CEG3185 A – Winter 2023
Introduction to Data Communication & Networking

Instructor: Prof. Dimitrios Makrakis, PhD, P.Eng.
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Lectures and Tutorials: In person or online, depending on the conditions with COVID-19

Consultation: Through email. When in person or on-line meeting is needed, it will be arranged.

Labs: Mondays, 13:00 – 14:20 (CBY B402, 161 Louis Pasteur)
Tuesdays, 14.30 – 15:50 (CBY B402, 161 Louis Pasteur)
Thursdays, 11.30 – 12:50 (CBY B402, 161 Louis Pasteur)
Fridays, 17.30 – 18:50 (CBY B402, 161 Louis Pasteur)

References

1: W. Stallings, "Data and Computer Communications", Pearson Prentice Hall
2: Tanenbaum, "Computer Networks", Pearson Prentice Hall.
3: J. Walrand, "Communications Networks: A First Course", R.D. Irwin Inc.
4: D. Comer, "Internetworking with TCP/IP, Vol. I: Principles, Protocols and Architecture, Pearson Prentice-Hall.
5: A. Leon-Garcia & I. Widjaja, "Communication Networks: Fundamental Concepts and Key Architectures", McGraw-Hill.

Marking scheme

Labs	10 %	Midterm 1	20%
Midterm 2	20 %	Final Exam:	50 %

Labs. Labs will be in-person. The lab reports are due 1 week after the lab takes place.

Tutorials: Students will be provided with problems to be discussed in tutorials, in advance, so that they try themselves to solve them before attending the tutorial session.

Mid-Term Exams - closed book **Dates:** TBD

Final Exam - closed book **Date:** Unknown (on-line)

Course Description

Overview of Computer networking. Communication and transmission systems. Physical layer issues: signal analysis, impairments, analog and digital data transmission, channel capacity, signal encoding. Data link layer: framing, error control, flow control, line configurations, bridging, protocols, introduction to LANs. Network layer: circuit and packet switching; Internet Protocols; Internet architectures; flow/congestion control and routing algorithms and protocols.

Prerequisite: MAT2377 (Probability and Statistics for Engineers) or corequisite ELG3126 (Random Signals and Systems).

NOTE: (1) Problems for exercising will be provided to the students but will not be marked. All marked material will be based on in-class written exams. This reduces the probability of plagiarism. (2) The current plan is to have the exams in-class. (3) Should conditions require to have them changed and happen online, they will be contacted using Brightspace. In such case, they will be supervised online, using Zoom and/or Respondus Monitor. Every student must always have his/her camera active during the examination period. If the student needs to walk away for

"nature's needs", s/he must notify the proctoring team that s/he is going to be away. Please note that s/he cannot remain absent from the camera's view for more than 10 minutes in total over the examination period. (4) Should an exam be conducted through Brightspace, only the device used to connect to Brightspace (to take the exam) is allowed to be in the proximity of the student; all other electronic devices, including smartphones, tablets etc. have to be far from the student and have to be switched off. Also books, notes etc. cannot be close to the student. (5) The student can communicate **only** with the proctoring personnel during the examination time. Communication with any other person during the examination period is NOT allowed. If it happens, it will be considered as attempt to plagiarize and the process for breach of academic integrity will be initiated. (6) If an exam does not take place in-class, a student writing the exam must be alone in the physical space s/he is writing the exam. (7) Plagiarism detection tools will be used to identify plagiarism. If plagiarism is identified, the student will be reported to the administration and a formal investigation, which might lead to expulsion, will be initialized. (8) Every student taking an examination will have to upload at the beginning of the course to Brightspace a signed Academic Integrity Statement form. If such form is not uploaded, the student will not be allowed to take the exam, ort if it is taken accidentally, the exam will not be marked and will receive failure grade. (9) In order to pass the course, you need to receive at least 50% average in the lab exercises.

Course Delivery Schedule (Chapters refer to William Stallings, 10th addition)

1. Data transmission (Chapter 3) **1 week**
Concepts and terminology, introduction to Fourier transform and signal analysis, analog and digital data transmission, transmission impairments, channel capacity.

2. Transmission media (Chapter 4) **0.5 week**
Guided transmission media, wireless transmission and propagation, line-of-sight transmission.

3. Signal encoding techniques (Chapter 5) **1 week**
Digital data to digital signals, digital data to analog signals, analog data to digital signals, analog data to analog signals.

4. Multiplexing (Chapter 8) **0.5 week**
Frequency division multiplexing, synchronous time division multiplexing, statistical time division multiplexing, spread spectrum (frequency hopping, direct sequence).

5. Digital data communication techniques (Chapter 6) **1 week**
Asynchronous and synchronous transmission, type of errors, error detection, error correction, line configuration, interfacing.

6. Data link control (Chapter 7) **1 week**
Flow control, error control, HDLC.

7. Data communications and networking (Chapters 1, 2) **0.5 week**
Communications model, data communications, data communication networking, protocol architecture, OSI protocol architecture, TCP/IP protocol architecture.

8. Local area network overview, high-speed LANS, Wireless LANs (Chapters 11, 12, 13) **1.5 weeks**
Topologies and transmission media, LAN protocol architecture, bridges, switches. Ethernet, token ring, fiber channel.

9. Circuit switching and packet switching (Chapter 9) **1 week**
Switching networks, circuit-switching network and concepts, packet-switching principles, X.25, frame relay.

10. Congestion control in data networks (Chapter 20) **1 week**
Effects of congestion, congestion control, traffic management.

11. Internetwork protocols (Chapter 14) **1.5 weeks**
TCP architecture and OSI, basic protocol functions, principles of internetworking, connectionless internetworking, internet protocol (IPv4, ARP, ICMP), IPv6, TCP.

12. Routing and routing protocols (Chapters 19) **1 week**
Routing in packet-switching networks, least-cost algorithms. Routing protocols (RIP, OSPF, BGP).

13. Other topics and reviews **1 week**
Concepts of ATM, Cellular Networks and/or QoS technologies for IP networks.