

CSC/ECE 570 Course Syllabus

CSC/ECE 570 – Computer Networks

Section 651

Summer I 10 Week 2024

3 Credit Hours

Course Description

The aim of this course is to impart to the student an understanding of the fundamental concepts of computer networking, knowledge of the basic taxonomy and terminology of the computer networking area. The students will be introduced to advanced networking concepts, preparing the student for entry to advanced courses in computer networks and telecommunication networks. The students will gain expertise in some specific areas of networking. The stress in the course is on theoretical and conceptual development rather than practical experience with specific technologies.

Some of the topics that will be investigated in class are: General introduction to computer networks. Discussion of protocol principles, local area and wide area networking, OSI stack, TCP/IP and quality of service principles. Detailed discussion of topics in medium access control, error control coding, and flow/congestion control mechanisms. Introduction to networking simulation, security, wireless networking.

Learning Outcomes

Upon satisfactory completion of the course, students will be able to:

1. Describe the OSI and TCP/IP layered protocol architectures.
2. Explain and evaluate the fundamental concepts of circuit-switching, virtual-circuit-switching and packet-switching architectures in wide area networks.
3. Describe and analyze the functions and operations of the physical layer such as modulation and multiplexing.
4. Describe and analyze the functions and operations of the data link layer such as flow control, error detection and correction, and media access protocols.
5. Describe and compare the characteristics of different wired and wireless networked technologies and standards such as Ethernet, WiFi, cellular, Internet of things among others.
6. Explain the security risks associated with communication such as privacy concerns and denial of service attacks.

Course Structure

There are two midterm exams, five homeworks, and a final exam, weighted as follows:

Homeworks: 40%

Midterms: 30%

Final: 30%

Homeworks can be worked out in groups of two (at most)

All exams are cumulative

All exams are closed book and notes (**YOU CAN ONLY BRING ONE A4-SIZED CHEAT-SHEET TO ANY EXAM**)

Course Policies

1. The course Moodle site shows the exams due dates. Please mark your calendars. Makeup exams for missing a test will not be granted without a certified medical excuse or prior instructor approval. Tests missed with certified medical excuses or prior instructor approval will be dealt with individually.
2. Please make sure to resolve any grading issues for a course assignment within a week from the date the grades of this assignment are posted.

Instructors

Dr Khaled Harfouh (kaharfou) - *Instructor*

Email: kaharfou@ncsu.edu

Phone: 919-455-7260

Office Location: Engineering Building II (EB2)

Office Hours: By appointment on Zoom Please use the following Zoom credentials (8536427236, 123456)

Course Meetings

The class lectures are pre-recorded (Spring 2022) and are available on Panopto using the following link
(<https://ncsu.hosted.panopto.com/Panopto/Pages/Sessions/List.aspx#folderID=%2263f9e33c-16a0-4103-a624-adff0185c699%22>)

Course Materials

Textbooks

None.

Expenses

None.

Materials

Douglas E. Comer, Internetworking with TCP/IP: Principles, Protocols, and Architectures , Volume 1, Prentice Hall, ISBN 0-13-018380-6 - 0

This material is optional.

Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill. - 0

This material is optional.

Probability and Random Processes for Electrical and Computer Engineers, by John A Gubner, Cambridge University Press, 2006 (or any other introductory text on probability and stochastic process) - 0

This material is optional.

Douglas E. Comer, David L. Stevens, Internetworking with TCP/IP: Client-server Programming and Applications, Linux/POSIX Sockets Version, Volume 3, Prentice Hall, ISBN 0-13-032071-4 - 0

This material is optional.

Richard Stevens, UNIX Network Programming, Networking APIs: Sockets and XTI, Volume 1, Prentice Hall. - 0

This material is optional.

Richard Stevens, TCP/IP Illustrated, The Protocols , Volume 1, Addison-Wesley. - 0

This material is optional.

R. Perlman, Interconnections: Bridges, Routers, Switches, and Internetworking Protocols, Addison-Wesley. - 0

This material is optional.

IETF documents and RFC pages - 0

This material is optional.

Transportation

This course will not require students to provide their own transportation.

Safety & Risk Assumptions

None.

Grading

Grade Components

Component	Weight	Details
Homeworks	40%	5 homeworks each accounting for 8% of the course grade. Homework exercises can be done in groups of two students. Only one submission per group is needed. Submissions are done on the course Moodle site.
Midterm Exams	30%	Two midterm exams, each accounting for 15% of the course grade. Midterm exams will be conducted online (over Zoom)
Final Exam	30%	The final exam accounts for 30% of the course grade. The final exam will be conducted online (over Zoom)

Letter Grades

This Course uses Standard NCSU Letter Grading:

97 ≤ **A+** ≤ 100

93 ≤ **A** < 97

90 ≤ **A-** < 93

87 ≤ **B+** < 90

83 ≤ **B** < 87

80 ≤ **B-** < 83

77 ≤ **C+** < 80

73 ≤ **C** < 77

70 ≤ **C-** < 73

67 ≤ **D+** < 70

63 ≤ **D** < 67
60 ≤ **D-** < 63
0 ≤ **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 3.17.G at <http://www.ncsu.edu/grad/handbook/index.php>

Late Assignments

Completed assignments should be submitted electronically through **Wolfware** by **11:45PM (15 min before Midnight)** on the due date (See below). It is your responsibility to make sure that your homework is not submitted late. Solutions will be accepted up-to three days after the due date but will receive a maximum grade of 50%. **ONLY ONE SUBMISSION PER GROUP. MAKE SURE THAT NAMES OF ALL GROUP MEMBERS ARE ON THE COVER PAGE.**

Attendance Policy

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

Attendance Policy

Students are expected to attend in full every scheduled lecture. Attendance does not count for grades, but it ensures engagement with the course, which has historically been demonstrated to improve comprehension of material and performance in work products.

Absences Policy

None.

Makeup Work Policy

None.

Additional Excuses Policy

None.

Academic Integrity

Academic Integrity

Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02) (<https://policies.ncsu.edu/regulation/reg-11-35-02/>).

Students are required to comply with the the Code of Student Conduct (NCSU POL11.35.01) and Pack Pledge. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02)

Honor Pledge

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Digital Course Components

Students may be required to disclose personally identifiable information to other students in the course, via digital tools, such as email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

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 Holmes Hall, Suite 304, 2751 Cates Avenue, 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 (NCSU REG 02.20.01) (<https://policies.ncsu.edu/regulation/reg-02-20-01/>)

Non-Discrimination Policy

NC State provides equal opportunity and affirmative action efforts, and prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information as to each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). 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 <https://oied.ncsu.edu/divweb/>. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Institutional Equity and Diversity (OIED) at 919-515-3148.

Additional NC State Rules and Regulations

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

Equal Opportunity and Non-Discrimination Policy Statement
<https://policies.ncsu.edu/policy/pol-04-25-05> with additional references at
<https://oied.ncsu.edu/divweb/policies/>

Code of Student Conduct <https://policies.ncsu.edu/policy/pol-11-35-01>.

Course Schedule

NOTE: The course schedule is subject to change.

Overview — 05/15 - 05/15

Course logistics and expectations

Background — 05/16 - 05/19

Edge vs core network structure

TCP/IP layers

Packet vs Circuit switching

Networking Foundation — 05/20 - 05/26

Electromagnetic spectrum

Bandwidth

Shannon's equation

Fourier Transform

The Physical Layer — 05/27 - 06/02

PHY layer responsibilities

Formatting

Encoding (NRZ, NRZI, Manchester Encoding, 4B/5B and 8B/10B encoding, scramblers)

Modulation

Multiplexing (FDM, TDM, CDM)

PHY Layer Systems — 06/03 - 06/09

Satellite

Public Phone Networks

Mobile Phone Networks

Cable Television

DSL Networks

Fiber-to-the-House

The Data Link Layer — 06/10 - 06/23

Layer 2 responsibilities

Framing (byte count, bit stuffing, byte stuffing)

Addressing

Services levels

Flow control

Error control (error detection and correction)

Media Access (content-based, contention-free, and limited contention protocols)

DLL Systems — 06/24 - 06/30

Ethernet

WiFi

Wimax

Bluetooth

RFID

Data Link Layer Switching — 07/01 - 07/07

Subnetting/Supernetting

VLANs

Learning Bridges/Spanning Tree Bridges

The Network Layer and the Transport Layer — 07/08 -07/14

Routing and forwarding

Fragmentation/reassembly

TCP vs UDP

IoT Technologies — 07/15 - 07/26

Long range vs short range communication

High bit rate vs low bit rate communication

IoT vs other communication systems