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.
- 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 and 2nd lectures – Monday Feb. 2nd, Tuesday Feb. 3rd

- Review of course outline, syllabus, projects and course requirements
- Review the mobile telephone system architecture
- Review multiple access techniques.

- Define requirements for spread spectrum wireless systems
- Derive the capacity equation for a CDMA system
- Discuss how to select a topic on CDMA for summarizing an article
- Discuss how to find sources, and write bibliography

** This week you will only need to select a topic to write about, and find related literature on the topic, you may use the same topic for your project presentations*
**Student after school activity: Read related material on chapter 1 of the text book*
**Student after school activity: Read related material on chapter 3 of the text book*

Objectives of 3rd lecture – Thursday Feb. 5th

- Define Cross Correlation and Auto-Correlation
- Define Orthogonal Codes
- Define PN codes
- Describe Properties of Orthogonal and PN Codes
- Video – The men who made Radio
- Discuss how to write annotated bibliography. Source: http://owl.english.purdue.edu/owl/resource/614/01/

**Student after school activity: Read related material on chapter 4 of the text book*
**Instructor Activity: Hand out first assignment*
**Student Reminder: Project presentation proposal due next Monday*
**Student Reminder: Next Monday annotated bibliography is due*
**Articles topic and bibliography due*
**In class activity: White paper review*

Objectives of 4th and 5th lectures – Monday Feb. 9th & Tuesday Feb. 10th

- 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
- Discuss how to separate main themes, how to summarize, rephrase, quotations, APA, outline (or introduction) MAIN IDEA (THESIS), main body (headings and subheadings), conclusion (or summary). Assess and evaluate, Reflect. Don't be afraid to include your own opinions (critic the article). Source: http://owl.english.purdue.edu/owl/resource/560/01/

  OR: http://owl.english.purdue.edu/

**Student after school activity: Read related material on chapter 5 of the text book*
**Student activity: Project Presentation Proposals due*
**Student activity: First assignment due today*
**Student Reminder: Midterm Exam, This Thursday*
**Annotated bibliography due*
**In class activity: Matlab*
**In class activity: Review Quiz*

Objectives of 6th lecture – Thursday Feb. 12th

- Discuss Power Control in CDMA

**Student activity: Midterm Exam*
**Instructor Activity: Hand out 2nd assignment- due next Monday*
**In class activity: Matlab (Create a simulation of a CDMA signal)*

Objectives of 7th and 8th lectures – Tuesday Feb. 18th & Thursday Feb. 19th

- 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
- Discuss Peer Review (Optional: you may choose to obtain professional peer review on your papers, either now, or in the future at smarthinking.com): http://smarthinking.com/

**Student after school activity: Read related material on chapter 9 of the text book – cont.*
**Student activity: 2nd assignments due*
**Submit ALL summarized papers (hard copy) to the instructor*
**In class activity: Demo with PN scanner*

Objectives of 9th and 10th, Monday Feb. 23rd and Tuesday Feb. 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

**Student after school activity: Read related material on chapter 8 of the text book*
**Student Reminder: Thursday is the Final Exam*
**In class activity: Peer Review on Articles – create team for peer review*
**In class activity: Review Quiz*

Objectives of 10th and 11th lectures, Thursday Feb. 26th and Friday Feb. 27th

** Student activity: Final Exam*

- Discuss Future of CDMA

** Submit all summarized work – final drafts*
** In class activity: Presentation of Projects*

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

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

Course Grading:

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

Learning Activity Weights and Scoring Guides	
Activity	**Weight**
1. Class Participation	**5%** = 5 Points

Learning Activity Weights and Scoring Guides	
Activity	**Weight**
2. Unit Assignments	**10%** = 10 Points
3. Course Project and Presentation	**15%** = 15 Points
4. Midterm Exam	**15%** = 15 Points
5. Final Exam	**20%** = 20 Points
6. Matlab project	**15%** = 15 points
7. Quiz participation	**5%** = 5 Points
8. Writing assignment	**15%** = 15 points
Total:	**100%** = 100 Points

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

Writing Resources:

Peer review: http://smarthinking.com/

Writing center: http://owl.english.purdue.edu/

Reference List: http://www.ub.ntnu.no/viko/en/mod7/mod7_side15_8.php

Writing handouts:
http://www.capella.edu/interactivemedia/onlineWritingCenter/handoutsModules.aspx

Other useful writing sources:
http://www2.smumn.edu/deptpages/~tcwritingcenter/APA/APA_Entry_Page.htm

In block quotations: http://www.rpi.edu/web/writingcenter/apa.html

Parenthetical Docs, references, citations:
http://leo.stcloudstate.edu/research/apaintext.html#place

APA Q&A: http://apastyle.apa.org/previoustips.html

Sources for Writing Assignment in APA 5th edition:
Reference: http://www.ub.ntnu.no/viko/en/mod7/mod7_side15_4.php

Example on how to write Appendix and Tables:
http://www.uwsp.edu/psych/apa4b.htm#A4

Course material and Resources:

www.globaltechnologies.biz

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

http://www.hedylamarr.org/hedystory5.html

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