

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

**CSE 550 – Computer Network Design (3-0-3)**

**SM: 6:30-7:45 PM, Room: 22-130**

**Spring 2008 (Term 072)**

**Syllabus**

**Catalog Description:**

Types of computer networks: LANs, VLANs, and WANs. Routing algorithms and routing protocols. The network development life cycle. Network analysis and design methodology. Network design issues: Manageability; Node placement and sizing; Link topology and sizing; Routing; Reliability. Data in support of network design. Structured enterprise network design. Hierarchical tree network design: Terminal assignment; Concentrator location. Mesh topology optimization. Traffic flow analysis. Analysis of loss and delay in networks. Network reliability issues.

*Prerequisite: (COE 540 and (ICS 431 or Equivalent)) or Consent of Instructor.*

**Instructor:** Dr. Mohammed Houssaini Sqalli

**Office:** 22-149      **Phone:** 1725      **Email:** [sqalli@kfupm.edu.sa](mailto:sqalli@kfupm.edu.sa)

**Office hours:** UT 10:00-11:30AM, SM 8:00-8:30PM, and by appointment.

**Course URL:** <http://www.ccse.kfupm.edu.sa/sqalli/072/cse550>

**Course Material:** WebCT will be used for discussions and for posting any course-related information.

**Text Book:**

There is no assigned text book for this class, but the following are the main references used:

- P. Oppenheimer, "Top-Down Network Design," Cisco Press, 2<sup>nd</sup> edition, 2004.
- J. McCabe, "Network Analysis, Architecture, and Design" Morgan Kaufmann Publishers, Inc., 2<sup>nd</sup> edition, 2003.
- M. Pióro and D. Medhi, "Routing, Flow, and Capacity Design in Communication and Computer Networks", Morgan Kaufmann Publishers, Inc., 2004.
- A. Kershenbaum, "Telecommunications Network Design Algorithms", McGraw-Hill, 1993.
- R. Cahn, "Wide Area Network Design: Concepts and Tools for Optimization", Morgan Kaufmann Publishers, Inc., 1998.

**Grading Policy:**

|                              |     |                                       |
|------------------------------|-----|---------------------------------------|
| Assignments/Quizzes          | 20% |                                       |
| Project                      | 30% |                                       |
| Midterm                      | 20% | Monday, April 21, 2008, 6:30-8:00 PM  |
| Final Exam                   | 25% | Thursday, June 5, 2008, 7:00-10:00 PM |
| Attendance and participation | 5%  |                                       |

**Attendance:** Attendance is required by all students. Official excuse for an authorized absence must be presented to the instructor no later than one week following the absence. More than 6 unexcused absences lead to a “DN” grade.

**Course Objectives:** The aim of this course is to provide students with a comprehensive and structured view of network design from a theoretical and a practical perspective. It presents basic principles and methods for developing traffic characterization and optimization models for a subset of network design problems. It also aims at helping students to understand recent advances and to be exposed to research problems in network design.

**Course Outcomes:** After successfully completing the course, students should be able to:

- Analyze and design a new and/or an existing network to meet specific requirements.
- Compare and contrast the different options in designing a network.
- List the major steps of the design process and identify tradeoffs involved in each one.
- Apply quantitative and qualitative techniques to design or upgrade a network.
- Gain practical knowledge using network simulation and management tools.
- Analyze network traffic flow and evaluate its performance.
- Identify network issues, risks, bottlenecks, etc.
- Apply algorithms to solve network design problems.
- Evaluate and choose the appropriate network technologies and interconnection strategies to meet design goals.
- Learn how to be a good team player by working on a semester-long project.
- Write a technical report describing a subject briefly or elaborately as required.
- Communicate design content, risk assessment, security issues and budgetary considerations to upper-management.

### **Tentative Course Topics:**

- Introduction to Computer Network Design
  - The Network Development Life Cycle
  - Network Analysis and Design Methodology
- The Science of Network Design
  - Traffic Flow Analysis and Performance Evaluation
  - Network Simulation and Traffic Measurement Tools
  - Topology Design and Terminal Assignment
  - Concentrator Location and Servers Placement
  - Traffic Engineering
  - Network Reliability
- The Art of Network Design
  - Structured Enterprise Network Design
    - Hierarchical Network Design Model
    - LAN and WAN Network Design
    - Backbone Design: Centralized vs. Distributed
  - Node Placement
  - Addressing and Routing
  - Reliability and Redundancy
  - Network Management and Security
  - Technology Choices
  - Structured Cabling Systems
- Case Studies