ECE 407 - Introduction to Computer Networks with Laboratory

2014 Catalog Data: ECE 407: Introduction to Computer Networks with Laboratory. Credit 4. Emphasis on the physical, data link, and medium access layers of the OSI architecture. Different general techniques for networking tasks, such as error control, flow control, multiplexing, switching, routing, signaling, congestion control, traffic control, scheduling will be covered along with their experimentation and implementation in a laboratory. Credit given for ECE 407 or ECE 408, not both. (3-3-4) (C)(P)

Enrollment: Elective course for CPE and EE majors.


Coordinator: L. Cai, Assistant Professor of ECE

Course goals: After completing this course, the student should be able to do the following:
1. Gain an understanding of the overriding principles of computer networking, including protocol design, protocol layering, algorithm design, and performance evaluation.
2. List the techniques and protocols for communicating between digital computers that were in use historically, are in use currently, or will be in use in the future.
3. Specify the details associated with computer networks in LAN, MAN, and WAN environments, and the many tasks performed by Routers/Gateways and Bridges in these networks.
4. Explain protocol stack implementation and verification, traffic considerations, congestion control techniques, etc.
5. Describe the functionality and significance of Circuit and Packet Switching, the Internet, ATM, VoIP, and other current topics.
6. Understand the specific implemented protocols covering the application layer, transport layer, network layer, and link layer of the Internet (TCP/IP) stack.
7. Prepare an informative and organized design project report
8. Gain pre-requisite knowledge to study advanced topics in computer networking.
9. Perform experiments in the laboratory to verify the operation of protocols.

Prerequisites by topic:
1. Probability and statistics
2. Senior standing

Lecture schedule: Two 75-minute sessions per week.
Laboratory schedule: One 150-minute session per week.

Topics:
1. Overview of computer networks, network architecture, and protocol stack (1 week)
2. Physical layer media, data transmission (1 week)
3. Analog and digital transmission, Multiplexing and switching (1 week)
4. Data link Layer, Framing (1 week)
5. Error Detection and Correction (1 week)
6. Flow control techniques, ARQ protocols (1 week)
7. Medium Access Control protocols (1 week)
8. TDM/FDM techniques and CSMA protocols (1 week)
9. Network layer introduction (1 week)
10. Internet protocol, switching, routing (1 week)
11. Transport layer protocols, TCP and UDP (1 week)
12. Application layer (1 week)
13. Network Security (1 week)
14. Cryptography, Firewalls (1 week)
15. Exams (1 week)

**Computer usage:** Students use the UNIX operating system to configure networks and protocols; students prepare reports using word-processing software.

**Laboratory topics:**
- Introduction to the laboratory (1 week)
- Single segment networks (1 week)
- IP networks with bridges (2 weeks)
- Static routing in IP networks (3 weeks)
- Dynamic routing in IP networks (3 weeks)
- Transport layer protocols (2 week)
- Final exam and project (1 week)

### Relationship of ECE 407 Course Goals to Student Outcomes:

<table>
<thead>
<tr>
<th>Student Outcomes</th>
<th>Course Goals</th>
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<tbody>
<tr>
<td>a. Apply knowledge of math, engineering, science</td>
<td>1,2,3,4,5,6,8,9</td>
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<td>b. Design and conduct experiments /Analyze and Interpret Data</td>
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<td>c. Design system, component, or process to meet needs</td>
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<td>d. Function on multi-disciplinary teams</td>
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<td>e. Identify, formulate, and solve engineering problems</td>
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<td>f. Understand professional and ethical responsibility</td>
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<td>g. Communicate effectively</td>
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<td>h. Broad education</td>
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<td>i. Recognize need for life-long learning</td>
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<td>j. Knowledge of contemporary issues</td>
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<td>k. Use techniques, skills, and tools in engineering practice</td>
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**Prepared by:** L. Cai  
**Date:** Oct. 26, 2014