EE 4321 - Computer Networks

EE Elective Course - Spring 2019

**2018-2019 Catalog Course Description:**
Network classification and services. Protocol and communication architectures. Hardware components: multiplexers, concentrators, bridges, routers, access servers. (3hrs lecture)

**Prerequisites:**
(EE 2325)

**Course Outcomes (Students should …):**
- Understand the basic communication needs and models (a, h)
- Understand the basic framework of network architecture established by the OSI reference model (a, c)
- Learn the system components of the TCP/IP protocol suite (b, c)
- Learn various transmission media (a,e)
- Learn transmission impairments (a,b,c)
- Learn signal encoding schemes. (a,b,e)
- Learn CSMA/CD (a, c, e, j)
- Learn data link control incl. flow control and error detection (a, b, c, j)
- Learn IPv6 (e, j)
- Learn various LAN and WAN technologies (j)
- Learn circuit and packet switching concepts (a, b, c, e)
- Learn Internet protocols and their operations (e, j)
- Learn congestion control (e, k)
- Learn routing algorithms (c, e, k)
- Learn transport protocols (c, e, k)
- Learn how to use the TCP/IP sockets (k, l, n)
- Complete and pass all assigned network programming (g, l, n)
- Pass hands-on network lab experiments (g, n)

(“a through n” are student outcomes)

**Educational Goals:**
Today’s computer communications are no longer limited to data communications between computers; it now integrates voice, fax, video and other information and extends communications to many wired and wireless devices and Internet appliances. This elective course is designed to provide a unified overview of the broad data and computer communications by breaking this massive subject into comprehensible parts.

This course emphasizes basic principles of integrating vast array of network technologies into a unified architecture of computer networks. Layered models including the OSI reference and TCP/IP models serve as the course organization or the basic framework. In the physical layer, the course covers only limited number of technologies such as Ethernet, fiber optics, and spread spectrum. In the upper layers, it covers details of data link control, multiplexing, circuit switching, packet switching, congestion control, routing algorithms, transport, and network layer. This course also includes topics on network security and encryption.

Several group and individual network projects that require TCP/IP network programming are assigned to allow for students experience application of the learned protocols in real-world problems.

**Relationship to EE Program Objectives:**
- This course is one of the EE technical elective courses that provides senior level students to an opportunity to explore advanced topics within the EE areas of specialty.
- Applies fundamentals of communication and protocol principles to computer networks.
- Exposes students to network programming and development of applications.
EE 4321 – Syllabus – Spring 2019 (Draft)

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Office Hours: M, W, F 2:00-4:00PM, web: www.d.umn.edu/~tkwon

Lecture: Room & Time: Chem 155, 11:00-11:50 MWF; Lab Room: MWAH 60


Computer Usage: Several individual or group projects that require network programming. The .net C# language is used as the programming language. The network lab, MWAH 60, is used for network experiments and projects.

Assessment: Attendance: 5%, HW: 7%, Projects: 23%, Midterm: 30% Final: 35%

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<thead>
<tr>
<th>Dates</th>
<th>Topics</th>
<th>Chapters</th>
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<tr>
<td>1/16,18</td>
<td>Basic signal theory in time and frequency review</td>
<td>Chap 3</td>
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<tr>
<td>1/23,25</td>
<td>Transmission impairments</td>
<td>Chap 3</td>
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<tr>
<td>1/28,30,2/1</td>
<td>Transmission media</td>
<td>Chap 4</td>
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<tr>
<td>2/4,6,8</td>
<td>Signal encoding, error detection</td>
<td>Chap 5,6</td>
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<tr>
<td>2/11,13,15</td>
<td>Protocol architectures (OSI, TCP/IP), ALOHA</td>
<td>Chap 2,</td>
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<td>2/18,20,22</td>
<td>CSMA/CD, Ethernet standards, MAC frame</td>
<td>Chap 12,13</td>
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<tr>
<td>2/25,27,3/1</td>
<td>Network layer and inside router, DNS</td>
<td>Note</td>
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<tr>
<td>3/4,6,8</td>
<td>IPv4 packet format, fragmentation, IPv4 addressing</td>
<td>Chap 14, Note</td>
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<tr>
<td>3/4</td>
<td>Midterm Exam</td>
<td>Note</td>
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<tr>
<td>3/18,20,22</td>
<td>DNS, Network programming basics</td>
<td>Note</td>
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<td>3/25,27,29</td>
<td>Asynchronous, multithreaded servers</td>
<td>Note</td>
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<td>4/1,3,5</td>
<td>Error control, flow control, TCP examples</td>
<td>Note, Chap 7</td>
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<td>4/8,10,12</td>
<td>TCP error recovery</td>
<td>Note</td>
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<td>4/15,17,19</td>
<td>Routing algorithms</td>
<td>Chap 19</td>
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<tr>
<td>4/22,24,26</td>
<td>Internet routing, source routing, IPv6</td>
<td>Chap 14,19, note</td>
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<tr>
<td>4/29,5/1,3</td>
<td>Network security, encryption, authentication</td>
<td>Chap 26,27</td>
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5/8 Final Exam, 10:00-11:55am, Wednesday

Outcomes addressed by this course:
(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, components, or process to meet desired needs
(e) An ability to identify, formulate, and solve engineering problems
(g) An ability to communicate effectively in writing and orally
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) A knowledge of computer software and hardware as demonstrated by the Computer Science Minor embedded in the program

Students with disabilities: It is the policy and practice of the University of Minnesota Duluth to create inclusive learning environments for all students, including students with disabilities. If there are aspects of this course that result in barriers to your inclusion or your ability to meet course requirements such as time limited exams, inaccessible web content, or the use of non-captioned videos, please notify the instructor as soon as possible. You are also encouraged to contact the Office of Disability Resources to discuss and arrange reasonable accommodations. Call 218-726-6130 or visit the Disability Resources web site for more information.

Academic Integrity: Academic dishonesty tarnishes UMD’s reputation and discredits the accomplishments of students. Academic dishonesty is regarded as a serious offense by all members of the academic community. UMD’s Student Academic Integrity Policy.

Policy on makeup exam: makeup exams are not provided.