

ITE 410 Advanced Computer Networks**4 cr.****Catalog description:**

This course offers an in-depth look at the top-down approach to networks, taking into consideration the requirements and goals, and understanding the methodologies and techniques involved in a complex network infrastructure. Topics include: identifying the needs and goals for building networks, logical and physical network design, addressing and numbering, switching and routing protocols, developing network security strategies, and selecting technologies and devices for campus and enterprise networks. Four lecture hours per week.

Prerequisites: ITE 315**Course Narrative:**

This course is on in-depth understanding of designing computer networks, taking into consideration the security measures. Students already familiar with fundamentals of computer and network architectures and the nature of security threats that exists in the globally connected environment will be able to learn “how to design.” That is, they will be able to design a network for a campus and enterprise top down. IT professionals who know how to design a network can resolve any issues that can potentially impact the smooth working of a network infrastructure. They can easily administer, test, and optimize the network performance.

This course begins with identifying and analyzing the business goals and constraints, technical goals, and tradeoffs. After ensuring the needs of an infrastructure, logical network design is put together that includes designing network topology, models for addressing and numbering, selecting switching and routing protocols, taking into consideration the security measures for securing networks and hence developing network security strategies, and developing network management strategies. Once the logical aspect of network design is complete, the physical aspect of network design will be taken into consideration where selecting the technologies and devices for campus and enterprise networks are considered. Testing, optimizing and documenting forms the last component of a network design.

Goals:

Upon successful completion of the course, a student should be able to do the following:

- G1: be able to clearly analyze the goals and requirements of an enterprise in terms of network design and deployment;
- G2: demonstrate the knowledge of issues in network design and security and in-depth understanding of techniques, tools, and mechanisms used to provide solutions;
- G3: applying the knowledge of network design and security in actually designing the network for an IT enterprise.
- G4: demonstrate understanding and skill required for testing and vulnerability assessment and documenting the network design.

Course Objectives:

Upon successful completion of the course, a student will have demonstrated the ability to:

- O1: apply correct technical terminology when analyzing requirements, describing the main issues, and offering solutions for building secure IT infrastructures;
- O2: use in-depth knowledge of protocols, algorithms, mechanisms, and tools used in designing and construction of IT network infrastructure and apply these techniques in practice;
- O3: apply assessment techniques and use tools that allow IT managers to test and assess vulnerabilities of their infrastructures;
- O4: analyze results of testing and vulnerability assessment, document, and design solutions to deploy networks.

Program Objective / Course Objective matrix (For ABET Accreditation Purposes)

(The following Matrix maps the Program Objectives for Information Technology Program outlined by Accreditation Board of Engineering Technology (ABET) with the Course Objectives. The check marks below the course objective represent that those course objectives accomplish specific program objectives set forth by ABET. The program objectives that have a * in front of them means that that course does not address those program objectives.)

Program Objective	O1	O2	O3	O4
PO-A: An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.	✓	✓	✓	✓
PO-B: An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.			✓	✓
PO-C: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.		✓	✓	✓
PO-D: An ability to function effectively on teams to accomplish a common goal.			✓	
PO-E: An understanding of professional, ethical, legal, security and social issues and responsibilities.	✓			✓
PO-F: An ability to communicate effectively with a range of audiences.	✓			
PO-G: An ability to analyze the local and global impact of computing on individuals, organizations, and society.	✓			✓
PO-H: Recognition of the need for and an ability to engage in continuing professional development.			✓	✓
PO-I: An ability to use current techniques, skills, and tools necessary for computing practice.	✓	✓	✓	✓
PO-J: An ability to use and apply current technical concepts and practices in the core information technologies.	✓	✓	✓	✓
PO-K: An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems.	✓	✓	✓	
PO-L: An ability to effectively integrate IT-based solutions into the user environment.	✓	✓	✓	✓

Program Objective	O1	O2	O3	O4
PO-M: An understanding of best practices and standards and their application.		✓		
PO-N: An ability to assist in the creation of an effective project plan.	✓	✓	✓	✓

Course topics:

- Identifying Customer's Needs and Goals IAS1(2), NET1(3), PT2(1), PT3(1), SP2(2), SP3(2)
 - Analyzing Business Goals and Constraints
 - Analyzing Technical Goals and Tradeoffs
 - Characterizing the Existing Internetwork
 - Characterizing Network Traffic
- Logical Network Design
 - Designing a Network Topology PT2(1), NET3(3)
 - Designing Models for Addressing and Numbering
 - Selecting Switching and Routing Protocols NET2(4)
 - Developing Network Security Strategies IAS11(2), NET4(4)
 - Developing Network Management Strategies NET5(3)
- Physical Network Design
 - Selecting Technologies and Devices for Campus Networks SA3(2), PT5(2), PT6(2), PT4(3)
 - Selecting Technologies and Devices for Enterprise Networks IAS1(2), NET6(3)
- Testing Optimizing and Documenting Your Network Design PT1(1), PT3(1), NET3(2)
 - Testing Your Network Design
 - Optimizing Your Network Design
 - Documenting Your Network Design

Organization of the course

The course consists of lectures, in class lab assignments (as long as the classroom chosen for offering the lecture is a lab and as much as space and time allows), homework assignments, quizzes, and two exams – a midterm and a final. Specific requirements for each assignment will be stated when the assignment is distributed; all written submissions will be graded against the Writing rubric. Presentations, if any, will be assessed based on the Presentation rubric.

Assignments:

Homework assignments include analysis of network components and design of solutions for network and security-related tasks, as well as exercises in using network and security tools. Assignments require students to use information given during the lectures and textbooks, and perform Internet research for necessary materials. Regular writing assignments include but are not limited to:

- review of technical articles;
- presentation of research findings;
- proposals to solve different security problems formulated by the instructor;
- analysis and evaluation of methodologies used in building secure networked environments;

Quizzes, Tests, and Examinations: There will be multiple quizzes (each covering a major topic), a midterm, and a cumulative final. Quizzes and exams will include multiple choice and problem solving tasks.

Grading: Final grades will be determined on the basis of the following approximate weights:

- Homework assignments 20%
- Quizzes and Projects 35%
- Midterm exam 20%
- Final exam 25%

Course Objective / Assessment Mechanism matrix

	Lab assignment	Homework assignment	Quizzes	Midterm exam	Final Exam
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓			
CO4	✓	✓			

Bibliography:

- Priscilla Oppenheimer. Top-Down Network Design. Third Edition. Cisco Press, 2010.
- J. F. Kurose, K.W. Ross. Computer networking. Seventh Edition. Pearson, 2016.
- Mike Meyers, CompTIA Network+ Certification All-in-One Exam Guide, Sixth Edition, 2015.
- Behrouz A. Forouzan, Firouz Mosharraf, Computer Networks: A Top Down Approach, 1st Edition, ISBN-13: 978-0073523262, 2011.
- Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5th Edition, ISBN-13: 978-0132126953, 2010.