

## **CSC335-W1**

### **Computer Networks**

Fall 2021

Instructor	:	Suleyman Uludag
Lecture	:	Mondays & Wednesdays, 14:30 - 15:45 (over zoom, to join <a href="https://umich.zoom.us/j/91959750032">https://umich.zoom.us/j/91959750032</a> Meeting ID: <b>919 5975 0032</b> Password: <b>335_F2021</b> )
Modality	:	Synchronous Online ( <a href="https://sis.umflint.edu/prod/bwckschd.p_disp_dyn_sched">https://sis.umflint.edu/prod/bwckschd.p_disp_dyn_sched</a> )
Credit Hours	:	3 credits
Schedule Number	:	10902
Prerequisites	:	<u>CSC 275</u> or <u>CSC 276</u> required, <u>MTH 118</u> or <u>122</u> recommended.
Office Hours	:	Mon → 12:45 - 13:45, Tue → 9:00 - 10:00, Wed → 20:45 - 21:45, (over zoom, to join <a href="https://umich.zoom.us/my/uludag.office.hours">https://umich.zoom.us/my/uludag.office.hours</a> or <a href="https://umich.zoom.us/j/6175942020">https://umich.zoom.us/j/6175942020</a> , Meeting ID: <b>617 594 2020</b> Password: <b>SU_F2021</b> ) or by appointment via email
Office Phone	:	Disconnected, please use Google Chat: <a href="https://chat.google.com">chat.google.com</a>
Web Page	:	<a href="http://canvas.flint.umich.edu">http://canvas.flint.umich.edu</a> (all class material)
E-mail	:	<a href="mailto:uludag@umich.edu">uludag@umich.edu</a>  <i>[Anticipated response time is 24 hours M-F, business days. Usually much faster including weekends]</i>
Textbook	:	Panko & Panko Business Data Networks and Security, 11 <sup>th</sup> edition, 2020, Pearson, ISBN-13: 9780134817125 [Required] <u><a href="#">Pearson textbook link</a></u> , <u><a href="#">Author's textbook online resources link</a></u>

**Catalog Course Description:**

([https://sis.umflint.edu/prod/bwckctlg.p\\_disp\\_course\\_detail?cat\\_term\\_in=202110&subj\\_code\\_in=CSC&course\\_numb\\_in=335](https://sis.umflint.edu/prod/bwckctlg.p_disp_course_detail?cat_term_in=202110&subj_code_in=CSC&course_numb_in=335))

Theoretical concepts necessary to understand the complex problem of computer networking. Computer network architectures and models, bandwidth limitations of physical media, analog and digital signaling methods, data link protocols, error detection and correction, medium access control in broadcast networks, routing algorithms, internetworking, the Internet Protocol, connection management, transport services including TCP/UDP, network applications, local-area and wide-area networks. [*Graded ABCDE*]

**Course Description:**

This course covers topics/concepts necessary for understanding data communications, computer networking and telecommunications with security. From the more theoretical perspective, the broad categories of material to be covered are layered network architectures, data communications fundamentals, wide and local area networks including wireless, network protocols, applications and security. An emerging need for providing networking infrastructure for the aging Power Grid, aka Smart Grid, may also be discussed, time permitting. From the practical perspective, the class will have discussions of state-of-the-art trends, technologies, products and approaches from academic publications and industry trade magazines to reinforce the theoretical concepts and relate the textbook material to real-world phenomena. Hands-on lab exercises will also be used.

**Course Objectives:**

- 1) Providing the student a solid foundation on the fundamentals of data communications, communications networks and computer networks with security.
- 2) Understanding of computer communications protocol architectures and their principles,
- 3) Familiarizing with the basic principles and topics of wide and local area as well as wireless network technologies,
- 4) Understanding of a good portion of the crucial building blocks of the current Internet data communications protocols, including the study of IP, TCP, UDP and its routing infrastructure,
- 5) Studying the inner workings and details of the Internet applications such as email, HTTP, DNS, VoIP, SIP, etc.
- 6) Laying the technical information infrastructure for the CIS/CSC students to facilitate them to have a holistic view of the business decisions involving the

Information Technology and especially the computer networking and telecommunications.

- 7) Hands-on lab exercises and/or case studies will be used throughout the course to highlight the practical dimensions of the topics and concepts.

**Student Learning Outcomes:** (Based on Bloom's taxonomy of cognitive domain as marked in parenthesis after each learning outcome: Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York: David McKay Company)

- 1) The students will describe layered protocol architectures with respect to OSI and TCP/IP reference models and list the protocol functions at each layer, (knowledge)
- 2) The student will name the communications cabling alternatives today with their characteristics, (knowledge)
- 3) The student will select appropriate IP addressing distribution based on the business needs of the organizations, (knowledge)
- 4) The student will compare and contrast circuit switching and packet switching principles as they apply to the WAN, (comprehension)
- 5) The student will explain the motivation for running all network applications, including voice (VoIP), video (IPTV), over the IP networks, (comprehension)
- 6) The student will summarize the underlying paradigms of the Internet applications, (comprehension)
- 7) The student will calculate and compute IP address subnetting to distribute a given IP address class among multiple departments of a company, (application)
- 8) The student will demonstrate such basic networking tasks by means lab exercises, (application)
- 9) The student will analyze case studies and apply the course material to come up with solutions to technical needs of organizations, (analysis)
- 10) The student will discuss and report on the cutting-edge trends and technologies by staying abreast of the hot topics in the industry trade magazines, (synthesis)
- 11) The student will report and present material in the class to improve their communication skills, (synthesis)
- 12) The student will analyze the network trace data collected by network sniffer software (ethereal or Wireshark), categorize it and distinguish different protocols and their constituent functions via subfields, (analysis and application)
- 13) The student will evaluate competing as well as emerging networking technologies and criticize them, (evaluation)

The student learning outcomes above will be achieved by means of reading assignments from the book as well as from different sources including the trade magazines, lecture slides, lectures, homeworks, hands-on exercises, exams and in-class presentations.

### Tentative Schedule:

Date	Topic	Reading	Assignments
8/30	Introduction	-	-
9/1	Core Network Concepts and Terminology	Ch. 1	-
9/6	Labor Day - No Class	-	-
9/8	Core Network Concepts and Terminology	Ch. 1	#1 assigned
9/13	Network Standards	Ch. 2	-
9/15	Network Standards	Ch. 2	#1 due, #2 assigned
9/20	Network Management	Ch. 3	-
9/22	Network Management	Ch.3	#2 due
9/27	Network Security	Ch.4	-
9/29	Exam I		
10/4	Network Security	Ch.4	-
10/6	Managing the Security Process	Appendix	#3 assigned
10/11	Fall Break - No class	-	-
10/13	Ethernet (802.3) Switched LANs	Ch. 5	-
10/18	Ethernet (802.3) Switched LANs	Ch. 5	#3 due
10/20	Wireless LANs - I	Ch. 6	#4 assigned
10/25	Exam II		
10/27	Wireless LANs - I	Ch. 6	-
11/1	Wireless LANs - II	Ch. 7	#4 due
11/3	Wireless LANs - II	Ch. 7	#5 assigned
11/8	TCP/IP Networking - I	Ch. 8	-
11/10	TCP/IP Networking - I	Ch. 8	#5 due, #6 assigned
11/15	TCP/IP Networking - II	Ch. 9	-
11/17	Exam III		
11/22	TCP/IP Networking - II	Ch. 9	#6 due
11/24	Thanksgiving Recess		
11/29	Carrier Wide Area Networks (WANs)	Ch. 10	#7 assigned
12/1	Carrier Wide Area Networks (WANs)	Ch. 10	-
12/6	Networked Applications	Ch. 11	# 7 due
12/8	Networked Applications	Ch. 11	-
12/15 Wed	Final Exam (13:30 - 16:00)^	-	-

^ [UM Flint Fall 2021 Official Calendar](#) [Fall 2021 Final Exam Schedule](#)

### Assessment of Student Learning Outcomes:

Assignments (7 Labs or Homeworks)	28%
Three Exams	33%
Peer Assessment	3%
Individual Class Presentation	6%
Final Exam or research paper project w/proposals due by 10/7	30%

Class Presentation → ~ **15-minute presentations** (13 to 17 minutes). The presentation slots will be posted at BB soon. Some potential topics are listed below. A full list that will be updated throughout the semester will be posted at BB under "Presentations".

- 1) IP Design Philosophy (Clark, ACM Sigcomm 1988)
- 2) Rethinking the design of the Internet (Blumenthal & Clark) 2001 ACM ToIT
- 3) Brief History of the Internet
- 4) Virtualization, Network Function Virtualization
- 5) Crowdsourcing and crowdsharing of Big (Internet) Data
- 6) Virtual Private Networking
- 7) Metro Ethernet
- 8) Information centric networking
- 9) Wireless Mesh Networks (WMN) (must choose a specific sub-topic)
- 10) Wireless Sensor Networks (must choose a specific sub-topic)
- 11) Network Access Control (NAC)
- 12) Localization
- 13) Wireless Security (IEEE 802.11)
- 14) IEEE 802.11n and upcoming WiFi standards including 802.11ac and 802.11ad
- 15) Smart Grid Zigbee Standard
- 16) IEEE 802.15, 802.16, WiMax
- 17) Storage Area Networks (SAN)
- 18) Spams, bloatware, adware, spyware, malware, etc.
- 19) Anonymous surfing, privacy problems,
- 20) Browser wars: FF, IE, Opera, Safari, and now Google's Chrome
- 21) Network Identity management, OpenID
- 22) Disaster Recovery, hot site, warm site, cold site, etc.
- 23) VoIP, IPTV, SIP, Convergence
- 24) MPLS
- 25) Location-based services
- 26) WAN Optimization
- 27) Windows Server 2012 features; compare and contrast to competition & Windows 2008, W2K3 Server
- 28) Energy-aware communications, green networking and IT
- 29) Grid Computing and clusters



- 30) MIMO-based networking
- 31) Underwater networks
- 32) Body area networks, Ubiquitous Body Sensor Networks
- 33) Network Calculus
- 34) Network Coding
- 35) Vehicular Internetworking (Intelligent Vehicular Communication Systems), Automotive networking
- 36) Cognitive Radio Networks, Software Defined Radios, IEEE 802.22
- 37) Network Science
- 38) Traffic Engineering
- 39) Energy harvesting in wireless networks
- 40) Bio-inspired Wireless Networks
- 41) NetFPGA
- 42) ID/locator split for IP routing
- 43) Computer Network Forensics
- 44) Security and Privacy in RFID systems
- 45) Wide-area Data Services
- 46) DNS vulnerabilities
- 47) Networking and other computing certificates
- 48) IEEE 802.11r (Fast Handoff)
- 49) Disruption-tolerant Networks
- 50) 3G, 4G, 5G, LTE Cellular networks
- 51) Fiber Access systems (EPON, GPON, etc.) FTTH, Fiber to the curb, etc, last-mile fiber technologies
- 52) Broadband power line
- 53) Nano-scale Networking
- 54) Energy aware Internet Routing
- 55) Network Technologies for assistive living (health care related)
- 56) Cloud Computing
- 57) Wireless Gigabit
- 58) Android SDK (Networking perspective)
- 59) iPhone SDK (Networking perspective)
- 60) Peer to Peer File sharing and darknets
- 61) Social Networking (facebook, myspace, twitter, etc.)
- 62) Broadband access, US and world survey
- 63) IEEE 801.11k (Radio Resource Management)
- 64) Femtocell (small cellular base station)
- 65) Future of Ethernet
- 66) Smart Grid Wireless communications
- 67) Content Distribution Networks
- 68) Tor (aka The Onion Router)
- 69) Secure email and its applications
- 70) Secure Multiparty Communications
- 71) Blind signature
- 72) Smart Cities
- 73) Vehicle-2-Grid (V2G), G2V
- 74) Smart Grid Security
- 75) Power Grid Control Center Communications
- 76) Smart Grid Networking Privacy
- 77) Government digital snooping
- 78) Internet of Things (IoT)
- 79) Machine to Machine Communications

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|---|--|
| 80) Networking for Single-board Computers (Raspberry PI, Arduino, BeagleBone, etc.) | 96) Network Lifetime Optimization in Wireless Sensor Networks                                  |
| 81) Connected vehicles  | 97) UAVs and Flying ad hoc networks (FANETs)   |
| 82) Software Defined Networks, OpenFlow   | 98) Key management, public key infrastructures, certification, revocation, and authentication  |
| 83) IEEE 802.11s (Mesh Networking)  | 99) Security and privacy in smart cities, smart and connected health, IoT, and RFID systems    |
| 84) Cryptocurrencies (Bitcoin, etc.)  | 100) Networking aspects of ubiquitous computing, including Internet-of-Things and Smart Cities |
| 85) Network Function Virtualization   | 101) Networking aspects of online social networks  |
| 86) Data Science and analytics for Network Management                               | 102) Peer-to-peer and overlay networks for infrastructureless communication                    |
| 87) Distributed Denial of Service Attacks and DoS                                   | 103) Cloud-Assisted Networking   |
| 88) Security and Privacy in Big Data  | 104) Airborne Communication Networks   |
| 89) Knowledge Centric Networking  | 105) Networking aspects of datacenters and cloud computing                                     |
| 90) Smart City : Networking, Privacy, Security                                      | 106) Challenged networks (e.g., disaster relief and emergency management)                      |
| 91) Machine Learning for Networks   | 107) Security/trust/privacy topics in emergency scenarios                                      |
| 92) Communication and networking aspects of cyber-physical systems                  |  |
| 93) Anomaly detection, network monitoring and forecasting                           |  |
| 94) Edge computing and distributed computing over networks                          |  |
| 95) Network games, network economics  |  |

For the topic, the student must do a search on the following digital libraries: (1) Google, (2) Google Scholar (<http://scholar.google.com/>), (3) IEEE Xplore (<http://ieeexplore.ieee.org/>), (4) ACM Digital Library (<http://acm.org/dl>), (5) CiteSeer (<http://citeseer.ist.psu.edu/>). The student has to pick papers from IEEE and/or ACM publications or other major academic publishers (Springer, Elsevier, etc.). The UMF has full text access to IEEE Xplore and ACM full text. To access any other papers you cannot access, please email me and I will get them to you, or you can get them from AA campus through interlibrary loan. Any other topic must be approved by me well before the intended presentation date. **Email is required for signing up to a topic and date.** **You must include the topic, initial list of papers with complete citations (at least one paper required) with pdf copies of the papers attached, day, and slot in your email.** Timestamp of the email header will be used for implementing the FIFO rule. **You must email for scheduling a date at least one week before the requested presentation slot.**

Peer Assessment means that each student will be grading all the presentations based on a standardized rubric. You must email your score for the presentations within one week of the date of the presentation.

Everyone is assumed to be taking the final exam by default. The deadline for switching to a project in lieu of final must be communicated to the instructor in written format (i.e. email) and the approval must be obtained by 10/7. Details to be provided...

**Grading Scale: (inclusive)**

A+	97-100
A	92-96
A-	90-91
B+	88-89
B	82-87
B-	80-81
C+	78-79
C	72-77

C-	70-71
D+	68-69
D	60-67
E	0-59

Grading may be curved if the class performance warrants it. Curving can only improve grades from the grading scale above.



**Prerequisites:** CSC 275 or CSC 276 required, MTH 118 or 122 recommended.

**Homeworks:**

- ✓ Although you are allowed and even encouraged to discuss the general concepts behind the assignments with your classmates you **MUST** complete them alone; no collaboration is permitted.
- ✓ Unless otherwise instructed, all homeworks / lab reports should be neatly typed with a cover page identifying the name, assignment number, course name and date.
- ✓ No late homeworks will be accepted.
- ✓ No email submission of homeworks is accepted.

**Academic Integrity** (<https://catalog.umflint.edu/content.php?catoid=29&navoid=3162>)

Intellectual integrity is the most fundamental value of an academic community. Students and faculty alike are expected to uphold the highest standards of honesty and integrity in their scholarship. No departure from the highest standards of intellectual integrity, whether by cheating, plagiarism, fabrication, falsification, or aiding and abetting dishonesty by another person, can be tolerated in a community of scholars. Such transgressions may result in action ranging from reduced grade or failure of a course, to expulsion from the University or revocation of degree.

It is the responsibility of all students and faculty to know the policies on academic integrity in the instructional units at the University of Michigan-Flint. Information about these policies and the appeals process is available from the appropriate administrative office of the instructional units: in the College of Arts and Sciences, the Office of the Dean of the College of Arts and Sciences; in the School of Education and Human Services, the Office of the Dean of the School of Education and Human Services; in the School of Management, the Office of the Dean of the School of Management; in the School of Health Professions and Studies, the Office of the Dean of the School of Health Professions and Studies and for graduate students, the Office of the Dean of Graduate Programs.

Departments and programs within these instructional units may have specific policies and procedures which further delineate academic integrity. In such cases students are bound by the University policy on academic integrity as well as these department or program policies.

**Procedural Rights of the Accused Student.** A student who is charged with academic dishonesty by an instructor, administrator, or another student may be assured that he/she has the right to a fair hearing of the charges and the evidence, the right to question witnesses, to invite witnesses on his/her behalf, and to introduce whatever other evidence may be relevant to the charge.

**Code of Academic Conduct.** The University, like all communities, functions best when its members treat one another with honesty, fairness, respect, and trust. Therefore, an individual should realize that deception for the purpose of individual gain is an offense against the members of the community. Such dishonesty includes:

**Plagiarism:** taking credit for someone else's work or ideas, submitting a piece of work (for example, an essay, research paper, assignment, laboratory report) which in part or in whole is not entirely the student's own work without fully and accurately attributing those same portions to their correct source.

**Cheating:** using unauthorized notes, or study aids, or information from another student or student's paper on an examination; altering a graded work after it has been returned, then submitting the work for regrading; allowing another person to do one's work, then submitting the work under one's own name.

**Fabrication:** fabricating data; selectively reporting or omitting conflicting data for deceptive purposes; presenting data in a piece of work when the data were not gathered in accordance with guidelines defining the appropriate methods of collecting or generating data; failing to include a substantially accurate account of the method by which the data were gathered or collected.

**Aiding and Abetting Dishonesty:** providing material or information to another person when it should reasonably be expected that such action could result in these materials or information being used in a manner that would violate this code of academic integrity.

**Falsification of Records and Official Documents:** altering documents affecting academic records; forging a signature of authorization or falsifying or omitting necessary information on an official academic document, election form, grade report, letter of permission, petition, or any document designed to meet or exempt a student from an established College or University academic regulation; falsification or unauthorized altering of information in any official academic computer file.

**Identity Theft:** Assuming another person's identity or role through deception or without proper authorization. Communicating or acting under the guise, name, identification, email address, signature, or indicia of another person without proper authorization, or communicating under the rubric of an organization, entity, or unit that you do not have the authority to represent.

**Misrepresentation and Other Acts of Academic Dishonesty:**

Fraudulently obtaining and/or using academic materials that would give oneself an unfair advantage over other students or would deceive the person evaluating one's academic performance.

**Attempts.** An attempt to commit an act prohibited by this code may be punished to the same extent as a completed violation.

**Accessibility Issues:**

(<https://www.umflint.edu/disabilitysupportservices>)

It is my intention to support the full participation of all students in the learning process of this class. Students with disabilities that may restrict their full participation in course activities are encouraged to meet with the instructor or to contact the Office of Accessibility Services (part of the Student Development Center, located at UCEN 264 University Center, 762-3456).

**Disability Statement:**

(<https://www.umflint.edu/disabilitysupportservices/syllabus-statement>)

"The University of Michigan-Flint strives to make learning experiences as accessible as possible and complies with Section 504 of the Rehabilitation Act of 1973 and the American with Disabilities Act. The university provides individuals with disabilities reasonable accommodations to participate in educational programs, activities, and services. Students with disabilities requiring accommodations to participate in class activities or meet course requirements must self-identify with Disability and Accessibility Support Services as early as possible at (810) 762-3456 or [dassflint@umich.edu](mailto:dassflint@umich.edu). The office is in 264 University Center, inside the CAPS Office. Once your eligibility for an accommodation has been determined you will be issued an Accommodation Letter. Please present this letter to each faculty member in each class at the beginning of the term, or at least two weeks prior to the need for the accommodation (test, project, etc.)."

**Available Support Services:**

There is a plethora of support services available to students from tutoring to mental health services. Many times, students are unaware of the services available to them. One such service is tutoring:

<https://www.umflint.edu/studentsuccess/tutoring#tab-individual-tutoring>

For other services, please check Student Success Center at

<https://www.umflint.edu/node/11634>

**Religious Holiday Accommodation:** ([https://catalog.umflint.edu/content.php?catoid=29&navoid=3220#Religious\\_Holidays](https://catalog.umflint.edu/content.php?catoid=29&navoid=3220#Religious_Holidays))

Although the University of Michigan, as an institution, does not observe religious holidays, it has long been the university's policy that every reasonable effort should be made to help students avoid negative academic consequences when their religious obligations conflict with academic requirements. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the coursework required during the period of absence. Students who expect to miss classes, examinations, or other assignments as a consequence of their religious observance shall be provided with a reasonable alternative opportunity to complete such academic responsibilities. It is the obligation of students to provide faculty with a reasonable notice of dates of religious holidays on which they will be absent. Such notice must be given by the end of the fourth week of the Fall or Winter semester or by the end of the third week of the Spring or Summer semester. Students who are absent on days of examinations or class assignments shall be offered the opportunity to make up the work, without penalty, unless it can be demonstrated that a make-up opportunity would interfere unreasonably with the delivery of the course. Should disagreement arise over an aspect of this policy, the parties involved should contact the Department Chair, Dean of the College or School, or Ombuds. Final appeals will be resolved by the Provost.

**Notes:**

I reserve the right to modify course policies, the course calendar, assignment point values, and due dates with the main goal of making things easier for the students. I must note that I rarely make changes. Any extenuating circumstances that hinder your participation in the course should be discussed with me as soon as those circumstances are known. Make-ups for graded activities may be arranged if an absence is caused by documented illness or personal emergency. A written explanation, including supporting documentation, must be submitted to me; if the explanation is acceptable, then an alternative to the graded activity will be arranged. Whenever possible, make-up arrangements must be completed prior to the scheduled activity.

**Important Dates:**

(<https://www.umflint.edu/registrar/academic-calendar/#tab-fall-2021>)

- ❖ The last class drop date with 100% tuition refund is Sep 13<sup>th</sup>, 5pm.
- ❖ The last day to withdraw from the term (drop all) with 1/2 tuition is Oct 8<sup>th</sup>, 5pm.
- ❖ The last class drop date without petition is Oct 22<sup>nd</sup>, 5pm.
- ❖ Under no circumstances will I write a letter supporting a withdrawal after the official withdrawal date.