

**Electrical, Computer And Systems Engineering Department**  
**ESCE-6600 Internet Protocols**  
Spring 2006 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**”).

Office: **JEC 6042**

Phone: **276-8979**

Email: [shivkuma@ecse.rpi.edu](mailto:shivkuma@ecse.rpi.edu)

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

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

### **Course Secretary [for all non-RSVP administrative requests]**

Melissa Reardon

Office JEC 6049

Phone: 276-6313

### **RSVP Point-of-contact [ for all RSVP-related administrative requests]**

Nadeen Thompson

Office: CII 4011

Phone: 518 276 8501

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Email: [thompn@rpi.edu](mailto:thompn@rpi.edu)

### **Teaching Assistants:**

Neeraj Jaggi, [jaggin@rpi.edu](mailto:jaggin@rpi.edu), x8289

### **Required Text**

**1. “Internetworking with TCP/IP Vol. I: Principles, Protocols, and Architecture”;** 5th edition, Douglas Comer, (June 30, 2005), Prentice Hall. ISBN #: 0131876716

[Note: Since this is an advanced graduate class, the textbook 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. An Engineering Approach to Computer Networking, Srinivasan Keshav**, 660 pages 1st edition (January 15, 1997), Addison-Wesley Pub Co; ISBN: 0201634422 ;
- 2. TCP/IP Illustrated, Vol 1;** W.R. Stevens, Addison-Wesley professional computing series, ISBN: 0-201-63346-9.

### **Tentative Grading Percentages**

Exams (Quizzes)		<b>50%</b>
( Test 1:	15 points;	
Test 2:	15 points;	
Test 3 (COMPREHENSIVE):	20 points )	
2 Labs: (10 points each)		<b>20%</b>
In-Class Informal Quizzes + Paper Summaries		<b>15%</b>

- 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

**15%**

### **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 15<sup>th</sup>, 2006</i>	<i>(15%)</i>
<i>EXAM 2: March 22<sup>nd</sup>, 2006</i>	<i>(15%)</i>
<i>EXAM 3: May 3<sup>rd</sup>, 2006</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 WebCT site for the course or on 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 weightage, and a budget of 2 missed submissions are 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. This is a new experimental teaching method to increase student involvement in the class.
- **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. Brilliant original thinking which could lead to new research contributions in the area will win up to 5% extra credit.
- **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")

### **General Policies Regarding Graded Material:**

1. The exams and problems sets are based upon lectures and required reading. So that you can plan your time well, a tentative schedule of topics and readings is included on the online WebCT course calendar. The lectures and other course material will also be available through the course calendar on WebCT.
2. Homeworks, labs and case studies should be **submitted online (through WebCT)**. Our policy will be to **return graded material** to you **within one week** of handing it in. To minimize the chances of lost homeworks etc, if we do not have your submitted material you will receive an email within 2-3 days of the submission informing you about it. All issues regarding graded material should be resolved within one week of the date graded material is returned.
3. **Late submission policy (for homeworks & labs):** Any problem set submitted later than this will be marked as late. Any papers not handed at the beginning of class (e.g. slipped under a door, placed in a mailbox) will be marked as late. There will not be a penalty for **upto one** late submission per student (including both homeworks and labs). The second late submission onwards will be each assessed a **penalty of 10%**. Exceptions will require a valid and documented reason (eg: doctor's letter). Late submissions **will NOT BE ACCEPTED after one week of the deadline or the day solutions are made available, whichever is earlier.** There will be no makeups for homeworks or labs.
4. If you feel that an error was made in grading, you should submit a re-grading request to the course secretary (Melissa for on-campus or Nadeen Thompson for off-campus) **WITHIN A WEEK** of the date the graded material was returned to the class. Requests for re-grading or any questions regarding graded material **WILL NOT BE ACCEPTED** after that time. Any graded material that is not picked up within two weeks will be discarded.