Example of Master Course Syllabus

Title: COMMUNICATION SYSTEMS

Credits: 3 (3 lecture - 0 lab)

Coordinator: Adel Ahmed Ali, Professor, Electrical Engineering

Goals: To introduce students to the theory, design analysis and operation of communication systems.

Objectives:

1. Understand the basic components of a communication system.
2. Understand the basic types of wire and wireless communication systems.
3. Design Line-of-Sight (LOS) microwave radio system
4. Understand and design various communication satellite systems.
5. Understand and design various copper wire and optical fiber systems
6. Enable students to design a final project on a communication system for industrial applications.
7. Write reports on various aspects of communication systems.
8. Work in teams to perform system design and technical presentations.

Textbook:

1. "Communication Networks, Fundamental Concepts and Key Architectures", Alberto Leon-Garcia & Indra Widjaja, Mc Graw Hill, 2002.

2. Telecommunication Transmission Handbook, Roger Freeman, Wiley Inter-sciences, 1991

Reference:

Worldwide web

Prerequisites by Topic:

1. Principles of modulation and propagation
2. Principles of multiplexing and multiple-access
3. Concepts of transmission speed and bandwidth

Topics:

- Introductory Concepts
- Guided Transmission
- ISDN-xDSL
- Mobile Communications
- Wireless Data Networks
- Line-of-Sight Microwave (Radio link) Systems
- Project
- Satellite Communications

Course Structure:

The class meets for three lectures a week, each consisting of 50 minute sessions. There is regular homework and two midterm exams. A final project is required by the end of the instruction period.

Week	Topics
1	**Introductory Concepts** • The transmission problem • A simplified transmission system • The Decibel • Basic derived Decibel units • Addition of power levels in dB(dBm/dBW) or similar absolute logarithmic units • Signal to noise ratio
2	**Guided Transmission** o Twisted pair o Coaxial cable o Optical fiber
3	**Digital Subscriber Loops -ISDN** o Asymmetric digital subscriber line (ADSL) o Extending asymmetric digital subscriber line (ADSL) services to remote digital loop carrier (DLC) Locations o Very high data rate DSL (VDSL)
4-5	**Mobile Communications** o Cellular principles o GSM Overview o The GSM Network Architecture o Cell size and capacity o Outline of the evolution of GSM to 3G o WiFi, Bluetooth and Satellite telephony o GPRS and 3G: CDMA
6	**Wireless Data Networks** o Why WLAN? o WMAN, WWAN, WLAN, WPAN... o Bluetooth & 802.15 o IEEE802.11x o HiperLAN/2 o HomeRF
7-8	**Line-of-Sight Microwave (Radio link) Systems** o Link engineering o Propagation o Path calculations
9	**Line-of-Sight Microwave (Radio link) Systems** Digital line-of-sight microwave links • Antenna subsystems • System and link propagation reliability

10	**Project** Students are required to select a suitable research topic related to wire or wireless communication systems of current interest. Two students can work together in one topic. • Submit a well documented project including summary, literature review, system design and operation, conclusion and references • Each student will make a presentation subject to peer evaluation. • Possible topics may include: multiple-access, 3G, capacity enhancement, ad-hoc networks, wireless LANs, interference rejection, network security, broadband communications, smart antennas, MIMO, Satellites, etc Students are **not** allowed to present projects based on their graduation projects (EE499)
11	**Satellite Communications** • Orbital satellites- Geostationary satellites-orbital patterns • Look angles- orbital spacing and frequency allocations • Radiation patterns (footprints)
12	**Satellite Communications** • Satellite system • link models • design parameters • link equations
13	**Satellite Communications** • link budget • VSAT design example

Computer Resources:

Students use computer facilities for their homework and final projects. Simulations of communication systems using commercial simulation software are used.

Laboratory Experiments:

None

Grading:

- First Exam 15%
- Second Exam 15%
- Homework and Quizzes 15%
- Project 15%
- Final Exam 40%

Attendance Policy:
According to KSU policy, every student should attend at least 75% of the course classes (including the tutorials). Those who fail to fulfill this condition will fail in the course.

Outcome Coverage:

a. Apply math, science and engineering

This course has extensive mathematical modeling of various elements of communication systems including channel capacity theorem, propagation models, and terrestrial and satellite link equations.

b. An ability to design and conduct experiments, as well as to analyze and interpret data.

None

c. An ability to design a system, component, or process to meet desired needs.

Throughout the homework and final project, the students are required to design systems to meet given desired objectives. Their designs are tested through simulations or laboratory experimentation, and modifications are implemented as needed.

d. An ability to function on multi-disciplinary teams.

Students form teams of up to 3 students for the final project. The students may have different background strength, but are cooperatively working to achieve the objectives of the experiments or project. Team members naturally tend to specialize in one aspect of the experiment or project, such as electronics or digital systems versus propagation and communications, creating a multi-disciplinary environment within the team. This cooperation is also required to prepare the project reports. Each person in the group is assigned a portion of the report.

e. Identify, formulate and solve engineering problems

The class includes various examples of operational problems such as designing radio systems with minimum number of repeaters, higher reliability, and lower tower highest, etc., all of which are conflicting issues. Students are required to identify the problems and design systems to solve them.

g. An ability to communicate effectively.

Students had a course on proper writing style. For design reports, each student is required to write a five to seven page report. The reports are separately graded for writing style and technical content. Writing style is typically 30% of the report grade.

The students are also required to prepare written report on their final projects. The reports are presented by the students in the class where they discuss and defend their work.

H. Broad education necessary to understand the impact of engineering solutions in a global and societal context

The impact of modern telecommunication systems on existing or new industrial process is discussed throughout the course. This includes the effect of efficient drive systems on environment, the effect of new technologies such as the electric car on society.

I. Recognition of the need for and an ability to engage in life-long learning.

The course material contains areas where technologies are continually changing. New generations of wireless communication devices are continually introduced and the students understand that they must be capable to track these development. Students also understand that wireless communication devices and systems are continuously and rapidly replacing cable plants. In addition, students must consult reference sources and inform themselves concerning certain aspects of the course material. This helps students realize that they need to be able to learn material on their own to acquire additional and necessary skills.

J. Knowledge of contemporary issues.

Attention is given on contemporary issues such as new service offering companies in the mobile and data sectors, impacts of e-business, e-governments, need and impact of mobile 3G and beyond. Students are engaged during the lecture time in discussing and evaluating these issues.

K. Use of modern engineering tools

The students in this course are utilizing the web to obtain copies of the lecture material, to receive and/or deliver their homework or labs. The web is also used as a supplemental source of research material. In addition, modern simulation tools are used to assist in the students designs.

Preparer: Adel Ahmed Ali

Last revised: September 1, 2004