COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mobile systems [S2EiT2E-TIT>SRR]

Course

Field of study
Electronics and Telecommunications

Year/Semester
1/2

Area of study (specialization)
Information and Communication Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

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Prerequisites

A student knows the rules of operation of communication systems. He/she has the ordered and mathematically supported detailed knowledge of the communication theory. He/she has the ordered and mathematically supported detailed knowledge in the area of foundations of wireless communications, wireless local area networks and methods of multiple access. A student is able to evaluate transmission parameters of digital signals transmitted in radio links. He/she is able to select the appropriate method of signal reception taking into account distortion, and interference occurring in radio channels. A student is able to formulate opinions on basic challenges which are faced by wireless communication systems and is aware of the influence of such systems on shaping the information society.

Course objective

Learning of theoretical foundations and standards describing the rules of operation of modern mobile wireless systems, in particular cellular (3G, 4G and 5G) and wideband wireless access to fixed networks.

Course-related learning outcomes

Knowledge:
A student has possesses the ordered knowledge on rules of operation of cellular systems based on spread spectrum and OFDM transmission. He/she has the knowledge on problems and methods associated with electromagnetic field in wireless systems. He/she has the ordered and mathematically supported detailed knowledge in the area of digital signal processing in wireless systems.

Skills:
A student is able to analyze 3GPP standards of modern wireless and cellular systems published in English. He/she is well oriented in 3GPP standards related to UMTS/HSPA, LTE and LTE-Advanced. He/she is able to evaluate and compare operation of 3G and 4G systems.

Social competences:
A student understands the meaning of standards in wireless cellular systems and law conditions associated with them. He/she understands meaning of the wireless systems for development of information society. He/she is aware of his/her responsibility for implementation of a cellular network projects in the context of their influence on environment and human being.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Written exam checking knowledge presented during lectures and trained during tutorials (problem sessions). An exam questionnaire is applied in which four problems to solve are presented. Students write their answers to the stated questions/probems in a supplied questionnaire. Solution of each problem is evaluated in the scale from 0 to 3 points. Exam is approved as passed if a student obtained at least 7 points (out of 12 points). If the number of obtained points is between 5 and 6.5 a student participates in an additional exam round in which he/she solves two additional questions using a similar, additional questionnaire. The satisfactory grade is received if the number of obtained points is 7, 7.5 or 8. The grades rise each full point achieved the "very good" grade when the number of points is 11.5 o 12. Evaluation resolution is 0.5 point.
Evaluation of learning outcomes of exercises is carried by means of a test that is to be taken at the end of a semester. A few questions span whole material covered during exercises showing knowledge, reasoning ability and proficiency in enginering calculations. The grade is given in the range from 2 to 5. Students that obtained 2 are asked to retake the test at the time consulted with the tutor.

Programme content

Repetition of knowledge on radio propagation, interference, fading and distortions in radio channels. Short overview of history of wireless systems including 2G (GSM/GPRS/EDGE). Basic architecture of GSM and GPRS networks. Packets bursts and basic parameters of GSM PHY layer. Cellular CDMA (3G) networks (UMTS/HSPA/HSPA+). Recalling RAKE receiver and spreading sequences used in CDMA systems/networks. Packet transmission in CDMA networks. Evolution to 4G: LTE and LTE-A: OFDM and OFDMA, SC-FDMA multiple access rules. Basic knowledge of 5G systems (New Radio parameters and access, basic scenarios, requirements and associated systems).
Exercises, because of limited time available cover only selectected topics from the set of materials presented during lectrures, e.g., cellular system concept and signal to interference ratio, GSM systems, spread spectrum systems including UMTS and PHY layer techniques introduced by LTE and 5G.

Course topics

none

Teaching methods

Interactive lecture; besides presentation of the course content the students are asked about possible solutions to active them. After a half of each lecture a short brake (3 minutes) is done in which the lecturer changes the topic. Due to specific topic of the lectures the students are often asked abouot mobile systems operating in their home countries.
Exercises are based on a set of taks solved by students with support from the teacher. Before each task teacher explains main problems and refers to appropriate material presented during lectrures.

Bibliography

Basic
1. K. Wesołowski, Mobile communication systems, John Wiley & Sons, Chichester, 2003,
2. Theodore Rappaport, Wireless Communications. Principles & Practice, Prentice Hall 2002
3. H. Holma, A. Toskala, WCDMA for UMTS - HSPA Evolution and LTE, John Wiley & Sons, Chichester, 2010
Additional
1. E. Dahlman, S. Parkvall, J. Skold, P. Beming, 3G Evolution. HSPA and LTE for Mobile Broadband, Academic Press,2007
2. E. Dahlman, S. Parkvall, J. Skold, 4G LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2010,
3. E. Dahlman, S. Parkvall, J. Skold, 5G NR. The Next Generation Wireless Access Technology, Academic Press, 2018
4. A. Molisch, Wireless COmmunications, John Wiley & Sons, CHichester, 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,00