SYLLABUS

1. Information about the program

1.1 Higher education institution	UNIVERSITY POLITEHNICA OF TIMISOARA
1.2 Faculty[1]/ Department [2]	ELECTRONICS, TELECOMUNICATON AND INFORMATION TECHNOLOGIES/COM
1.3 Field of study (name/code[3])	ELECTRONIC ENGINEERING, TELECOMUNICATION AND INFORMATION TECHNOLOGIES
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	TST-ENG/20/20/10/100/10/TST-ENG

2. Information about the discipline

2.1 Name of discipline/ formative category[4]			MOBILE COMMUNICATIONS/DS				
2.2 Coordinator (holder) of course activities			ȘL. PETRIȚA TEODOR				
2.3 Coordinator (holder) of applied activities[5]			SL. PETRIȚA TEODOR				
2.4 Year of study[6]	4	**2.5** Semester	7	**2.6** Type of evaluation	D	**2.7** Regime of discipline[7]	DO

3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [8]

3.1 Number of fully assisted hours / week	4 of which:	**3.2** course	2	**3.3** seminar / laboratory / project	0/1/1
3.1* Total number of fully assisted hours / semester	56 of which:	**3.2*** course	28	**3.3*** seminar / laboratory / project	0/14/14
3.4 Number of hours partially assisted / week	of which:	**3.5** training		**3.6** hours for diploma project elaboration	
3.4* Total number of hours partially assisted / semester	of which:	**3.5*** training		**3.6*** hours for diploma project elaboration	
3.7 Number of hours of unassisted activities / week	4.93 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0.93
		hours of individual study after manual, course support, bibliography and notes			2
		training seminars / laboratories, homework and papers, portfolios and essays			2
3.7* Number of hours of unassisted activities / semester	69 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			13
		hours of individual study after manual, course support, bibliography and notes			28
		training seminars / laboratories, homework and papers, portfolios and essays			28
3.8 Total hours / week [9]	8.93				
3.8* Total hours /semester	125				
3.9 Number of credits	5				

4. **Prerequisites** (where applicable)

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[1] The name of the faculty which manages the educational curriculum to which the discipline belongs
[2] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[3] The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.
[4] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).
[5] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[6] Year of studies in which the discipline is provided in the curriculum.
[7] Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).
[8] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.
[9] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

4.1 Curriculum	• Radio communications
4.2 Competencies	• Knowledge of radio circuits, antennas and wave propagations

5. Conditions (where applicable)

5.1 of the course	• Course hall with video projector
5.2 to conduct practical activities	• Laboratory with PCs; student's own smartphones for some experiments

6. Specific competencies acquired through this discipline

Specific competencies	• Understanding of mobile networks • Understanding of mobile technologies • Understanding of radio coverage with applications to mobile networks • Ability to perform and process own coverage measurements with own smartphone • Ability to perform a site survey and to evaluate a site for a base station installation • Understanding and ability to evaluate EMF exposure in base station vicinity • Use of GIS systems
Professional competencies ascribed to the specific competencies	• Selection, instalation, configuration and operation of fixed and mobile equipment and equipping the site with common telecommunication networks.
Transversal competencies ascribed to the specific competencies	• Adaptation to new technologies, professional and personal development through continuous training, using printed documentation sources, specialized software and electronic resources in Romanian and at least one foreign language.

7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	• Defining principles underlying the main mobile telecommunications technologies, usage of radio channels for access networks
7.2 Specific objectives	• Understanding mobile network technologies, use of propagation models, link budget calculation, coverage measurement

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
Basic concepts in Wireless communications, multiple access	3	Lectures, teaching material – presentations, pdfs, Interactive discussions, questions and answers, problem solving
Cellular systems, operating mode, sectorization and frequency management	3	
Propagation matters: models, fading, antennas, link budge, geographical coordinates, coverage maps	5	
2G networks, GSM architecture, GMSK	3	
CDMA basics, PN and orthogonal codes, DS-CDMA, soft handover	2	
3G networks, UMTS architecture	2	
4G networks, OFDM / OFDMA, LTE	4	
5G, NR, standardization in mobile networks, 3GPP, ITU	3	

[10] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".
[11] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

EMF matters	3	

Bibliography [12]

1. Gordon L. Stuber, Principles of Mobile Communication, Springer International Publishing 2018
2. Tse, D., & Viswanath, P. (2005). Fundamentals of Wireless Communication. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511807213
3. N Tripathi, Cellular Communications: A Comprehensive and Practical Guide, IEEE Wiley, 9780470472071, 2014
4. T.S. Rappaport, Wireless Communications – Principles and Practices, IEEE/Prentice Hall New York, 1996
5. Materials on the virtual campus
6. A. Goldsmith, Wireless Communications, 2020 draft second edition (as on Stanford University site, https://web.stanford.edu/class/ee359/doc/WirelessComm_Chp1-16_March32020.pdf)
7. Emil Björnson, Jakob Hoydis and Luca Sanguinetti (2017), "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency", Foundations and Trends in Signal Processing: Vol. 11, No. 3-4, pp 154–655. DOI: 10.1561/2000000093
8. 3GPP site (3gpp.org)

8.2 Applied activities [13]	Number of hours	Teaching methods
Introduction, decibels, radio spectrum	4	
Geographical coordinates	2	
Link budget, RF chain	6	
Modulations	2	
Basic network concepts applied on GSM network	4	
Network coverage map	4	
Homework, projects, recap	4	
Recovery	2	

Bibliography [14] CV.UPT.RO (virtual campus materials), 3GPP.ORG, ITU.INT, ANCOM.RO,QGIS.ORG

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

- Course content agreed with Nokia

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	LEVEL OF COURSE KNOWLEDGE AND UNDERSTANDING	WRITTEN EXAM	1/2
10.5 Applied activities	**S:**		
	L: GRADE OF COMPLIANCE, ACTIVITY LEVEL	LIVE QUESTIONS, QUIZZ	1/4
	P[16]**:** MEASUREMENT REPORT	WRITTEN PROJECT	1/4

[12] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.
[13] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".
[14] At least one title must belong to the discipline team.
[15] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [17])			
• 5			

Date of completion 11.07.2023	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
Head of Department (signature)	**Date of approval in the Faculty Council** [18] 14.09.2023	**Dean (signature)**

[16] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.
[17] It will not explain how the promotion mark is awarded.
[18] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.