Lecturer:
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Course Handbook entry
Modern communication systems from a systems point of view. Cellular mobile communication systems. Radio Propagation-loss model. The mobile fading channel. Multiple access techniques TDMA, CDMA. Modulation and coding in mobile communication systems, Equalization and channel diversity, Wireless Standards – GSM, CDMA IS-95, and 3G WCDMA. The concept of Spread Spectrum (SS) Communications - historical background; Major Characteristics of SS-CDMA; Direct Sequence Spread Spectrum; Basic Features of DS-CDMA Systems, PN Sequences; CDMA System Processing Gain; Synchronization in CDMA; The BER Performance of DS-CDMA System; Interference Limited Capacity of a Single Cell CDMA System; Adaptive Multi-user Detection on Multi-path Fading Channel; Diversity and Smart Antennas; Antenna Beam-Forming, and Space Division Multiple Access; Overview of Fundamental Concepts Used in IS-95 CDMA; Channel Coding (Convolutional Codes); Maximum Likelihood Decoding (Viterbi Algorithm); Hadamard-Walsh Orthogonal Coding (orthogonal modulation); Concatenated Coding and Block Interleaving; IS -95 CDMA Link Capacity; CDMA 2000; Evolution of IS-95 to CDMA 2000; Conceptual Similarities and Differences Between IS-95 and CDMA 2000. UMTS 3G WCDMA networks. Satellite Communication, Link budget Analysis.
Course Objectives  
At the end of this course the student should:
a) Understand the concepts of mobile communication systems and the engineering issues associated with these concepts.
b) Have knowledge of the algorithms used in the implementation of the current cellular mobile communication systems, GSM, CDMA IS-95, and 3G networks.
c) Acquire knowledge of the latest developments in modern cellular networks.

Lecture Times  
Monday 4-6pm, Civil Eng G1

Tutorials:  
A tutorial should be attended every second week. The tutorial times are: Wednesday 9-10; and Wednesday 10-11 (both EE219). It is planned that the tutorials will run for 2 hours, from 9-11 in EE219 with a break at the hour mark, rather than the scheduled one hour slot. This will give the students greater exposure to course material and problem solving.

Laboratories:  
There are five labs in total, and students must attend the lab every second week, starting week 2. The labs will not be done in order, as the equipment is limited. The lab program will be organised by Ning Wang (ning.w@student.unsw.edu.au). Contact him or the lecturer if there are any problems regarding the labs. Available lab times are: (all room EE322) Monday 12-3, Wednesday 12-3, Wednesday 3-6, Thursday 9-12, and Thursday 12-3. Some of these lab slots will be closed due to low enrolments. Confirmation of allocated lab periods will be made in week 1.

Please come only to the lab time you are enrolled in. If you need to miss a lab for any reason alternative arrangements must be made with Ning or the lecturer.

Assessment  
Final Examination: 50%  
Two Assignments: 20% (Due around weeks 7 and 11)  
Labs: 15%  
Vista Quizzes 15%  

- The final exam will be held during the examination period, and material will encompass the entire course, lectures, tutorials, and laboratories.
- Two assignments will be handed out in lectures, and the precise date and time for submission will be advised. Assignments must be submitted in the assignment box with an official assignment cover sheet. Late submissions will attract the following penalties, without exception: One day late 15% reduction in maximum attainable mark; then maximum attainable mark is reduced a further 10% for each subsequent day late.
- Labs must be marked at the end of the session during which the lab was attended, with no exceptions. Attendance must be punctual – lateness will result in a reduction of available marks.
- At the beginning of the lab period there will be a Vista quiz, consisting of 8 questions. The quiz will be closed book, and must be done individually in the laboratory under exam conditions. The quiz will only be available at the beginning of the lab time, and any students who are late and miss the quiz will forfeit those marks.

In addition attendance will regularly be taken in the lectures and the tutorials. This attendance will carry no marks, however it will assist the lecturer assessing special consideration requests and supplementary exam requests at the end of session.

**Academic honesty and plagiarism**

Plagiarism is a serious issue at UNSW. Students should all be familiar with the university wide policy for plagiarism and academic honesty. This can be found at www.lc.unsw.edu.au/plagiarism.

**Course Website**

The subject website is http://subjects.ee.unsw.edu.au/tele4652. Check this regularly, as important announcements about the course will be posted on this website. All the lecture notes, tutorial solutions, assignments and solutions, will be posted on this website.

In addition WebCT Vista (vista.elearning.unsw.edu.au) will be used for the online quizzes at each laboratory session, and for the on-line discussion forum. Important course announcements will be posted on the forum and students should check this regularly.

**Syllabus**

The aim of this course is to provide students with a fundamental understanding of the system architecture, system design, and the effects of the channel, on two of the most important digital telecommunication systems; Digital Cellular Mobile Communication Systems and Digital Satellite Communication Systems. It will demonstrate how digital modulation and channel coding techniques, as were taught in TELE4653 – Digital Modulation and Coding, are used to improve the reliability and performance of each system. It also aims to provide a general understanding of these systems from a network perspective.

The syllabus covers Propagation-Loss models, mobile fading channels, multiple access techniques, the GSM standard, Digital Satellite Communication Systems, and equalisation and channel diversity techniques. Central to the course is a detailed explanation of the fundamentals of the existing digital mobile communication systems in Australia, as well as world-wide: GSM, CDMA IS-95, cdma2000 and 3G/UMTS.

**Background Knowledge:**

Introductory courses in telecommunications (such as TELE3013: Telecommunication Systems 1 at UNSW) and signal processing (ELEC3004: Digital Signal Processing) are necessary to undertake this course. A solid grounding in digital modulation and channel coding techniques, such as that gained in TELE4653, would be highly beneficial.

**Resources for students**
There are a variety of lecture notes available for this course, and many suitable textbooks. Printed lecture notes will be handed out in lectures and made available on the website, http://subjects.ee.unsw.edu.au. These notes will represent the course curriculum and examinable material. Additional lecture notes for previous years can also be found on this website. Students should note that the purpose of these notes is to provide alternative explanations of the important concepts in the course. There may be significant differences and omissions in these notes from past years, and so should be treated as supplementary supporting material.

There a couple of recommended textbooks:

Students should note that, while these books will roughly follow the course syllabus, there will be significant material in the lecture notes that is not covered in these textbooks. Due to the very nature of the course itself, representing a technical elective in a continually changing and developing field, it is impossible to find a thorough and comprehensive textbook covering all aspects of the course.

There are many other good books covering different aspects of the course. Students should in general be industrious and gather information from a wide variety of sources. Suggested other reference books are:

M. Mouly and M-B. Pautet, “The GSM System for Mobile Communications.”

Tentative Timetable

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<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>July 28</td>
<td>Introduction, Cellular concepts, 1G – AMPS, Trunking theory and Capacity</td>
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<tr>
<td>2</td>
<td>August 4</td>
<td>RF circuits, Antennae, E/M wave propagation, and channel models.</td>
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<tr>
<td>3</td>
<td>August 11</td>
<td>Digital communications 1 – multiple access, duplexing, modulation</td>
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<td>4</td>
<td>August 18</td>
<td>Digital communications 2 – equalization, diversity, channel and source coding</td>
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<td>5</td>
<td>August 25</td>
<td>GSM 1</td>
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<td>6</td>
<td>Sept 1</td>
<td>GSM 2</td>
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<td>7</td>
<td>Sept 8</td>
<td>Spread Spectrum Communications and CDMA</td>
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<td>8</td>
<td>Sept 15</td>
<td>IS-95 CDMA</td>
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<td>9</td>
<td>Sept 22</td>
<td>3G networks 1 – W-CDMA</td>
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<tr>
<td>10</td>
<td>Sept 29</td>
<td>3G networks 2 – cdma2000</td>
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<td>11</td>
<td>Oct 6</td>
<td>Satellite Communications, Link Budget analysis</td>
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<td>12</td>
<td>Oct 13</td>
<td>4G networks and final revision</td>
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