ECE 46300: Introduction to Computer Communication Networks
Fall 2021

1 Course Information

Course Number and Title: ECE 46300, Introduction to Computer Communication Networks
CRN: 57741
Sections: 001
Instructional Modality: Face-to-Face
Lecture Time: Mon, Wed, Fri 9:30–10:20am in EE 170
Course Credit Hours: 3
Prerequisites: ECE 36800 (Data Structures) and proficiency in C and Python
Course Web Page: https://web.ics.purdue.edu/~vshriva/courses/ece46300fa21/index.html
Course Brightspace Page: https://purdue.brightspace.com/d2l/home/336241
Course Piazza Page: https://piazza.com/purdue/fall2021/ece463/home

2 Instructor(s) Contact Information

Instructor
Vishal Shrivastav
Assistant Professor of Electrical and Computer Engineering
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Office Hours: Mon 3–4pm on Zoom

Teaching Assistants (TA)
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Avneet Badwal
Undergraduate TA
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3 Course Description

The goal of this course is to provide students with a proper grounding in the fundamentals of computer networking. The course will cover classic concepts such as Internet architecture, naming and addressing, routing, forwarding, reliability, flow control, congestion control, and socket programming. The later part of the course will introduce students to topics such as secure communication, router architecture, datacenter and software-defined network. The course will also provide students with a hands-on experience of building practical and efficient networked systems and applications through various programming assignments.

4 Course Topics

1. Internet Architecture Principles
2. Data Link Layer – MAC Addressing, ARP, CSMA/CD, Switched Ethernet, MAC Learning, STP
3. Network Layer – IP Addressing, NAT, IP Forwarding, Distance Vector, Link State, BGP, DNS
4. Transport Layer – UDP, TCP Reliability, TCP Flow Control, TCP Congestion Control
5. Application Layer – Web, HTTP, TLS, HTTPS, HTTP/2, QUIC
6. Socket Programming
7. Secure Communication
8. Router Architecture
9. Datacenter and Software-defined Network

5 Prerequisites

Proficiency in C and Python and familiarity with basic data structures (ECE 36800).

6 Learning Resources, Technology, and Texts

1. **Required Material:** Lecture slides on Brightspace.

7 Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated:

1. an understanding of the architectural principles underlying the Internet design.
2. an understanding of the design of various layers in the network stack, including data link layer, network layer, transport layer, and application layer.
3. a familiarity with secure communication, router architecture, software-defined network, and datacenter network.
4. an ability to implement distributed routing, forwarding, and reliability protocols.
5. an ability to implement networked applications using socket interface.
8 Assignments and Exams

Programming Assignments — 50% of the grade
1. PA0: Setting up the Environment [0%]
2. PA1: MAC Learning, Forwarding, and STP [10%]
3. PA2: Distributed Network Routing Protocols [10%]
4. PA3: Reliable Transport [15%]
5. PA4: HTTP Web Client and Server [15%]

In-class Quizzes — 10% of the grade [9 quizzes; each quiz will carry equal credit]

Midterm Exam — 15% of the grade

Final Exam — 25% of the grade

The first two programming assignments (PA1 and PA2) will be in Python and the last two (PA3 and PA4) will be in C. Each programming assignment will be 3 weeks long, and must be done in group of at most two students. Barring extraordinary circumstances (serious medical situations or family emergencies accompanied by verification), no extensions will be granted for assignment submissions. In-class quizzes and exams must be submitted individually. Quizzes will be open-book and students will be allowed to collaborate on the solutions while in class. Midterm and Final exams will be closed-book with no collaboration allowed. Final exam will cover the entire syllabus. Students who are most active (and helpful) in answering questions on Piazza may receive bonus points.

9 Grading Scale

The breakpoints for letter grades will be decided by the instructor at the end of the semester adjusting for the difficulty level of quizzes, programming assignments, and examinations. Normally, the grading follows the trend shown below.

<table>
<thead>
<tr>
<th>Grade</th>
<th>A+</th>
<th>A</th>
<th>A−</th>
<th>B+</th>
<th>B</th>
<th>B−</th>
<th>C+</th>
<th>C</th>
<th>C−</th>
<th>D+</th>
<th>D</th>
<th>D−</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>95+</td>
<td>90+</td>
<td>85+</td>
<td>80+</td>
<td>75+</td>
<td>70+</td>
<td>65+</td>
<td>60+</td>
<td>55+</td>
<td>50+</td>
<td>45+</td>
<td>40+</td>
<td>≤40</td>
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10 Attendance Policy

This course follows Purdue’s academic regulations regarding attendance, which states that students are expected to be present for every meeting of the classes in which they are enrolled. Attendance will be taken at the beginning of each class and lateness will be noted. When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to the instructor is not possible, the student should contact the instructor as soon as possible by email or phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor’s department because of circumstances beyond the student’s control, and in cases falling under excused absence regulations, the student or the student’s representative should contact or go to the Office of the Dean of Students website to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted for cases of grief/bereavement, military service, jury duty, and parenting leave. For details, see the Academic Regulations & Student Conduct section of the University Catalog website. Guidance on class attendance related to COVID-19 are outlined in the Protect Purdue Pledge for Fall 2021 on the Protect Purdue website.
11 Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Programming Assignment</th>
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<tbody>
<tr>
<td>1</td>
<td>Aug 23 – Aug 27</td>
<td>Introduction&lt;br&gt;Background&lt;br&gt;Internet Architecture Principles I</td>
<td></td>
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<tr>
<td>2</td>
<td>Aug 30 – Sep 3</td>
<td>Internet Architecture Principles II&lt;br&gt;<strong>In-class Quiz # 1</strong>&lt;br&gt;Data Link Layer I</td>
<td>PA0 release</td>
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<td>3</td>
<td>Sep 6 – Sep 10</td>
<td><strong>Labor Day Holiday</strong>&lt;br&gt;Data Link Layer II&lt;br&gt;Data Link Layer III</td>
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<td>4</td>
<td>Sep 13 – Sep 17</td>
<td>Data Link Layer IV&lt;br&gt;<strong>In-class Quiz # 2</strong>&lt;br&gt;Network Layer I</td>
<td>PA1 release</td>
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<tr>
<td>5</td>
<td>Sep 20 – Sep 24</td>
<td>Network Layer II&lt;br&gt;Network Layer III&lt;br&gt;Network Layer IV</td>
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<tr>
<td>6</td>
<td>Sep 27 – Oct 1</td>
<td><strong>In-class Quiz # 3</strong>&lt;br&gt;Network Layer V&lt;br&gt;Network Layer VI</td>
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<tr>
<td>7</td>
<td>Oct 4 – Oct 8</td>
<td><strong>In-class Quiz # 4</strong>&lt;br&gt;Network Layer VII&lt;br&gt;Network Layer VIII</td>
<td>PA2 release</td>
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<td>8</td>
<td>Oct 11 – Oct 15</td>
<td>October Break&lt;br&gt;<strong>In-class Quiz # 5</strong>&lt;br&gt;Midterm Exam</td>
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<td>9</td>
<td>Oct 18 – Oct 22</td>
<td>Midterm Exam Recap&lt;br&gt;Transport Layer I&lt;br&gt;Transport Layer II</td>
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<tr>
<td>10</td>
<td>Oct 25 – Oct 29</td>
<td>Transport Layer III&lt;br&gt;Transport Layer IV&lt;br&gt;<strong>In-class Quiz # 6</strong></td>
<td>PA3 release</td>
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<tr>
<td>11</td>
<td>Nov 1 – Nov 5</td>
<td>Transport Layer V&lt;br&gt;Transport Layer VI&lt;br&gt;Transport Layer VII</td>
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<tr>
<td>12</td>
<td>Nov 8 – Nov 12</td>
<td><strong>In-class Quiz # 7</strong>&lt;br&gt;Application Layer I&lt;br&gt;Application Layer II</td>
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<tr>
<td>13</td>
<td>Nov 15 – Nov 19</td>
<td>Socket Programming&lt;br&gt;Secure Communication&lt;br&gt;<strong>In-class Quiz # 8</strong></td>
<td>PA4 release</td>
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<tr>
<td>14</td>
<td>Nov 22 – Nov 26</td>
<td>Thanksgiving Break</td>
<td></td>
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<tr>
<td>15</td>
<td>Nov 29 – Dec 3</td>
<td>Router Architecture I&lt;br&gt;Router Architecture II&lt;br&gt;Router Architecture III</td>
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<tr>
<td>16</td>
<td>Dec 6 – Dec 10</td>
<td><strong>In-class Quiz # 9</strong>&lt;br&gt;Software-defined Network&lt;br&gt;Datacenter Network</td>
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<tr>
<td>17</td>
<td>Dec 13 – Dec 17</td>
<td><strong>Finals Week</strong></td>
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12  Academic Guidance in the Event a Student is Quarantined/Isolated

If you must miss class at any point in time during the semester, please reach out to the instructor via email so that they can communicate about how you can maintain your academic progress. If you find yourself too sick to progress in the course, notify your advisor and instructor via email. They will make arrangements based on your particular situation. Note that, Details for Students on Normal Operations for Fall 2021 announced on Protect Purdue website states, “individuals who test positive for COVID-19 are not guaranteed remote access to all course activities, materials, and assignments”.

13  Classroom Guidance Regarding Protect Purdue

Guidance on classroom protocols related to COVID-19 are outlined on the Protect Purdue website. Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources on Brightspace.

14  Academic Integrity

Unless expressly allowed, students are expected to complete all quizzes, exams, and programming assignments by themselves (or within their chosen group of two for programming assignments). However, students are allowed to discuss general issues with other students (programming techniques, clearing up confusion about requirements, etc.). Students may discuss particular algorithmic issues on Piazza (but do not post or copy code!). If there is any doubt, please contact the instructor. We will be using software designed to catch plagiarism in programming assignments and copying on quizzes and exams. A student is considered in violation of the academic integrity policy regardless of whether they are the one “copying” or the one “being copied from.” Punishments for academic dishonesty are severe, including receiving a failing grade in the course or being expelled from the University. By departmental rules, all instances of cheating will be reported to the Dean of Students. On the first instance of cheating on a programming assignment, quiz, or exam, students involved will receive a 0; the second instance of cheating will result in a failing grade in the course.

Use of Copyrighted Materials: All course materials, including lecture slides and notes, quizzes, programming assignments, examinations, and solutions are subject to Purdue’s copyright policies. Please do not share, distribute, or post any material on an online website without checking with the instructor.

15  Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on our course Brightspace table of contents, under University Policies.
16 Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

17 Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are Mon-Fri, 8am-5pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you are struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

18 TaskHuman Service

TaskHuman offers private, real-time, on-demand, 1-on-1 video calls with wellness coaches covering over 800+ topics such as anxiety, mindfulness, reducing stress, clean eating, time management, in-home workouts, relationship tensions, financial issues, spiritual guidance and many more. You can access these wellness coaches from around the world 24/7. The College of Engineering has an exclusive agreement with TaskHuman which gives you FREE and UNLIMITED access to these resources. Over 3,200 calls have been made by College of Engineering students, staff, and faculty so far with an average satisfaction rating of 4.89/5.

Learn more here: https://engineering.purdue.edu/ECE/TaskHuman.

Download TaskHuman

Scan the QR Code to download the TaskHuman App or download the TaskHuman App directly from the App Store or Google Play Store. Create an account - Go to Setting and tap on “Check for Discounts”, Insert your code: purdue63 Don’t see a topic you want or have other questions? Contact Brooke Parks, Senior Lecturer in ECE, at brookeparks@purdue.edu
19  Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8am–5pm Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the Critical Needs Fund.

20  Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided through Brightspace, Piazza, and/or email. You are expected to check the course page on Brightspace and Piazza, and read your @purdue.edu email on a frequent basis.

Updates and emergency information will be posted on Purdue’s home page. Students are urged to sign up for emergency text alerts. Text message sign up procedures can be found at:
http://www.purdue.edu/securepurdue/

See the University’s web site for additional information:
https://www.purdue.edu/ehps/emergency_preparedness/