

COURSE SYLLABUS

1 ECE 3180 - Computer Networks

2 Meeting Information

3 credits, 3 contact hours (Two 75-minute lectures per week)

a. **Section 001:**

Lecture: MW 1:55 pm - 3:10 pm, **Drosdick 107**

3 Course Instructor(s), TA(s)

a. **Section 001:**

Class Instructor: [Sarvesh Kulkarni](#)

Office Hours: MW 11:30 am - 1:00 pm, or by appt.

TA(s):

Daniel Calabrese dcalabre@villanova.edu

Office Hours: Tue, Thu 11:30 am - 12:45 pm, or by appt.

Room: TBA

4 Textbook

L. L. Peterson and B. S. Davie, *Computer Networks - A Systems Approach, 6th ed.*, Morgan Kaufmann, 2022. ISBN: 978-0-12-818200-0. **REQUIRED.**

a. **Other Supplemental Materials:** Class slides and notes (will be posted on Blackboard)

b. **Misc. Notes:**

If you are in Villanova's Textbook Access Program (students are automatically enrolled) you can access the course e-textbook **AT NO ADDITIONAL CHARGE**. You should have received an email from the Bookstore with instructions on how to access this e-textbook. Please **DO NOT** pay to subscribe. If you have not received access instructions, you must go to the campus book store to resolve the matter.

If you have specifically opted out of Villanova's Textbook Access Program, then you will need to purchase either a physical copy of the textbook, or an electronic one if you can locate it. Do not purchase earlier editions since the page numbers, sections and end-of-chapter problems will not match our assigned reading and homework problems.

5 Specific Course Information

a. **Catalog Description**

ISO/OSI, TCP/IP reference models; data transmission, encoding, framing, error detection, stop and wait, sliding windows; CSMA/CD, Ethernet; bridges, spanning tree protocol; connectionless, connection-oriented and source routing, IP addressing, forwarding, VPNs; switching fabrics; ARP, DHCP, DV, OSPF, BGP, DNS.

b. **Prerequisites:** Electrical & Computer Engr 1260 Or Computer Science 2405; **Co-requisites:** None

- c. Required for B.S. Computer Engineering

6 Learning Objectives

- a. At the conclusion of this course, students are expected to: Acquire a broad understanding of the principles of architectural design and operation of contemporary, wired, packet-switched computer networks; Be acquainted with the hardware, software and design tradeoffs in current-day networks; Understand how network protocols at different levels inter-operate with each other and their role in a much larger world-wide system; Be acquainted with the social, economic and cultural impacts of this world-wide system; Learn the use of common network analysis tools.

b.

ABET Student Outcomes														
1a	1b	2a	2b	2c	2d	3	4a	4b	4c	5	6a	6b	7a	7b
						X	X	X	X					

The above student outcomes are defined by the Accreditation Board for Engineering and Technology (ABET) as:

- 3. an ability to communicate effectively with a range of audiences
- 4a. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global and societal contexts
- 4b. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in economic contexts
- 4c. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in environmental contexts

7 List of Covered Topics

1. The ISO-OSI and the TCP/IP reference models for communication, functions of individual layers, data movement between layers, protocols and their relationship to layers
2. PHY data transmission: wired media and wireless media; basics of modulation; NRZ, NRZI, Manchester and 4B/5B encoding; the Nyquist and Shannon-Hartley theorems (without proof) and their application
3. Data Link layer: framing; error detection using 2-D parity, checksum and Cyclic Redundancy Check (CRC); error recovery - stop-and-wait & sliding window protocols; CSMA/CD and case study of Ethernet; Learning bridges and Spanning Tree Protocol (STP)
4. Network layer: virtual circuits, datagrams, source routing; intra-domain routing algorithms - Distance Vector (DV), Open Shortest Path First (OSPF); inter-domain routing Border Gateway Protocol (BGP); IP addressing with classes, Classless Inter-Domain Routing (CIDR); IP subnets, masks, route lookups; switching fabrics and network processors
5. Protocols - ARP, DHCP; Private communication - Virtual Private Networks (VPNs)
6. Name resolution - Domain Name Service (DNS) architecture, records, and usage
7. Practical Skill 1: Design/implement simple file transfer protocol over UDP by programming in C or C++ using gcc/g++ compiler on Ubuntu Linux

8. Practical Skill 2: Network analysis tools - ping, route, traceroute, ss and wireshark

8 Tentative Schedule

Tentative schedules for all sections follow. Be sure to refer to the schedule for your specific section, if more than one is provided.

Tentative Schedule for **All Sections**

Week #	Dates	Topics of Study
1	1/12 - 1/16	Introduction; common terms; network characteristics & general classification - LAN, MAN, WAN
2	1/19 - 1/23	1/19: MLK Day, no class. Wired & wireless connection characteristics; network topologies; circuit and packet-switching; error classification; services and functions of communication hardware/software; layers, protocols & services; ISO-OSI reference model
3	1/26 - 1/30	TCP/IP reference model; model differences; network evolution; performance measurements and metrics; delay-bandwidth product and its significance
4	2/2 - 2/6	Wed, 2/4: Quiz 1 (moved from Mon to Wednesday due to snow day); ping tool; PHY layer: transmission media & their characteristics
5	2/9 - 2/13	Information theory: Nyquist and Shanon-Hartley theorems with examples; data transmission: modulation, encoding
6	2/16 - 2/20	Mon, 2/16: Quiz 2; DL layer: framing; error detection: parity, checksum, CRC
7	2/23 - 2/27	Open free-form discussion: ethical, societal, global and economic impacts; Wed, 2/25: Midterm Exam
8	3/2 - 3/6	Spring break, no classes
9	3/9 - 3/13	Error recovery with ARQ: stop-and-wait & sliding window protocols
10	3/16 - 3/20	Ethernet, channel access using CSMA/CD; intro to switching/routing
11	3/23 - 3/27	Mon, 3/23: Quiz 3; ISO-OSI switching/routing: datagram, VC, source-based; learning bridges
12	3/30 - 4/3	Bridges contd: STP Protocol for breaking loops; Internet layer (IP): protocol, packet format, fragmentation / defragmentation, addressing (classes, public & private). IP protocol details: packet forwarding, masks & subnets
13	4/6 - 4/10	4/{6} Easter break, no class. IP protocol details (contd.): solved subnetting example, CIDR, Related protocols: ARP, DHCP
14	4/13 - 4/17	Mon, 4/14: Quiz 4; Related protocols (contd.): ICMP; IP tunnels & VPNs, IP routing: DV, OSPF, BGP
15	4/20 - 4/24	DNS: system architecture & records
16	4/27 - 5/1	Switching fabrics; network processors
17	5/4 - 5/8	Final review (if time permits) 5/4: final class day; 5/5: reading day Final Exam: Fri, 5/8 from 11:30 am - 2:00 pm in Drosdick 107 (Our classroom)

9 Grading Policy

Homework: 25% weightage

Quizzes: four quizzes, 20% total weightage

Midterm Exam: 25% weightage

Final Exam: 30% weightage

A single final composite score (out of 100) will be computed from the above weighted components. This composite score will be converted to a letter grade as follows: A student with a composite score of 90+ will receive an *A* grade while a student with a composite score of less than 50 will receive an *F* grade. A grading curve will apply to all scores between 50 and 90 that reflects a class average of *B*.

10 HW Assignment and Laboratory Report Submission Policy

HW assignments must be uploaded to “**Blackboard**” by the posted deadline. Late assignments/reports will be assessed a 10% penalty per day, up to the cut-off date (usually three days later). After the cut-off date, assignments/reports WILL NOT be accepted. You may turn in incomplete work to receive partial credit.

You may work in groups and discuss your general solution approaches with others. However, you may not show each other your written solutions or share the details of your work. Code sharing is forbidden. You may NOT use AI code generation tools at any point in any assignment.

Be sure to maintain a working Linux partition on your laptop with functional *C* and *C++* compilers (i.e. `gcc & g++`). And do backup your work - your grade depends on it!

11 Attendance Policy

General Rules

The full version of the official Villanova class attendance policy is posted at <https://live-villanova-catalog.cleancatalog.io/class-attendance>, but the main points are as follows.

A roll call will not be taken at the start of each class. However, you are expected to attend ALL classes unless officially excused. Since examination questions will be based on the material taught in class and the prescribed reading from the course textbook, missing classes will put you at a severe disadvantage. So, attend all classes, and be sure to take notes attentively.

Whenever possible, students should inform the instructor if they plan to be late or absent from class. In all cases, documentation is required to petition for *excused* absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. The excused absence form is posted on this page: <https://villanova.sharepoint.com/teams/COECurrentUndergrads/SitePages/Catalog.aspx> under the heading “Engineering Academic Policies and Forms”.

Excused absences do not count towards a failure in the course for first year students. Absence from class does not release the student from assigned work. Students who miss an in-class obligation such as an exam, a presentation, etc., due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement. In the case of illness or injury, the form must be submitted within 24 hours of missing a class. The University’s list of excused absences for all students includes the following:

1. Participation in NCAA athletic competitions

2. Participation in special academic events such as: conferences, field trips, project competitions, etc., and in official university business such as student representatives attending meetings related to university governance
3. Attendance at significant events of the immediate family such as: funerals, weddings, etc.
4. Religious holidays - see the University's policy on Religious Holidays
5. College-approved participation in placement activities such as: job interviews, graduate school interviews, job fairs
6. Legally required absence such as: jury duty, court appearance, short-term military service
7. Documented serious illness or disability

Personal Days

Personal Days are NOT allotted for laboratory sessions and courses that meet once a week. For all other courses that meet at least twice a week, students are entitled to excused absences for any reason that may contribute to their personal wellness. The following rules apply.

Students must advise the instructor by email *before* class of their intent to utilize a Personal Day as the reason for their absence. A Personal Day will not be approved retroactively. Students may, but are not required, to provide additional information regarding their absence. A Personal Day does not grant an automatic extension for items due. Students remain responsible for all assignments, exams, presentations, etc. due on that date. The instructor may apply her/his discretion on a case-by-case basis to determine whether an extension on a deliverable item is appropriate.

For classes that meet thrice a week (50 mins \times 3), TWO personal days are allowed in the semester. These personal days may not be used ...

1. on consecutive class days
2. in the same week
3. immediately preceding or following a University holiday or break period, and
4. on days when exams, presentations or other major assignments are scheduled.

For classes that meet twice a week (75 mins \times 2), ONE personal day is allowed in the semester. This personal day may not be used ...

1. immediately preceding or following a University holiday or break period, and
2. on days when exams, presentations or other major assignments are scheduled.

12 Examination Policy

The College of Engineering has adopted the following general examination guidelines:

1. Students must arrive before the start of the examination. Under exceptional circumstances a student may need to arrive late, but he/she can enter the examination room no later than 5 minutes after the start of the exam.
2. All cell phones and smart devices must be turned off and stored away until the student exits the exam room, unless explicitly permitted by the instructor.
3. The official [Villanova class attendance policy](#) must be followed when requesting excuses for absences or lateness to an examination.
4. Each student must write and sign the following statement, "I have neither given nor received any unauthorized assistance in the completion of this examination."

5. In the case of virtual exams, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will announce ahead of time to students if they plan to use any form of video proctoring during an assessment and whether a recording will take place.

13 Academic Integrity Policy

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs. The University's academic integrity policy can be found on the following web page:

<https://live-villanova-catalog.cleancatalog.io/academic-integrity-0>.

14 Use of Artificial Intelligence

The use of AI-generated textual content, mathematical analyses or program code is NOT permitted in this course. If questions arise about the authorship of your work, you may be asked to verify your authorship by either submitting to an oral examination/assessment by the instructor, or by submitting evidence of your work in the form of drafts, notes and version histories.

15 Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to university regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

16 Inclusive Classroom

This classroom is a place where you will be treated with respect; we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment to allow all among us to learn and flourish.

17 Students with Disabilities

It is the policy of the university to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability (non-physical) please register with the office of [Learning Support Services \(LSS\)](#) by emailing Learning.support.services@villanova.edu or by phoning 610-519-5176 as soon as possible. Registration is *required* in order to receive accommodations. In addition, please contact the instructor during office hours in order to make the appropriate arrangements.

The [Office of Disability Services \(ODS\)](#) collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities at 610-519-3209 or visit the office on the second floor of the Connelly Center.

18 Tutoring Services

Villanova’s tutoring services include [The Writing Center](#), [The Learner’s Studio](#), and [The Center for Speaking and Presentation](#). These services are offered free of charge to students. Drop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length.

Register for an account and book sessions in advance at villanova.mywconline.com. If you don’t see your class listed, request a tutor for a missing subject at: tutorrequest.villanova.edu For more information, contact Juliana Struder at juliana.studer@villanova.edu or at 610-519-5862.

19 Online Expectations

Some or all sessions of this class may be recorded for educational purposes and for later playback. In order to foster a professional environment, please wear appropriate clothes, refrain from eating, mute your microphone when you are not talking so as to eliminate background noise, and select an appropriate setting free of distractions. You may turn off your webcam for privacy reasons unless explicitly instructed not to do so by the instructor (such as during the conduct of online examinations).

20 Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, calculators, etc., during class is generally allowed, unless their use causes a disturbance to others. During examinations, the use of any electronic device is prohibited, unless it is expressly authorized by the instructor.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University’s Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

21 Copyright Policy

The materials used in Villanova University courses (“Course Materials”) generally represent the intellectual property of course instructors, third parties and/or the university which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and

presentations such as lectures, videos, slides, etc., provided by a course instructor. Course materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in “Blackboard” are copyrighted materials. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g. uploading to websites, sale, exchange, etc.) without the permission of the copyright owner.

Follow these links for more information on [Intellectual Property](#), [Copyright](#), and [Computer Acceptable Use](#).

22 Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results... to name just a few commitments.