**National University**
**School of Engineering and Technology**

# WCM606 – CDMA Wireless Standards and Applications

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**Course Prerequisites:** WCM602,

**Required Text**: Vijay K. Garg, "Wireless Network Evolution: 2G to 3G", 2002, Prentice Hall, ISBN: 0130280771

## Course Description:

Analysis of CDMA (code division multiple access) concepts, models and techniques. An overview of second- and third-generation (3G) air interfaces. Direct-sequence spread spectrum (DSSS); physical and logical channels; CDMA IS-95 call processing, diversity, combining and antennas; access and paging channel capacity; planning of a CDMA system.

## Learning Outcomes:

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

- Illustrate the basics of spread spectrum technology.
- Select effective code acquisition and tracking techniques based on given requirements.
- Justify and design CDMA overlays.
- Apply sound CDMA system design philosophies to design CDMA receivers and systems.
- Illustrate on emerging third-generation CDMA-based mobile radio systems.
- Contrast the existing CDMA standards.
- Defend why CDMA has taken the mobile wireless world by storm and has become a major Second Generation (2G) technology and the dominant technology choice for Third Generation (3G) systems
- Identify about pseudo-random codes, their role in CDMA systems, and how they offer enhanced privacy, security, call quality, and coverage in comparison to other cellular technologies
- Understand how CDMA offers increased capacity and improved performance

## Course Requirements:

Students are expected to attend all class sessions, participate in all class activities, complete exams as scheduled, complete and present course project and turn in all assignments on time. Failure to do so may result in the loss of points or the lowering of one's grade.

Objective of 1st lecture – Monday March 2nd

- Review of course outline, syllabus, project and requirements

- Review the mobile telephone system architecture.
- Video – The men who made Radio
- Read related material on chapter 1 of the text book

Objective of 2nd lecture – Tuesday March 3rd

- Review multiple access techniques.
- Define requirements for spread spectrum wireless systems.
- Derive the capacity equation for a CDMA system.
- Read related material on chapter 3 of the text book

Objectives of 3rd lecture – Thursday March 5th

- Define Cross Correlation and Auto-Correlation
- Define Orthogonal Codes
- Define PN codes
- Describe Properties of Orthogonal and PN Codes
- Read related material on chapter 4 of the text book
- Hand out first assignment

Objectives of 4th and 5th lectures – Monday March 10th and Tuesday March 11th

- Forward Traffic Channel Generation
- Pilot Channel Generation
- Sync Channel Generation
- Paging Channel Generation
- Demodulation of the Forward CDMA Channel
- Reverse Traffic Channel Generation
- Access Channel
- Read related material on chapter 5 of the text book
- First assignment due Monday
- Presentation proposal due on Tuesday

Objectives of 6th lecture – Thursday March 13th

- Discuss Power Control in CDMA
- Midterm Exam
- Hand out 2nd assignment

Objectives of 7th and 8th lectures – Monday March 17th, and Tuesday March 18th

- Describe the synchronization process in IS-95 systems
- Discuss the structure of paging channel
- Describe the structure of access channel
- Discuss important signaling in Traffic mode
- Read related material on chapter 9 of the text book – cont.
- Second assignment due Monday

Objectives of 9th and 10th lecture – Thursday March 20th and Monday March 24th

- Discuss the Registration Process in IS-95 Systems
- Discuss the Handoff Processes in IS-95 Systems
- Discuss the Improvements Made to Handoff Process in IS-95B Systems
- Discuss Handoff Messages and Parameters
- Read related material on chapter 8 of the text book

Objectives of 11th lecture – Tuesday March 25th

- Presentation of Projects

Objectives of 12th lecture – Thursday March 27th

- Final Exam
- Presentation cont.
- Lecture and Demo with Spectrum Analyzer

Objectives of 12th lecture – Friday March 28th

- Discuss Future of CDMA

## Course Project:

The term project will be an exiting or research oriented project related to any topic in the CDMA area. The project MUST be accompanied by a presentation.

Some suggested topics are listed below, but you are by no means limited to these topics.

The project can be a literature survey, analysis, and/or simulation. **Ideally**, the project should include some original research. However, re deriving a known result from scratch, repeating a simulation experiment or a literature survey of existing papers is also one.

The project should follow APA style.

Details and deadline: A one paragraph project proposal is due by seminar 5 (email to nazila@globaltechnologies.biz or hard copy is fine too).

The project proposal should include few lines describing what you plan to do.

Do not propose an overly ambitious project that cannot be completed by the end of the semester. The project should be accompanied by 15 - 20 minutes of presentation and is due by session 10. You may either hand me the hard copy or email it to me in a readable format.

Some suggested topics:

- 4G CDMA.
- Voice over IP
- Combining voice and data in wireless systems.
- Coding/spreading trades in CDMA systems
- Smart antennas
- RFID
- Interference in CDMA systems

- Future of CDMA
- CDMA Market, Economical issues, Vendors, Design, Impact, Future

## Course Grading:

Course requirements include the following major independent measures of learner competency.

| Learning Activity Weights and Scoring Guides | |
|---|---|
| **Activity** | **Weight** |
| **1. Class Participation** | **10%** = 10 Points |
| **2. Unit Assignments** | **10%** = 10 Points |
| **3. Course Project and Presentation** | **30%** = 30 Points |
| **4. Midterm Exam** | **20%** = 20 Points |
| **4. Final Exam** | **20%** = 20 Points |
| **5. Quizzes** | **10%** = 10 Points |
| **Total:** | **100%** = 100 Points |

## Final Course Grade:

Your final course letter grade is determined by a cumulative percentage, a total of the graded percentages you receive for each weighted activity above.

## Grades/Points:

| | | | |
|---|---|---|---|
| A | 4.0 = 95 – 100 | C | 2.0 = 74 - 76 |
| A- | 3.7 = 89 – 94 | C- | 1.7 =70 - 73 |
| B+ | 3.3 = 86 – 88 | D+ | 1.3 = 67 - 69 |
| B | 3.0 = 83 – 85 | D | 1.0 = 64 - 66 |
| B- | 2.7 = 79 – 82 | D- | 0.7 = 60 - 63 |
| C+ | 2.3 = 77 – 78 | F | 0.0 = 00 – 59 |

## National University Statements on:

**Diversity:**

Learning to work with and value diversity is essential in every program. Students are required to act respectfully toward other students and the instructor 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:**

Computer Lab, DVD

**Writing Across the Curriculum:**
http://www3.nu.edu/schools/SOET/writing.html

**Student Discipline and Plagiarism:**
http://www3.nu.edu/schools/SOET/plagiarism.html

**Attendance Procedures:**
http://www3.nu.edu/schools/SOET/attendance.html

**Library Resources:**
http://www3.nu.edu/schools/SOET/library.html
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 hel
Recorded class presentations
Tutorials & Guides (APA/MLA, Peer-Review, and more)

**APA Reference Guide:**
http://www.apastyle.org/pubmanual.html

## References:

Spread Spectrum Communications, Scholtz, Bary K.levit, 1995.

Multiuser Detection, Sergio Verdu, Cambridge Univ.Press, 1998.

CDMA systems Engineering Handbook, J S Lee and L E Miller, Artech House, 1998

CDMA Principles of Spread Spectrum Communications, Andrew J Viterbi, Addison Wesley, 1995

**Wireless News and events:**

http://www.wirelessdevnet.com/

www.sdtelecom.org

http://www.computerworld.com/

http://www.instat.com/

http://www.itconversations.com/

http://www.instat.com/MarkAlrt/insightw.asp

http://www.wired.com/news/wireless/

http://www.livenewswires.com/wimax/WIMAX-news

http://www.3gnewsroom.com/3g_news/index.shtml

**Note: This syllabus is tentative and is subject to change.**