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/
1.7 Form of education	Full time
1.8 Subject code	TST-E48.00b

2. Data about the subject

2.1 Subject name	Project – IoT Systems (Radio)						
2.2 Subject area	Electronic Engineering, Telecommunications and Information Technologies						
2.3 Course responsible							
2.4 Teacher in charge with project	Professor Emanuel PUSCHITA, PhD Emanuel.Puschita@com.utcluj.ro Assistant Eusebiu JECAN, Eusebiu.Jecan@com.utcluj.ro						
2.5 Year of study	4	2.6 Semester	7	2.7 Assessment	VP	2.8 Subject category	DS/DI

3. Estimated total time

3.1 Number of hours per week	1	of which: 3.2 course	-	3.3 project	1
3.4 To Total hours in the curriculum	14	of which: 3.5 course	-	3.6 project	14
Distribution of time					hours
Individual study					23
Manual, lecture material and notes, bibliography					6
Supplementary study in the library, online specialized platforms and in the field					4
Preparation for seminars / laboratories, homework, reports, portfolios and essays					0
Tutoring					3
Exams and tests					0
Other activities:					

3.7 Total hours of individual study	36
3.8 Total hours per semester	50
3.9 Number of credit points	2

4. Pre-requisites (where appropriate)

4.1 curriculum	Radiocommunications, Cellular communications
4.2 competence	NO

5. Requirements (where appropriate)

5.1. For projects	The Technical University of Cluj-Napoca IIoT Gateway and sensors nodes available Observator 2, Room 410, with the support of Control Data System (CDS)

6. Specific competences

Professional competences	**C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks** C5.3 Installation, configuration and exploiting of communications networks C5.4 Use of evaluation techniques and diagnostics for communications systems and equipment C5.5 Endowment with communications means of a location with a small/ medium degree of complexity C5.6 Solving an installation and maintenance problem for a communications system with low/ medium complexity **C6. Solving specific problems of the broadband communications networks: propagation in different environment, circuits and equipment for high frequencies (microwaves and optical).** C6.3 Solving practical problems using design methods of the microwave circuits, planning, coverage, selection and location of transmission and receiving equipment
Transversal competences	N/A

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

7.1 General objective	To develop professional competences in the field of planning, configuration and testing of the industrial IoT systems.
7.2 Specific objectives	1. To apply the theoretical and practical concepts regarding the design and testing of the industrial IoT systems by using specific infrastructure components. 2. To develop skills and abilities to analyze and evaluate the industrial IoT systems

8. Contents

8.2 Project	**Teaching methods**	**Notes**
1. Organizing the project teams. Presentation of subjects: • The implementation of a Client/Server application using the GSAP (Gateway Service Access Point) interface • The implementation of a MODBUS TCP/IP client capable of reading field device data (temperature and humidity) from ISA100.11a and WirelessHART industrial sensors. • A site expertise report for an IIoT system comprising the sources of interference and the planning and allocation of resources for the radio links between the field sensors and the Gateway.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, magnetic board
2. Assignment of the topics and bibliographic search		
3. Presentation of results: test scenario		
4. Presentation of implementation results		

5. Presentation of experimental results		
6. Final integration; project recovery		
7. Defending of the project		

References:

1. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 13: 978-1-4822-0733-0, 2017.
2. R. Zurawski (editor), Industrial Communication Technology Handbook, CRC Press, Taylor & Francis Group, ISBN-13: 978-1-4822-0733-0, 2015.
3. T. Rappaport, Wireless Communications Principles and Practice, 2nd edition, Prentice Hall, ISBN 0-13-042232-0, 2002.
4. J. Olenewa, Guide to Wireless Communications, 3rd edition, Cengage Learning, ISBN-13 987-1-111-54569-7, 2013.
5. ***, IEC-62734, Industrial networks - Wireless communication network and communication profiles - ISA 100.11a, International Electrotechnical Commission (IEC), 2014.
6. ***, IEC-62591, Industrial Communication Networks - Wireless Communication Network and Communication Profiles - WirelessHART, International Electrotechnical Commission (IEC), 2010.

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
Project	The level of acquired knowledge and abilities	Practical evaluation (individual): to implement and evaluate IIoT networks using Software (SW) or Hardware (HW) means using the laboratory infrastructure	100%

10.6 Minimum standard of performance

Qualitative point of view

Minimal theoretical and practical knowledge:

- ✓ The fundamental principles of IIoT networks (Industrial IoT): network topologies, subnetwork concept, network access schemes, network administration (distributed and centralized), the management and distribution of radio resources.
- ✓ Aspects regarding the configuration of an IIoT network by the means of a command line interface and web interface exposed by an IIoT Gateway: subnetwork, security keys, number of channels, data publish contracts

Minimal acquired competences:

- ✓ To use Gateway equipment implementing the ISA100.11a and WirelessHART standards
- ✓ To use IIoT sensors from manufacturers such as Yokogawa, Honeywell, CDS
- ✓ To use the laboratory infrastructure to analyze and configure IIoT systems (spectrum analyzers, packet sniffer)

Quantitative point of view

- ✓ Practical score ≥ 5

Date of filling in:		**Title Surname NAME**	**Signature**
29.09.2020			
	Applications	Prof. Emanuel PUSCHITA, Ph.D., Habil.	
		Assistant Eusebiu JECAN, Ph.D. student	

Date of approval in the Department of Communications 30.09.20	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 30.09.20	Dean Prof. Gabriel OLTEAN, Ph.D.