Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Masters
1.6 Programme of studies	Mobile Communications

2. Date despre disciplină

2.1 Course name (ro) (en)				Planificare radio şi sisteme IoT Radio planning and IoT systems			
2.2 Course Lecturer				Prof. Dr. Razvan Craciunescu			
2.3 Instructor for practical activities				As. drd. ing. Razvan Mihai			
2.4 Year of studies	2	2.5 Semester	1	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		DA	2.9 Course code	UPB.04.M3.O.08-32		2.10 Tipul de notare	Nota

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week	3	Out of which: 3.2 course	1.5	3.3 seminary/laboratory	1.5
3.4 Total hours in the curricula	42	Out of which: 3.5 course	21	3.6 seminary/laboratory	21
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					69
Tutoring					10
Examinations					4
Other activities (if any):					0

3.7 Total hours of individual study	83.00
3.8 Total hours per semester	125
3.9 Number of ECTS credit points	5

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Advanced Data Transmission Techniques
4.2 Results of learning	fundamental concepts of signals and communication systems

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	
5.2 Seminary/ Laboratory/Project	

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

At the beginning of the course, students will be introduced to the fundamental concepts of radio planning, focusing on the specifics and challenges associated with IoT technologies. This section will lay the groundwork for understanding how radio signals are used to enable communication between IoT devices.

Network level is another critical aspect covered in this course, where students will learn about various IoT-specific protocols and network technologies, such as LoRa, NBIoT/LTE catM, as well as common wireless technologies like Bluetooth, Zigbee, and WiFi. This section will help students understand how to choose the right connectivity technology based on specific project requirements.

Finally, the course will discuss IoT applications in the industrial environment and their national impact, emphasizing the crucial role of IoT in the digitalization of industries and its contribution to the digital economy.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Correlates knowledge. Oral and written communication in a foreign language (English): demonstrates understanding of the domain-specific vocabulary in a foreign language.
Transversal (General) Competences	Analytical and synthesis skills: concisely presents the knowledge gained as a result of a systematic analysis.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* Defines specific concepts in the IoT field.
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* Analyzes and compares different techniques encountered in IoT systems.

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Adheres to the principles of academic ethics by correctly citing the used bibliographic sources.

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

The course materials are: notes and course presentations, collections of proposed problems (theoretical and with solutions on the computer or on the board).

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction to Radio Planning for IoT	2
2	Introduction to IoT	2
3	Sensors and Actuators	3
4	Network Level for IoT Systems	3
5	Connectivity in IoT Systems - LoRa	2
6	Connectivity in IoT Systems - Cellular Communications NBIoT/LTE catM	3
7	Connectivity in IoT Systems - Bluetooth, Zigbee, Wifi	2
8	Data Aggregation Platforms from IoT Devices	2
9	Industrial IoT and National Impact	2
	Total:	21

Bibliography:

Razvan Craciunescu - lectures notes - moodle
Anil Kumar, Jafer Hussain, Anthony Chun "Connecting the Internet of Things", ISBN-13 (pbk): 978-1-4842-8896-2 ISBN-13 (electronic): 978-1-4842-8897-9 https://doi.org/10.1007/978-1-4842-8897-9

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Introduction to Programming IoT Boards	3
2	Extracting Data from Sensors	3
3	Data Aggregation Platform from Sensors	3
4	IoT System Using WiFi, MQTT, and a Data Processing Platform	4
5	IoT System for Long-Range Transmission Using LoRa and a Data Processing Platform	4
6	IoT System for Long-Range Transmission Using LTE-m, MQTT, and a Data Processing Platform	4
	Total:	21

Bibliography:
Razvan Craciunescu, Programarea Modulelor IoT folosind MicroPython, Îndrumar de laborator, 2022, Editura POLITEHNICA PRESS, ISBN online: 978-606-9608-06-7 - moodle

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	Understanding of fundamental theoretical concepts related to IoT systems. Knowledge of how to apply theory to solving problems specific to the field.	Written exam during the exam session.	50%
11.5 Seminary/laboratory/project	Understanding the fundamental techniques of IoT systems.	Lab sheet for each laboratory work.	50%
11.6 Passing conditions			
Fulfilling the obligations characteristic of laboratory/project activities (participation in planned works).			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

Professional associations emphasize the importance of training that keeps pace with rapid developments in the field, promoting a multidisciplinary approach and understanding the ethical and security implications of IoT technologies. At the same time, educational practices in higher education institutions within the European Higher Education Area (EHEA) highlight the integration of research, innovation, and active learning methods into the educational process, ensuring that students are exposed to the latest scientific and technological advances and are prepared to apply theoretical knowledge in practical contexts.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	Prof. Dr. Razvan Craciunescu	As. drd. ing. Razvan Mihai

Date of department approval	Head of department
26.09.2025	Conf. Dr. Serban Georgica Obreja

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Date of approval in the Faculty Council

26.09.2025

Dean

Prof. Dr. Mihnea Udrea