NATIONAL UNIVERSITY
SCHOOL OF ENGINEERING AND TECHNOLOGY

COURSE EXPECTATIONS

Course Title and Number: **Third-Generation (3G) Wireless Networks, WC 607**

Course Prerequisite: **WCM 604**

Course Textbook:
Vijay K. Garg, "Wireless Network Evolution: 2G to 3G", 2002, Prentice Hall, ISBN: 0130280771. Chapters 11-17.

For the most recent textbook information, you can view and order required textbooks through our online bookstore at: http://direct.mbsbooks.com/nu.htm.

Instructor: Dr. Nazila Safavi

Email: nazila@globaltechnologies.biz

Tel #: 1.949.280.5297

Course Description:
Third –generation standards, evolution of TDMA-based 2G systems to 3G systems; CDMA2000 system architecture; third generation European standards, wireless data in CDMA; wireless local loop; Wireless application protocol (WAP), WLAN, and Bluetooth technologies. Prerequisites: WC 602.

Learning Outcomes:

Upon successful completion of this course, students will be able to:

- Explain the functions of the major components in a wireless network
- Understand the 2G and 3G standards.
- Illustrate the TDMA, CDMA2000 system architecture.
- Contrast 3G European standards, CDMA, Wireless Local Loop, WAP, WLAN, Bluetooth technologies, etc.
- Design, build and implement WLAN based on the IEEE 802.11b standard

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Course Requirements:
Students are expected to attend all class sessions, participate in all class activities, complete quizzes and exams as scheduled, make presentation(s) if applicable, and turn in all assignments on time. Failure to do so may result in the loss of points.

Grades and Grading System:

- **Homework 25%** (total of nine homework to be completed before the final exam)
- **Midterm Exam: 20% (**to be given during the beginning of the fifth class)
- **Final Exam: 25%**
- **Class Attendance: 10%**

Diversity:
Learning to work with and value diversity is essential in every program. Students are required to act respectfully toward other students and instructors throughout the course. Students are also expected to exhibit an appreciation for multinational and gender diversity in the classroom and develop management skills and judgment appropriate to such diversity in the workplace.

Ethics:
Ethical behavior in the classroom is required of every student. Students are also expected to identify ethical policies and practices relevant to course topics.

Communication Skills:
Both written and oral communications are required in the classroom of every student.

Technology:
Students are expected to be competent in using word-processing, spreadsheet, and presentation software in this course. The use of the Internet and email may also be required.

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Attendance Procedures:
Please see Catalog #71, page 40.

Library Resources:
National University Library supports academic rigor and student academic success by providing access to scholarly books and journals both electronically and in hard copy. Print materials may be accessed at the Library in San Diego or through document delivery for online and regional students. Librarians are available to provide training, reference assistance, and mentoring at the San Diego Library and virtually for online or regional students. Please take advantage of Library resources:

- URL: www.nu.edu/library
- Contact the Library:
  - RefDesk@nu.edu
  - (858) 541-7900 (direct line)
  - 1-866-NU ACCESS x7900 (toll free)
- Use the Library Training Tools (on the Library Homepage) for additional help
  - Recorded class presentations
  - Tutorials & Guides (APA/MLA, Peer-Review, and more)

Recommended Reference Books:

Computer Networks by Andrew Tanenbaum, 2000, ISBN: 0133499456.

Essentials of Data Communications, by David Stamper and the Saratoga Group, The Benjamin/ Cummings Publishing Company Inc., 1997, ISBN: 0805377360.

Peter Norton's Complete Guide to Networking by Peter Norton and Dave Kearns, 1999. ISBN 0672315939.

Digital Communications, John Proakis, McGraw-Hill Science/Engineering/Math; ISBN: 0072321113; 4th edition (August 15, 2000)

Digital Communications: Fundamentals and Applications (2nd Edition), Bernard Sklar, Prentice Hall PTR; ISBN: 0130847887; 2nd edition (January 11, 2001)



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Principles of Digital Transmission: With Wireless Applications (Plenum Series in Telecommunications), Sergio Benedetto and Ezio Biglier, Plenum Pub Corp; ISBN: 0306457539; (June 1999)

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Detailed objectives:

Sec 1:

- Review Generations of Wireless Systems
- Discuss a forecast of wireless market growth and the role of 3G in future systems
- Discuss IMT-2000 3G Requirements
- Review the spectrum allocation for 3G around the world
- Compare and contrast W-CDMA and cdma2000™ systems and their evolutionary paths

Sec 2:

- Multirate Transmission
- Orthogonal Variable Spreading Factor codes
- I/Q Code Multiplexing
- Antenna Arrays
- Multiuser Detection

Sec 3:

- Review some fundamental limits in Digital Communications Theory
- Present the W-CDMA and cdma2000 voice coding standards
- Discuss Error Correction Techniques, including convolutional and Turbo codes
- Introduce the variable length Orthogonal spreading codes
- Describe Pseudorandom Noise Codes, including m-sequences and Gold codes

Sec 4:

- Explain the signal generation process and role of the new code channels in the cdma2000™ forward and reverse links
- Discuss the new data rate capabilities of forward and reverse links in cdma2000
- Describe the enhancement made to power control algorithm in the reverse link in cdma2000™
- Describe different modes of power control for the forward link

Sec 5:

- Present the air protocol 1xEVDO (HDR) and its main design features
- Discuss the architectural options for EVDO
- Analyze EVDO's channel structure and waveforms
- Introduce the main Forward and Reverse Link characteristics

- Understand EVDO´s data rate capabilities on both links
- Introduce the concept of dynamic data rate selection
- Present the main features of EVDO´s layering structure

Sec 6:

- Discuss the evolutionary aspects of the road from GSM to UMTS
- Introduce the standards HSCSD, GPRS and EDGE
- Present the architecture of UTRA
- List the functions and services provided by Layers 3, 2 and 1 of UTRA
- Compare the UTRA and the GSM/GPRS air interfaces

Sec 7:

- Present the structure and functionality of the uplink and downlink physical channels in FDD UTRA
- Understand the data rate capabilities on each link
- Discuss the multiplexing and coding algorithms
- Explain the BS synchronization algorithm
- Describe the WCDMA power control mechanisms
- Study the handover procedures in WCDMA
- Present the slotted operation mode
- Discuss the different mechanisms for packet transmission

Sec 8:

- Understand capabilities of Bluetooth and Wireless LAN devices
- Understand the BT core and the profiles
- Understand layering structure in Bluetooth
- Understand the layering structure in WLAN systems
- Understand capabilities of different generations on WLAN systems.

Note: The syllabus is tentative and subject to change without notice.

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