

**King Fahd University of Petroleum & Minerals**  
**College of Computer Sciences and Engineering**  
**Computer Engineering Department**

**COE 444 - Internetwork Design and Management (3-0-3)**

**Syllabus**

**Course Objective**

- To provide students with the main concepts in internetworking, network design and network management.
- To help students build the necessary skills for designing and managing networks.
- To prepare students for the professional life in the area of internetwork design and management.

**Course Learning Outcomes**

1. To demonstrate understanding in the area of internetworking including devices, protocols, topologies, etc.
2. To demonstrate understanding of bridging and switching technologies and be able to differentiate between bridging/switching and routing.
3. To demonstrate understanding of network design concepts and structured cabling systems (SCS) standards.
4. To demonstrate understanding of the network development life cycle (NDLC) and be able to analyze requirements, perform a market survey and design an enterprise network by following a network analysis and design methodology.
5. To be able to write and understand a Request For Proposal (RFP) and perform quotation analysis.
6. To perform topology design and traffic flow analysis of a network, and to be able to use some of the algorithms widely used in this area.
7. To be able to simulate a network and estimate its performance using network simulation tools.
8. To be able to define performance metrics and describe how each affects a particular network and/or service paradigm
9. To demonstrate understanding of network management concepts including the ISO functional areas of management.
10. To demonstrate understanding of network management standards including SNMP (Simple Network Management Protocol).
11. To become familiar with some network management tools.
12. To demonstrate understanding of network security and be able to compare and contrast the various types of firewalls.

## Course Description

Types of computer networks. Principles of internetworking. Internetworking hardware. OSI internetworking. Connectionless and Connection-oriented internetworking. Routing strategies. The network development life cycle. Network analysis and design methodology. Network design and backbone design. Structured cabling systems. Topology design and Network design algorithms. Traffic flow analysis. Network reliability. Network management (SNMP). Network security and firewalls. Network administration. Case studies.

**Prerequisite:** COE 442

## Text Book

*There is no textbook for this course. Copies from several references are provided throughout the course.*

### References include:

1. "Computer Networks" by Andrew S. Tanenbaum, Fourth Edition
2. "Local & Metropolitan Area Networks" by Stallings, Sixth Edition
3. "Managing Switched Local Area Networks - A Practical guide" by Darryl P. Black. Addison Wesley, 1998
4. "The Switch Book" by Rich Seifert. Wiley, 2000
5. "Top-Down Network Design" by Priscilla Oppenheimer, Cisco Press, 2001.
6. "Applied Data Communications - A Business-Oriented Approach" by James E. Goldman, 1998
7. "Cisco Internetwork Design" edited by Matthew H. Birkner. Cisco Systems, 2000
8. "LAN Technologies Explained" by Philip Miller and Michael Cummins. Digital Press, 2000
9. "Telecommunications Network Design Algorithms" by Aaron Kershenbaum, 1993
10. "Network Management - Principles and Practice" by Mani Subramanian, 2000

## Course Topics (Weekly breakdown)

Week #	Topic	Reference	Design Aspect
1.	<b>1. Overview of Computer Networks</b> Types of computer networks. LANs and WANs. Protocols and protocol families. The OSI reference model. The TCP/IP protocol.	1	N/A
2.	<b>2. Internetworking</b> Basic terminology. Principles of internetworking. Types of internetworking devices. Repeaters, hubs.	1	N/A
3.	<b>2. Internetworking (Cont.)</b> Bridges, Transparent and source-routing bridges.	2	- Choice between types of bridging in bridges and switches

4.	<b>2. Internetworking (Cont.)</b> Routers, switches and gateways. Routing strategies. Addressing. Multilayer switches. VLANs.	3 & 4	- Choice between switches/bridges and routers - Choice between layer-2 and multilayer switches - Choice of the VLAN grouping type
5.	<b>3. The Network Development Life Cycle</b> Network analysis. Network design methodology. Writing of a Request For Proposal (RFP) and quotation analysis. Prototyping/simulation. Implementation.	5 & 6	- Network design methodology including tradeoffs to be considered
6.	<b>4. Enterprise Network Design</b> Enterprise Network Design Model. Backbone design concepts.	5 & 7	- Choice between different backbone design topologies - Decision on the number of layers and functionality of each in the network being designed
7.	<b>4. Enterprise Network Design (Cont.)</b> Backbone design concepts (cont.). Structured cabling systems.	7 & 8	- Choice of the cabling to be used in different types of networks
8.	<b>5. Topology design and analysis</b> Topology design. Network design algorithms.	9	- Choice of the right algorithm to use for different types of problems in network design
9.	<b>5. Topology design and analysis (Cont.)</b> Terminal assignment. Concentrator location.	9	- Decision on how to model the problem and which algorithm to use.
10.	<b>5. Topology design and analysis (Cont.)</b> Traffic flow analysis and performance evaluation.	9	- Decision on which parameters to look at and how to analyze the information in studying real networks
11.	<b>5. Topology design and analysis (Cont.)</b> Network reliability. Network simulation.	9	- Decision on what reliability is required for a network and how to meet that
12.	<b>6. Network Management</b> Network management standards & models. ISO Functional areas of management.	10	- Decision on what functional areas are needed in a network
13.	<b>6. Network Management (Cont.)</b> Proactive vs. Reactive management. Network management tools and systems.	10	- Tools to use in different situations for monitoring networks - Use of data monitored for network redesign

14.	<b>6. Network Management (Cont.)</b> SNMP architecture & operations.	10	<ul style="list-style-type: none"> <li>- Gathering information from network components</li> <li>- Choice of the parameters that will provide useful information</li> </ul>
15.	<b>7. Network Security and Troubleshooting Problems</b> Network security and firewalls. Troubleshooting common network problems.		<ul style="list-style-type: none"> <li>- Types of firewalls to use</li> </ul>

## Laboratory Requirements

N/A

## Computer Usage

- A Network design and simulation tool is used by the students, usually using a UNIX lab.
- Students are introduced to a network management tool.

## Design Aspect(s)

- Students are given case studies where they read problem specifications and design a network by following a methodology learned in the course.
- A project in network design and simulation is also given to the students. Part one involves designing an enterprise network including a market survey. Part two is concerned with the simulation of this design using a network simulation tool. The project is performed by teams of 3 to 4 students.