, but not graded	
- Upto 2 missed submissions will not lead to lost points.	
- No late/make-up submissions: this is in-class work.	
- Each submission has a uniform weight	
Research Case Study	20%

Exam (Quiz) Schedule and Conflicts

Since the **exams will be held during class hours**, you should not have any conflicts. However, if you do have a scheduled conflict for the exam period with a lower-numbered course, see the instructor. There will be **NO make-up exams**. All exams will be **open book/notes**. Exams will typically consist of quantitative problems, design questions, multiple choice (true-false) questions and short answer questions and will focus on concepts. Exams will be extremely time-limited and will cover both text and additional reading material. Exams 1 and 2 will test you on the incremental material covered since the previous exam. Exam 3 will be comprehensive, but it will place extra emphasis on incremental material.

Exam dates:

<i>EXAM 1: February 23rd, 2007</i>	<i>(15%)</i>
<i>EXAM 2: March 30th, 2007</i>	<i>(15%)</i>
<i>EXAM 3: May 1st, 2007</i>	<i>(20%, comprehensive)</i>

Course Delivery Format:

This course will consist of lectures, in-class exercises, informal quizzes, problem sets, a case study and examinations (quizzes).

- **Lectures** will consist of upto 75% of class time. Lectures and other course material will be available online through the instructor's web page. WebCT details will be announced in the first day of class.
- **Informal quizzes** will be handed every class. Informal quizzes will consist of true/false answers that will help probe course material and emphasize important concepts. There is no grading of informal quizzes, but your submissions will be logged as part of your grade (10% of class grade). Each submission has an equal weight, and 1 (one) missed submission is ok. No make up or late submissions allowed. Getting questions on the informal quiz wrong is often a good hint to revisit the underlying concepts.
- **Books, Papers and RFC readings:** The class will involve a fair bit of reading. The reading is meant in part to supplement lectures, help you catch up, and allow lectures to be more focused and interactive. More importantly, research paper readings will also give a historical and research perspective, and convey the authors' excitement of their seminal discoveries/designs.
- **Lab assignments** (one on IP and one on TCP). Each lab assignment comes in the form of a package with files and handouts. The labs essentially consist of Unix OS code placed inside a simulator to simplify your programming, but yet giving you a flavor of real protocol coding. A graphical user interface is provided to help you visualize the protocol concepts, and debug the code you write. Your coded protocol should match the performance of a demo (which is provided in the package) and you need to produce a short report for each lab. Remote students, please double check if you have the software etc to be able to do the labs.
- **Exams** will contain true/false questions, design questions, short-answer or quantitative type questions. Exams will be open-book, but will be extremely time-constrained. Material from slides, text, paper reading and homeworks will be included in the scope of exams.
- **Research Case study** is intended to give you a first hand, in-depth experience in researching a new area in networking. Groups of up to two students are allowed per case study, but a more in depth study and report is expected from groups of two. You will choose from a menu of research topics. Each topic will have a list of mandatory paper readings, followed by a set of other references. Your task is to critique the material, organize it in a framework of your own, and make sound judgments about the past and future directions of work in the topic area. The case study report should be a document no longer than 10 pages. I will expect the case study to be of high quality, reflecting deep understanding, original thinking and be written like a professional technical paper, and will grade it strictly.

- **Bulletin Board:** The WebCT site for the course has a bulletin board that we will use for all course related technical and administrative discussion. The TAs and Instructor will be monitoring the bulletin board and respond promptly to your queries. Please use this facility in preference to sending us emails directly because the entire class can benefit from the discussion.
- **Online Videos of Prior offerings:** available for reference at the instructor's web page (Google: "shiv rpi")