SUBJECT INFORMATION SHEET
University year 2019 - 2020

Dean,
prof. dr. ing. Daniela Tarniceriu

1. Information on the programme

1.1 Higher education institution	„Gheorghe Asachi" Technical University of Iasi
1.2 Faculty	Electronics, Telecommunications, and Information Technology
1.3 Department	Applied Electronics and Intelligent Systems
1.4 Field of study	Electronics, Telecommunications, and Informational Technologies Engineering
1.5 Study cycle	Bachelor's Degree Studies
1.6 Study programme/ Qualification	Telecommunication Technology and Systems

2. Information on the subject

2.1 Subject name				Microwave			
2.2 Lecture activities coordinator				Assoc.Prof. Nicolae Lucanu, Dr. eng.			
2.3 Application activities coordinator				Assoc.Prof. Nicolae Lucanu, Dr. eng.. Lecturer Cristian Andriesei, Dr. eng.			
2.4 Study year [1]	4	2.5 Semester[2]	7	2.6 Evaluation[3]	C	2.7 Type of subject[4]	EDID 405

3. Estimated total no. of hours

3.1 Number of hours per week	5	Out of which 3.2 lecture	3	3.3a sem.	-	3.3b applications	2	3.3c project	-
3.4 Total number of hours in the curriculum plan [5]	70	Out of which 3.5 lecture	42	3.6a sem.	-	3.6b applications	28	3.6c project	-

Individual study [6]	Nr. hours
Study based on the manual, the lecture materials, bibliography and notes	16
Additional documentation in the library, on the specialized electronic platforms and in the field	14
Preparing laboratory activities, homework, papers, portfolios and essays	14
Tutorship [7]	2
Exams [8]	2
Other activities - guidance:	2

3.7 Total no. of hours of individual study [9]	50
3.8 Total no. of hours per semester [10]	120
3.9 ECTS	5

4. Prerequisites (if necessary)

4.1 curriculum[11]	No
4.2 competence	No

5. Conditions (if necessary)

5.1 for the lecture [12]	The course will make use of the projector existent in the classroom. The board will be used as well. During the course, the students will receive educational materials, such as Smith chart, tables with formulas and complex figures.
5.2 for the applications [13]	The smart board existent in the laboratory will be used for applications. The laboratory computer network will be used as well. There will be used the following: X Band training kit; Transmission line training kit; Microwave integrated circuits training kit; Antenna training kit; „Phase array" antenna training kit; Satellite communication training kit for C and S bands; K band radar training kit. The software Ansys HFSS will be used as well.

6. Specific competence acquired[14]

			ECTS[15]: 5	ECTS Distribution[16]
Professional competence	CP1	Knowledge of the microwave particular terminology;		0.5
	CP2	Know the basic theory of electromagnetic waves propagation;		0.5
	CP3	Understand the main problems concerning waveguides and the variables involved in characterizing the wave propagation inside of the waveguides;		0.5
	CP4	Knowledge of the analysis methods and design procedures of the microwave devices based on the linear theory for microwave circuits;		0.5
	CP5	Understanding of the functioning of microwave generators;		0.5
	CP6	Knowledge of the main types of semiconductor devices for microwaves and understand the principles behind their functioning;		0.5

	CP7	Knowledge of the basic principles addressing simulation and design of the microwave integrated circuits;	0.5
	CP8	Understanding of the RADAR principles and knowledge of other radiolocation techniques;	0.5
Interdisciplinary competence	CT1	Using the information, communication and professional training resources effectively;	0.33
	CT2	Showing interest for professional training by practicing critical thinking and improving their knowledge and skills throughout the activity;	0.33
	CT3	Developing teamwork abilities and getting used to working in a space equipped with measurement and control electronic equipment.	0.33

7. Subject goals (resulting from the table of the specific competence acquired)

7.1 General subject goal	Deep knowledge of the microwave theory and applications.
7.2 Specific goals	Understanding of the free space wave propagation and guided propagation of microwaves. Ability to analyze and design passive microwave devices. Ability to analyze and design active microwave devices. Getting used with computer aided design tools for microwave circuits.

8. Content

8.1 Lecture (syllabus)	Teaching methods	Observations
Introduction. Waveguides – definitions. Classifications.	Mixing of: - presentation - projector using - explanation - debates - case study - referral to other technical disciplines, previous course or to applications of interest for the subject.	1 course
Electromagnetic wave equation. Propagation modes. Wavelength.		2 courses
Electromagnetic field distribution inside of the uniform metallic waveguides.		2 courses
Theory of the linear circuits for microwaves. Junctions and loads.		1 course
The scattering matrix S. Properties of S matrix for lossless junctions.		1 course
Smith chart.		1 course
Electromagnetic resonators. Classification of cavity resonators. Quality factor of a cavity resonator.		1 course
Circuit elements and devices for microwaves. Directional couplers. Delay systems.		1 course
Magnetron. Static and dynamic functioning.		1 course
Semiconductor devices for microwaves. Gunn diode. IMPATT diode. PIN diode.		1 course
Elements of radiolocation. Radar for mobile targets. Doppler based radar speed gun.		1 course
Industrial applications of the microwaves.		1 course
Evaluation.	Test	

Selected bibliography:
[1] Roger F. Harrington – Time-Harmonic Electromagnetic Fields – IEEE Press Series on Electromagnetic Theory, Wiley-Interscience, New York, 2001.
[2] Robert E. Collin – Field Theory of Guided Waves - IEEE Press Series on Electromagnetic Theory, Wiley-Interscience, New York, 2001.
[3] Mike Golio – RF and Microwave Applications and Systems – CRC Press, Taylor and Francis, Boca Raton 2008
[4] Harvey Lehpamer – Microwave Transmission Networks – McGraw-Hill, New York, 2004.
[5] David Bailey - Practical Radio Engineering and Telemetry for Industry – Newness, Oxford, 2003
[6] Itoh Tatsuo - Numerical Techniques for Microwave and Millimetre-Wave Passive Structures, John Wiley Sons, New York, 1988.

8.2b Applications	Teaching methods	Observations
Conectivity and adaptors in microwave applications.	Training kit Application notes Theoretic introduction Debates	1 application
Experimental study of the Gunn oscillator.		1 application
Experimental study of X-band power divider.		1 application
Experimental study of X-band coupler and circulator.		1 application
Physical implementation of an X-band wireless link		1 application
Experimental study of VSWR factor for a slot line.		1 application
Experimental measurement of the input impedance for an S-band microstrip antenna.		1 application
S parameter measurement for active and passive microwave circuits.		1 application
Pattern radiation measurement for a microstrip antenna.		1 application
Experimental study of "phased array" antenna systems.		1 application
Physical implementation of a satellite communication system.		1 application

Experimental study of a RADAR system.		1 application
Introduction to HFSS design.		1 application
Evaluation.	Oral examination	
Selected bibliography: [1] David M. Pozar – Microwave and RF design of wireless systems, John Wiley & Sons, 2001. [2] Mike Golio – RF and Microwave Circuits, Measurements, and Modelling – CRC Press, Taylor and Francis, Boca Raton 2008. [3] Course notes.		

9. Corroboration of the subject content with the expectations of the epistemic community representatives, professional associations and relevant employers in the field of the study programme

- In establishing the subject content and evaluation methods, we also consulted curricula used in other national and foreign universities. In addition, it takes into account the feedback and expectations of the main industrial actors from Romania. The subject goals follow closely the curriculum plan, as it provides information and trains skills necessary for the future specialists in the field of electronics, telecommunications and information technology. The competences acquired will be necessary for the employees working in the microwave field. The course makes use of basic theory already delivered by other disciplines such as Physics and Fundamentals of Electrical Engineering, being adequately placed in the chronology of the curriculum plan.

10. Evaluation

Type of	10.1 Evaluation criteria	10.2 Evaluation	10.3 Weight in the final mark
10.4 Lecture	Theoretical knowledge (quantity, correctness, accuracy)	Continuous evaluation[17]:	40%
		Homework:	-
		Final evaluation:	40%
10.5b Applications	Knowledge of the devices and their use during the experiment Understanding of the principles behind the measurements and the necessity of conducting such measurements from practical perspective.	Oral evaluation.	20%
10.5d Other activities[18]			-
10.6 Minimum performance standard [19]			
Being marked with the minimum mark 5 for applications evaluation and lecture exam as well.			

Date,

06.09.2019

Subject coordinator,

Assoc.Prof. Nicolae Lucanu, Dr. eng.

Applications coordinator,

Assoc.Prof. Nicolae Lucanu, Dr. eng.

Lecturer Cristian Andriesei, Dr. Eng.

Date of approval within the department,

12.09.2019

Department Director,

Associate Prof. Irinel Valentin Pletea, Dr. Eng