

HUT

Department of Electrical and Communications Engineering  
Communications Laboratory

# **S-72.2210 Mobile communication systems and services**

*Lectures autumn 2005*

**Sven-Gustav Häggman**

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## Course status

### Old degree structure

Compulsory course in

option Networks and Systems

Televiestintäjärjestelmät (Radio Communications Path)

Communications Engineering

International Master's Program in Telecommunications

Elective course in

option Product Design and User Interfaces in Communications

Acoustics and Audio Signal Processing,

Radio Engineering,

Signal Processing

Teletraffic Theory

Televiestintäjärjestelmät (Other Paths than Radio Comm. Path)

### New degree structure:

Compulsory course in the Bachelor degree program major subjects

Transmission systems in communications

Networking technology

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## Course targets

The course gives

- basic knowledge about mobile communication systems and services,
- knowledge for future cellular radio network planners, operators and equipment designers about the possibilities and limitations of mobile traffic and services,
- the terminology used in mobile communication systems,
- principles of transmission methods used in mobile systems.

In addition, the student knows

- characteristics of presently used mobile communication systems

The emphasis is on the radio access network.

## Prerequisites

Old degree structure: S-72.245 Transmission Methods in  
Telecommunication Systems

New degree structure: S-72.1140 Transmission Methods in  
Telecommunication Systems

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## Teachers

- Professor Sven-Gustav Häggman is the responsible teacher and lecturer of this course.
- MSc Helka-Liina Määttänen takes care of the exercises and the responsibility for the course web-material
- Information about the course will be found on the web-address [www.comlab.hut.fi/studies/2210/](http://www.comlab.hut.fi/studies/2210/)

## Lectures and exercises

Lectured every academic year in Period II

Lectures starting on November 1 are held on

Tuesdays 10 - 12 in Auditorium S4

Fridays 12 - 14 in Auditorium S1.

Exercises starting on November 11 are held on

Fridays 14 - 16 in Auditorium S3 starting.

There are 10 voluntary home-works, which will be checked and graded and they will give bonus to the final course grade.

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## Requirements

- The course is carried out with an exam and home assignments.
- The exam requirements consist of the material distributed to the students.
- The exam is a closed-book exam with one compulsory task and six tasks of which the four best answers are considered for the exam grade.
- The tasks will be available in English and Finnish.
- The first exam is on December 19, 2005.
- Information about the following exams will be shown on the Departments web-pages.
- Calculators are allowed and their use is highly recommendable. Otherwise the general exam rules in HUT are followed.

## Final grade

The final course grade is the nearest integer to the exam grade +  $0.2 \times$  assignment grade

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## Literature

- Lecture handouts distributed via Edita Oy. Following textbooks can provide background material:
  - William C. Jakes: *Microwave Mobile Communications*, USA 1974, Wiley, 642pp.
  - Michel Mouly, Marie-Bernadette Pautet: *The GSM System for Mobile Communications*  
France 1992, Published by authors, 699pp.
  - Andrew J. Viterbi: *CDMA, principles of spread spectrum communications*  
USA 1995, Addison-Wesley, 245pp.
  - Theodore S. Rappaport: *Wireless communications, Principles & practice*  
USA 1996, IEEE Press, 641 pp.
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- Harri Holma, Antti Toskala (Ed.): WCDMA for UMTS, Radio Access for third generation mobile communications. Revised edition Chichester, England 2001, Wiley, 338pp.
  - David Parsons: The Mobile Radio Propagation Channel, 2<sup>nd</sup> edition Great Britain 2000, Wiley, 418pp.
  - Raymond Steele (Ed): Mobile Radio Communications, 2<sup>nd</sup> edition Great Britain 2000, Wiley, 1090pp.
  - Gordon L. Stüber: Principles of mobile communications. 2<sup>nd</sup> edition USA 2001, Kluwer, 752pp.
  - Jyrki Penttinen: GSM-tekniikka; Järjestelmän toiminta ja kehitys kohti UMTS-aikakautta, 3. painos Vantaa 2001, WSOY, 412s.
  - Jyrki Penttinen: GPRS-tekniikka; Verkon rakenne, toiminta ja mitoitus Vantaa 2001, WSOY, 264s.
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## Journals:

1. IEEE Transactions on Vehicular Technology
2. IEEE Personal Communications Magazine
3. IEEE Transactions on Communications
4. IEEE Journal on Selected Areas of Communications
5. IEEE Communications Magazine
6. IEEE Transactions on Antennas and Propagation
7. IEE Proceedings, Part F
8. Wireless Personal Communications

## Conference proceedings:

1. Vehicular Technology Conference, VTC spring, VTC fall
  2. IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, PIMRC
  3. International Conference on Communications, ICC
  4. Globecom
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## S-72.2210 Lecture plan autumn 2005

Tue.	1.11. 2005	10 - 12	Lecture 1&2	Introduction Cellular system concepts
Fri.	4.11. 2005	12 - 14	Lecture 3&4	Radio wave propagation and channel modelling in mobile communication systems
Fri.	4.11. 2005	14 - 16	Lecture 5&6	Generic mobile radio system techniques, e.g. diversity and modulation
Tue.	8.11. 2005	10 - 12	Lecture 7&8	2 <sup>nd</sup> generation digital cellular systems, GSM Architecture and services
Fri.	11.11. 2005	12 - 14	Lecture 9&10	2 <sup>nd</sup> generation digital cellular systems, GSM Radio interface
Fri.	11.11. 2005	14 - 16	Exercise 1&2	
Tue.	15.11. 2005	10 - 12	Lecture 11&12	Mobility and radio resource management in GSM
Fri.	18.11. 2005	12 - 14	Lecture 13&14	2.5G, GPRS and EDGE
Fri.	18.11. 2005	14 - 16	Exercise 3&4	

Tue.	22.11. 2005	10 - 12	Lecture 15&16	CDMA principles
Fri.	25.11. 2005	12 - 14	Lecture 17&18	3 <sup>rd</sup> generation cellular systems architecture and channel structure
Fri.	25.11. 2005	14 - 16	Exercise 5&6	
Tue.	29.11. 2005	10 - 12	Lecture 19&20	3 <sup>rd</sup> generation cellular systems radio interface
Fri.	2.12. 2005	12 - 14	Lecture 21&22	3 <sup>rd</sup> generation cellular systems radio resource management
Fri.	2.12. 2005	14 - 16	Exercise 7&8	
Tue.	6.12. 2005	10 - 12	No lectures	
Fri.	9.12. 2005	12 - 14	Lecture 23&24	Other mobile communication systems, TETRA, DECT
Fri.	9.12. 2005	14 - 16	Exercise 9&10	