

SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Communications
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study / Qualification	Telecommunications Technologies and Systems/ Engineer Applied Electronics/ Engineer
1.7 Form of education	Full time
1.8 Subject code	TST-E47.00/ EA-E103.00

2. Data about the subject

2.1 Subject name	Mobile Communications						
2.2 Subject area	Theoretical area						
	Methodological area						
	Analytic area						
2.3 Course responsible	Professor, Romulus Terebeș Romulus.Terebes@com.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Professor, Romulus Terebeș, Romulus.Terebes@com.utcluj.ro Assistant Andreia Valentina Miclea Ph.D student Andreia.Miclea@com.utcluj.ro						
2.5 Year of study	4	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DS/DI

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28
Distribution of time					hours
Manual, lecture material and notes, bibliography					42
Supplementary study in the library, online specialized platforms and in the field					7
Preparation for seminars / laboratories, homework, reports, portfolios and essays					14
Tutoring					3
Exams and tests					3
Other activities:					0
3.7 Total hours of individual study	69				
3.8 Total hours per semester	125				
3.9 Number of credit points	5				

4. Pre-requisites (where appropriate)

4.1 curriculum	N. A.
4.2 competence	N. A.

5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, Cluj-Napoca
5.2. for the seminars / laboratories / projects	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	<p>C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information</p> <p>C4.3 Explanation and interpretation of the main requirements and specific approach techniques for data, voice, video, multimedia transmissions</p> <p>C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks</p> <p>C5.2 Explanation and interpretation of the fundamental technologies and protocols for the fixed -mobile integrated communication systems</p> <p>C6. Solving specific problems of the broadband communications networks: propagation in different environment, circuits and equipment for high frequencies (microwaves and optical).</p> <p>C6.4 Use of the QoS parameters and measurement techniques specific to the propagation and transmission channels and media</p>
Cross competences	N.A.

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Development of professional skills in the field of mobile communications
7.2 Specific objectives	<ol style="list-style-type: none"> 1. Assimilation of the theoretical knowledge regarding the operation of mobile communication systems 2. Development of skills and abilities needed to design and implement mobile applications and services

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
<ol style="list-style-type: none"> 1. Mobility specific concepts. Evolution of mobile communications. Standards for mobile communications. The mobile radio channel 2. The GSM system. Standardization phases. Categories of services in GSM. The architecture of a GSM network. Functional description of a GSM network 3. Addresses and identifiers in GSM. Call routing in GSM intra(inter)- PLMN calls, MT calls, MO calls, calls between GSM users 4. The GSM's radio interface. Signal processing for transmission over the radio interface (voice codecs, ciphering, channel coding, channel equalization, modulation) 5. The GSM's radio interface. Logical and physical channels. Mapping logical channels onto physical channels 6. The stack of signaling protocols. Signaling protocols for transmission over the radio, the A and the Abis interfaces. Signaling protocols inside NSS. The SS7 signaling system 7. Signaling procedures. RR, MM and CM procedures 8. GSM/GPRS networks: architecture, functional description, GPRS identifier: logical and physical GPRS channels, temporal multiplexing of logical channels, radio resource sharing between GSM and GPRS, MM and PDP contexts 9. GSM/GPRS networks: the stack of signaling and transmission protocols, GPRS signaling and transmission procedures. EDGE: GPRS limitations, classification (EGPRS and EGPRS), the architecture of EDGE networks, mechanisms for increased data rates (modulation, link adaptation, incremental redundancy) 10. Introduction to UMTS: architecture (release 99, Release 4 and Release 5) ,multiple access scheme, functional description, specific procedures for accessing the network and providing mobility 11. Data and voice transmission over UMTS's radio interface: transport channels and bearers. Examples of CN-CS and 12. CN-PS procedures 13. UTRA evolution – HSDPA, HSUPA: architecture, key enabling technologies, channels, data transmission, mobility support. HSPA+ 14. LTE networks: architecture, multiple access, functional description 15. LTE sample signaling/transmission procedures. Evolution to 5G 	Presentation, exemplification, problem presentation, exercises and case studies, formative evaluation	Use of overhead projector and of simulation platforms
<p>Bibliography</p> <ol style="list-style-type: none"> 1. R. Terebes – “Mobile communication systems. Part one: GSM networks“, Editura UTPRES, Cluj-Napoca, 2006, ISBN 978-973-662-221, 978-973-622-222-9. 2. Erik Dahlman, Stefan Parkvall, and Johan Sköld, 4G, LTE-Advanced Pro and the road to 5G, Academic Press, 2016 3. C. Kappler – “UMTS networks and beyond“, John Wiley and sons, 2009 4. Ralf Kreher, Torsten Ruedebusch, “UMTS Signaling: UMTS Interfaces, Protocols, Message Flows and Procedures Analyzed and Explained” [Hardcover], Wiley; 2 edition (March 19, 2007) ISBN-10: 0470065338 ISBN-13: 978-0470065334. <p>Online references</p> <ol style="list-style-type: none"> 1. R. Terebes, Mobile communications (lecture notes, lab guides), http://ares.utcluj.ro/mc/mc.html 2. ETSI/3GPP specifications http://www.3gpp.org 		

8.2 Laboratory (4h modules every 2 weeks)	Teaching methods	Notes
1. The GSM radio access network. Hardware configuration using Alcatel-Lucent equipment	Practical demonstration, lab experiments, applications	Use of emulators, mobile phones and devices computers
2. The GSM AT command set. The SMS service.		
3. Mobile web applications		
4. Signaling protocols and procedures in GSM		
5. Android applications		
6. JME applications. M2M applications		
7. LTE networks		
Bibliography		
1. Lab support http://ares.utcluj.ro/mc/mc.html		
2. Alcatel-Lucent and Nokia equipment manuals.		

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The discipline content and the acquired skills are in agreement with the expectations of the professional Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	Written exam - multiple choice test with open and closed answers	75%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Multiple choice tests at the end of each lab	25%
10.6 Minimum standard of performance			
Qualitative point of view			
Minimal theoretical and practical knowledge:			
<ul style="list-style-type: none"> ✓ Understanding of the architecture, functionality, stack of protocols of the following mobile communication systems: GSM, GPRS, EDGE, UMTS; LTE ✓ Ability to perform a thorough analysis of the various signal processing tasks for increased data-rate and reliable data transmission in mobile networks 			
Minimal acquired competences:			
<ul style="list-style-type: none"> ✓ Ability to develop mobile applications using various technologies: Android, JME, mobile web ✓ Ability to analyze and improve performance of a mobile network 			
Quantitative point of view			
<ul style="list-style-type: none"> ✓ Minimal mark at the exam 5 ✓ Final mark = 0.75 x Exam + 0.25 x Mean of the marks at the lab tests 			

Date of filling in:	Responsible	Title First name SURNAME	Signature
27.09.2021	Course	Professor Romulus TEREBES, Ph.D.	
	Applications	Professor Romulus TEREBES, Ph.D.	
		Assistant Andreia MICLEA, Ph.D. student	

Date of approval in the Department of Communications 27.09.2021	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 27.09.2021	Dean Prof. Gabriel OLTEAN, Ph.D.