Course Syllabus

Fall 2023

INT433—*Broadband Networks and Communication*

Mohammed El-Telbany

`Information Technology Department`
E-mail: mohammed.elsaid@su.edu.eg
Office: Building N, Room 313 & Ext: 3401
Office Hours: Saturday—Tuesday, 2:30—3:40PM. By Appointment
Lectures: **Saturday**, 9:00AM-10:40PM.

Course Description and Prerequisites

INT433—Broadband Networks and Communication (2+0+2) 3 credits hours

Official Course Description: Principles of broadband networks and communications. Telephone system structure, signaling services, and protocols. Circuit, packet and cell switching. Broadband signaling & traffic management. Advanced switch technology. Case studies: SONET, SDH, frame relay, B-ISDN. Asynchronous mode transfer (ATM), IP and multimedia over ATM.

Prerequisite(s): INT232—Computer Networks & INT330—Data Communications

Mohammed's Description: This course focuses on the architecture and technologies (hardware and software), principles of operation, and evaluation and design of integrated broadband computer networks. The course will consider various communication techniques (WDM, SONET, optical and electronic switching, wireless, Gigabit Ethernet, POS, etc), primarily focusing on the physical, link and network protocol layers. The course will also explore broadband ISDN, switching techniques, ATM, SONET/SDH, congestion control, high-speed switching architectures, traffic modeling of broadband services, admission control, traffic scheduling, IP/ATM convergence, QoS provisioning in IP Networks, and optical networks.

About the Teaching Assistants   Teaching assistants can help you with the course material, including labs, assignments and exams. They will do most of the assignment marking.

Teaching Assistants:

- NADEEN EMAD **Email:**`nadeen.emad@su.edu.eg`

Student Learning Outcomes

After taking this course, you should be able to:

1. Understand Broadband communication and high speed networks supporting broadband integrated services digital networks (B-ISDN); and

2. Understand about the broadband network architecture and data transmission; and

3. Understand wireline Access networks/technologies: public switched telephone networks (PSTN), digital subscriber line (DSL), wireless-access (broadcasting, mobile, fixed-wireless access (FWA)), fiber to the curb/home (FTTx); and

4. Distinguish between the different switching and multiplexing techniques (Multiple Access Technologies: TDMA, FDMA, CDMA.); and

5. Analyze and compare Core networks/technologies: Ethernet, Ethernet wide area networks, optical technologies, synchronous optical networks (SONET), wave division multiplexing (WDM), passive optical networks (PONs); and

6. Practice broadband networks using MATLAB or Python.

List of Required Course Materials

Required Textbook: *Data Communication and Networking*, McGraw Hill, 5th edition, 2013, by B. Forouzan.

Optional Textbook(s):

1. *Computer Networking, a Top-Down Approach*, Pearson Education, 8th, 2023, by J. Kurose and K. Ross.

2. *Data and Computer Communications*, Pearson Education, 10th, 2014, by W. Stallings.

3. *Introduction to Broadband Communication Systems*, SciTech Publishing, 2008, by C. Akujuabi and M. Sadiku.

4. *Introduction to Computer Networking*, Summerer, 2017, by T. Robertazzi.

5. *Understanding Telecommunications Networks*, IET, 2nd, 2017, by A. Valdar.

6. *Communication Networks Fundamental Concepts and Key Architectures*, McGraw-Hill, 2nd, 2004, by A. Leon-Garcia and I. Widjaja.

7. *Computer and Communication Networks*, Pearson Education, 2nd, 2015, by Nader F. Mir.

Course Schedule: A Weekly Breakdown

The topics below correspond sections in B. Forouzan textbook but you should only consider them a guide to what we'll go over. The weekly coverage might change as it depends on the progress of the class. Most weeks we'll need to cover some additional material to prepare for the upcoming labs/tutorials. Tentatively, here's what we're going to cover:

Teaching Methods

The course will be based on the following teaching and learning activities:

1. *Lectures and Demonstrations*: Important material from the text and outside sources will be covered in class using both Power-Point presentations and White board. You should plan to take careful notes as not all material can be found in the texts or readings. Discussion is encouraged as is student-procured, outside material relevant to topics being covered

2. *Quizzes*: Occasional scheduled or unscheduled quizzes will be given to help ensure you stay up with assigned material..

Week	Topics/Daily Activities	HW	Labs
1	History of the Internet and its flexible future	-	IP Address and Sub-netting
2	Telecommunication Networks	HW1	Networking Tools
3	Telephone Network and Services	-	Socket Programming using Python
4	Switching Technologies	HW2	UDP
5	B-ISDN & Frame Relay		FTP
6	Need for broadband communication	HW3	SMTP
7	Midterm Examinations	-	-
8	Broadband Access Technologies		Web Server
9	Recent Advances: Software Defined Networking	HW4	HTTP Web Proxy Server
10	ATM Based switching principle		ICMP Traceroute
11	Traffic Scheduling & Management	-	P2P Chat
12	Optical switching technologies and networks	HW5	-
13	Software Defined Networking	-	Lab Exam
14	Final Revision	-	-

3. *Exercises assignments*: Concepts Reviews, Skills Reviews, Independent Challenges and other projects and readings will be periodically assigned to help support and supplement material found in the lessons. These assignments may require the application of various software applications.

4. *Exams*: Two exams will be given. The exams will be closed book/note and will test assigned readings and material discussed in class. Review sheets will be provided before the exam day. The final exam will not be comprehensive in nature. However, the instructor reserves the right to retest on material that was not appropriately comprehended. These items will be noted on exam review sheets.

5. *Project*: The group project involves a written proposal with an in-class presentation, a written final report, and simulation code with a demonstration to the instructor.

6. *Internet Support*: Using the Internet to find the recent information related to the course topics.

Lectures will be presented to supplement the subject matter covered in the text. The student will be expected to complete the reading assignments prior to the class in order to have a better understanding of the important concepts and material covered in each chapter. Unannounced quizzes will be given to the student during the semester.

Approximate Schedule of Exams

The purpose of the tests and final exam is to provide a more comprehensive assessment of a student's knowledge of and ability to apply the concepts covered in class. The midterm and and final exam must be taken when scheduled, unless the student has extenuating circumstances (e.g., medical). The student must obtain approval from the dean or instructor. There will be midterm exam and a comprehensive final. the midterm exam will cover the topics discussed up to 1 week ahead of the exam date. The final exam will be comprehensive, 180 minutes in duration, and may consist of **multiple-choice**, **true/false**, **short answers** and **problems** questions. The final exam will cover the topics discussed throughout the semester, with an emphasis on the materials covered after the mid-term.

Assignments

Homework assignments will be given on a per chapter basis. Homework is assigned to provide students with the opportunity to review and apply new concepts taught during class on their own. It is recommended that the homework assignments be completed, because quiz questions will be closely correlated to the assignment questions. The assigned homeworks will be falling mainly into three categories:

1. Computational exercises related to the specific chapters treated during the past instruction week.
2. Computational exercises requiring a "big picture" approach, using material from different lectures throughout the semester
3. MATLAB simulations to be written by the students to cover more realistic scenarios for which closed-form equations often do not exist.

Project

The course includes hands-on projects that are executed by small teams of students. The educational objectives of the course project include the ability to apply knowledge of mathematics, science, and engineering; to design and conduct experiments, as well as to analyze and interpret data; to design a system, component, or process to meet desired needs within real-world constraints; the ability to function on multi-disciplinary teams; and to identify, formulate, and solve engineering problems.

Grading Timeline

Homework will be corrected within 1 week of submission and returned to the students. Results can be discussed during the office hours with the TA or instructor.

Lab Work

This course maintains a laboratory for its students. There are **5-8** lab sessions in the course and the *first lab* session starts at the *second week* of the semester. The lab work will be timed to reinforce ideas learned in the lecture. Lab assignments for all lab sessions are given in course Laboratory Manual, which is available from the instructor. The lab problems will include experimental tasks using Network Simulator-3 (GNS3) or Python. All homework will be submitted on Moodle. Detailed instructions and resources for each assignment will be posted on Moodle along kmoodle LMS.

Computer Usage

Students will use network simulator (i.e. GNS3 or Packet Tracer) or Python to design and simulate different broadband networks and communication systems and their properties.

Attendance Policy

Student attendance is highly recommended. Every student who misses a class is responsible to learn the materials discussed and obtain the homework assigned on the missed class. The instructor is not responsible for re-teaching the material missed by a student who did not attend the

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class. The attendance is important as the student will have an opportunity to ask for clarification of course and text material. There will be problem solving sessions during class period so that students gain experience applying the theory in practice. However, attendance itself is not part of the grade or otherwise enforced. Your responsibility for this course may include attendance at a final exam. The exact dates will depend on our progress through the material. If you are not present when an exam is given, you will receive a zero for that exam. Suggested strategy: keep current, attend class, and be ready.

Late Submission Policy

Homework may be submitted late by up to two days; the penalty for late submission increasing linearly from 10% to 100% of the homework score.

Makeup Policy

No make-up tests/quizzes will be given, unless a credible reason and its supporting evidence are given - e.g. due to illness or emergency events - no makeup is acceptable for students missing a homework assignment or an exam.

Grading and Assessment

To do well in this course, you must do well on both the lab assignments *and* the exams. These two different forms of evaluation test different aspects of the material—how well you understand the underlying concepts (exams) and how well you can put the concepts into practice (labs). There will be midterm and final exams. Your grade will be determined by your performance on the *project*, *practical*, *assignments* and *exams*. The Final grades will be based on the average achieved over the following point distribution:

- 5% Project
- 10% Lab
- 5% Homework Assignments and Quizzes
- 20% Midterm exam
- 60% Final exam

Grade Settings

If your overall grade falls within one of the prescribed ranges, then you are guaranteed to receive at least the letter grade indicated. The usual 5-point scale will apply (subject to any curve). A final average of 95% will guarantee an A+, 90% will guarantee a A, and so forth.

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Grading Scale

Score	Grade
95%–100%	A+
90%–95%	A
85%–90%	A-
80%–85%	B+
75%–80%	B
70%–75%	C+
65%–70%	C
60%–65%	D
Less than 60%	F

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Classroom Regulations

Student must observe the following classroom regulations to have a proper learning environment for the entire class.

1. Turning off the cellular phone and pager

2. No chatting during the lecture

3. Absolutely quiet and no sleeping during the lecture

A student violates any of the above regulations will be asked to leave the classroom voluntarily to respect the rights of other classmates.

Statement on Academic Dishonesty

Cheating, plagiarism or otherwise obtaining grades under false pretenses constitute academic dishonesty according to the code of this university. Academic dishonesty will not be tolerated and penalties can include canceling a student's enrollment without a grade, giving an **F** for the course or for the assignment. For more details, see the *University of Sinai* rules.

Attendance Policy

Absence from lectures and/or tutorials shall not exceed 25%. Students who exceed the 25% limit without a medical or emergency excuse acceptable to and approved by the university council shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse due to a severe medical condition or exceptional circumstance approved by the university council, the student withdraws from the course and withdrawal rules applies. The student receives a W grade on his/her academic record.

Statement for Academic Success Services

Your student fees cover usage of the computer laboratories. These laboratories support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.

Professionalism Policy

Per university policy and classroom etiquette; mobile phones, iPods, etc. must be silenced during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.

Subject to Change Statement

All information contained in this syllabus is subject to change, with advance notice, as deemed appropriate by the instructor.