CSC/ECE 573 Course Syllabus

CSC/ECE 573 – Internet Protocols

Spring 2024

3 Credit Hours

Course Description

This course deals with the principles and issues underlying the provision of wide area connectivity through the interconnection of autonomous networks. Emphasis will be placed on Internet architecture and protocols as they are today and as they are likely to evolve in the future. Case studies of particular protocols will demonstrate how fundamental principles are applied in practice. They will also provide the opportunity to practice a critical skill: shifting through details for the key idea. The functional requirements of internetworking will be motivated by selected examples of networked client/server applications. The project will give the students a first-hand experience in building networked applications and/or in analyzing and evaluating the performance of protocols and applications.

Learning Outcomes

At the conclusion of the course you should be able to:

1. demonstrate understanding of the fundamental problems, tradeoffs, and design issues that arise in internetworking, as well as identify and critically evaluate internet technologies, solution approaches, and design methodologies for future network architectures;

2. understand the details of several particular protocols, as example implementations of fundamental principles, and digest descriptions of specific protocols, extracting the fundamental concepts;

3. design and implement complex networked applications, protocols, and algorithms, and use the socket interface;

4. apply basic concepts to new networking environments; and

5. (optionally) engage in original research in the area of computer networks.

Course Structure

Primarily lecture based, with two exams, four homework assignments and two projects.

Instructors

Jianqing Liu - *Instructor*
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Web Page: http://www.jianqingliu.net/
Phone: 919-515-2179
Office Hours: 2:15pm to 4:15pm Tuesday, at 2401 Engineering Building 3.

Stuart Pelletier - *Teaching Assistant*
Email: sopellet@ncsu.edu
Office Hours: 1:15pm to 2:15pm Monday, at 2402 Engineering Building 3.

Course Meetings

Lecture

Days: Tuesday and Thursday
Time: 04:30pm - 05:45pm
Campus: Centennial
Location: 1021 Engineering Building 2

Course Materials

Textbooks

Computer Networking: A Top-Down Approach - *James Kurose, Keith Ross*
Edition: 8th
ISBN: 978-0136681557
Web Link: https://www.amazon.com/Computer-Networking-James-Kurose/dp/0136681557/
This textbook is required.

Expenses

None.

URL for Recorded Lectures

https://ncsu.hosted.panopto.com/Panopto/Pages/Sessions/List.aspx#folderID=49377b6d-ea29-4a4b-baf0-b0d50172da75

Requisites and Restrictions

Prerequisites

Experience with the basic principles of computer networks and network programming.

Co-requisites

None.

Restrictions

None.

General Education Program (GEP) Information

GEP Category

This course does not fulfill a General Education Program category.

GEP Co-requisites

This course does not fulfill a General Education Program co-requisite.

Transportation

This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

Safety & Risk Assumptions

None.

Grading

Grade Components

Component	Weightage

4 homework assignments	5% each
2 programming projects	20% each
2 exams	20% each

Letter Grades

This Course uses Standard NCSU Letter Grading:

$97 \leq$ **A+** ≤ 100

$93 \leq$ **A** < 97

$90 \leq$ **A-** < 93

$87 \leq$ **B+** < 90

$83 \leq$ **B** < 87

$80 \leq$ **B-** < 83

$77 \leq$ **C+** < 80

$73 \leq$ **C** < 77

$70 \leq$ **C-** < 73

$67 \leq$ **D+** < 70

$63 \leq$ **D** < 67

$60 \leq$ **D-** < 63

$0 \leq$ **F** < 60

Requirements for Credit-Only (S/U) Grading

Performance in research, seminar and independent study types of courses (6xx and 8xx) is evaluated as either "S" (Satisfactory) or "U" (Unsatisfactory), and these grades are not used in computing the grade point average. For credit only courses (S/U) the requirements necessary to obtain the grade of "S" must be clearly outlined.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at http://policies.ncsu.edu/regulation/reg-02-20-04.

Policies on Incomplete Grades

If an extended deadline is not authorized by the Graduate School, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at http://policies.ncsu.edu/regulation/reg-02-50-03. Additional information relative to incomplete grades for graduate students can be found in the Graduate Administrative Handbook in Section 3.18.F at http://www.fis.ncsu.edu/grad_publicns/handbook/

Late Assignments

Late submissions are not allowed.

Grade Appeal

Appeal to the instructor within one week of grade posting.

Attendance Policy

For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03

Attendance Policy

None.

Absences Policy

Absence from exams and project deadlines will require explicit approval from the instructor.

Makeup Work Policy

No makeup exams will be allowed, except with explicit prior approval from the instructor.

Additional Excuses Policy

None.

Academic Integrity

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01

Academic Honesty

See http://policies.ncsu.edu/policy/pol-11-35-01 for a detailed explanation of academic honesty.

Honor Pledge

Your submission of tests and assignments indicates "I have neither given nor received unauthorized aid on this test or assignment."

Electronically-Hosted Course Components

All materials will be posted on Moodle for the students to access.

Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Suite 304, University College Commons, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01) (https://policies.ncsu.edu/regulation/reg-02-20-01/).

Non-Discrimination Policy

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or http://www.ncsu.edu/equal_op/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Course Schedule

NOTE: The course schedule is subject to change.

Week 1 — 01/08/2024 - 01/15/2024

T: Introduction, course overview (Lec 1)

TH: Internet architecture, network metrics (Lec 2)

Week 2 — 01/15/2024 - 01/19/2024

T: Protocol layers (Lec 3)

TH: Application layer techniques (Lec 4)

Week 3 — 01/22/2024 - 01/26/2024

T: Web proxy, email (Lec 5)

TH: DNS, P2P file transfer-part1 (Lec 6)

Week 4 — 01/29/2024 - 02/02/2024

T: P2P file transfer-part2, Internet video, multiplex (Lec 7)

TH: Socket programming practice, UDP (Lec 8).

Week 5 — 02/05/2024 - 02/09/2024

T: Transport layer, reliability requirement (Lec 9)

TH: TCP basics, flow control-part1 (Lec 10)

Week 6 — 02/12/2024 - 02/16/2024

T: Wellness Day, No Class

TH: flow control-part2, congestion control-part1 (Lec 11)

Week 7 — 02/19/2024 - 02/23/2024

T: congestion control-part2 (Lec 11), midterm review

TH: Midterm Exam, 4:30pm-5:45pm, 1021 Engineering Building 2

Week 8 — 02/26/2024 - 03/01/2024

T: TCP variants-CUBIC and DCTCP (Lec 12)

TH: TCP variants-BBR and PCC (Lec 13)

Week 9 — 03/04/2024 - 03/08/2024

T: Network layer, addressing, and forwarding (Lec 14)

TH: IP, DHCP protocol, NAT protocol (Lec 15)

Week 10 — 03/11/2024 - 03/15/2024

No Class, Fall Break

Week 11 — 03/18/2024 - 03/22/2024

T: Network control/data plane, routing (Lec 16)

TH: shortest path algorithms-part1 (Lec 17)

Week 12 — 03/25/2024 – 03/29/2024

T: shortest path algorithms-part2, autonomous systems (Lec 18)

TH: Intra-/inter-AS routing, BGP (Lec 19)

Week 13 — 04/01/2024 - 04/05/2024

T: Software-defined networks, Openflow (Lec 20)

TH: Mobile IP, ARP protocol (Lec 21)

Week 14 — 04/08/2024 - 04/12/2024

T: Link layer, switch, local area networks (Lec 22)

TH: Link-layer protocols for multiple access (Lec 23)

Week 15 — 04/15/2024 - 04/19/2024

T: Advanced topics: cloud networks (Lec 24)

TH: Advanced topics: edge networks (Lec 25)

Week 16 — 04/22/2024 - 04/26/2024

T: Last day of class, final review

Final Exam

Date: Tuesday, 04/30/2024, 3:30pm-6:00pm

Location: 1021 Engineering Building 2