

SYLLABUS

1. Data about the program of study

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| 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

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|------------------------------------|---|--------------|---|----------------|----|----------------------|-------|
| 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 | Assistant Calin BUTA, PhD student, Calin.Buta@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)

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| 4.1 curriculum | Radiocommunications, Cellular communications |
| 4.2 competence | NO |

5. Requirements (where appropriate)

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| 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) |
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6. Specific competences

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| Professional competences | <p>C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks</p> <p>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</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>C6.3 Solving practical problems using design methods of the microwave circuits, planning, coverage, selection and location of transmission and receiving equipment</p> |
| Transversal competences | N/A |

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

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|-------------------------|---|
| 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 | <ol style="list-style-type: none"> To apply the theoretical and practical concepts regarding the design and testing of the industrial IoT systems by using specific infrastructure components. To develop skills and abilities to analyze and evaluate the industrial IoT systems |

8. Contents

| 8.2 Project | Teaching methods | Notes |
|---|---|---|
| <ol style="list-style-type: none"> Organizing the project teams. Presentation of subjects: <ul style="list-style-type: none"> 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. Assignment of the topics and bibliographic search Presentation of results: test scenario Presentation of implementation results | Didactic and experimental proof, didactic exercise, team work | Use of laboratory instrumentation, experimental boards, computers, magnetic board |

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|---|--|--|
| 5. Presentation of experimental results | | |
| 6. Final integration; project recovery | | |
| 7. Defending of the project | | |
| References: <ol style="list-style-type: none"> 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-13 987-1-11-54569-7, 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: <ul style="list-style-type: none"> ✓ 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: <ul style="list-style-type: none"> ✓ 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 <ul style="list-style-type: none"> ✓ Practical score ≥ 5 | | | |

| Date of filling in: | | Title First Name Surname | Signature |
|---------------------|--------------|-----------------------------------|-----------|
| 13.09.2022 | | | |
| | Applications | Assistant Calin BUTA, PhD student | |
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| Date of approval in the Council of the Communications Department 13.09.2022 | Head of Communications Department Prof. Virgil DOBROTA, Ph.D. |
| Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 21.09.2022 | Dean Prof. Ovidiu POP, Ph.D. |