National University of Science and Technology
Politehnica Bucharest
Faculty of Engineering in Foreign Languages

Undergraduate program: INTERNET OF THINGS ENGINEERING in ENGLISH LANGUAGE, 2024-2028

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CONTENT OF THE LECTURES FROM THE STUDY PLAN

Ist YEAR

I Year, 1st Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.F.01.I.131	F	1	1	**Calculus 1**	E	2	2			**4**
UPB.12.F.01.I.132	F	1	1	**Linear Algebra, Analytical and Differential Geometry**	E	2	2			**4**
UPB.12.D.01.I.133	D	1	1	**Electrical Engineering 1**	E	2	1			**4**
UPB.12.D.01.I.134	D	1	1	**Operating Systems 1**	V	2		2		**4**
UPB.12.F.01.I.135	F	1	1	**Programming Languages**	E	2		2		**4**
UPB.12.F.01.I.136	F	1	1	**Computer Aided Graphics**	V	1		1		**3**
UPB.12.F.01.I.137	F	1	1	**Chemistry**	E	1	1			**3**
UPB.12.C.01.I.138	C	1	1	**Professionnal Communication 1**	V		2			**2**
UPB.12.C.01.I.139	C	1	1	**Physical Education 1**	V		1			**2**
UPB.12.C.01.F.101	C	1	1	**European Culture and Civilisation 1**	V		2			**2**
UPB.12.C.01.F.102	C	1	1	**Foreign Language 1**	V		2			**2**
UPB.12.C.01.F.103	C	1	1	**Romanian Language and Culture for Foreign Students 1**	V		2			**2**
UPB.12.C.01.F.104	C	1	1	**Educational Psychology**	E	2	2			**5**
UPB.12.C.01.F.105	C	1	1	**Volunteering 1**	V				4	**3**

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Calculus I - Teacher: Mircea OLTEANU

This discipline aims to familiarize students with the fundamentals of mathematics and engineering,by acquiring the basic notions of differential calculus. Calculus 1 continues the theory of functionsof a single variable (from college).

The discipline covers the following subjects: real and complex numbers, sequences and series of numbers, sequences and series of functions, partial derivatives, differential, extrema and bound extrema, implicit functions.

Linear Algebra, analytical and differential geometry - Teacher: Ariana PITEA

The discipline studies introductory chapters in linear algebra, analytic and differential geometry and aims to familiarize students with their main approaches, models and explanatory theories, used in solving practical applications and problems, with relevance to stimulate the learning process in students. It also addresses as a specific subject specific basic notions, concepts and principles, all of which contribute to the training of students with an overview of methodological and procedural milestones related to the field.

Knowledge of vector calculus for its application in engineering sciences, elements of linear algebra: vector spaces, bases, vectors and eigenvalues, general scalar product, norm, distance, angle of two vectors, orthogonality, bilinear and quadratic forms, elements of analytical geometry: straight, plane, conical, quadric.

Electrical Engineering 1 - Teacher: Mihai REBICAN

Introduction and presentation of the basic knowledge of the theory of electric circuits with concentrated parameters, through the prism of applications of interest in electronics, telecommunications and information technologies. Among the topics covered: Kirchhoff's theorems, circuit elements, resistive circuits, non-linear DC circuits, capacitors, inductors.

Operating Systems 1 - Teacher: Viorel Constantin MARIAN

This discipline is studied in the field and specialization and aims to familiarize students with the main approaches, models and explanatory theories of the field, used in the resolution of practical applications and problems, with relevance to stimulate the learning process in students.

The discipline addresses basic (or advanced) notions, specific concepts and principles as a specific subject, all of which contribute to the transmission / training of students with an overview of methodological and procedural benchmarks related to the field.

- The main objective of the course is to provide an overview of computers, computer networks and computer operating systems. At the same time, educate students on the cyber-security of computer systems.
- The main objective of the course is to provide a first view of the computer operating systems of computers.
- The course presents the basic concepts and mechanisms of modern operating systems and virtualization.
- It focuses on the principles and organization of operating systems, but also on the practical part to illustrate key concepts in practical contexts.
- By the end of the course, students will understand some of the basic concepts of computer operating systems.

Programming Languages - Teacher: Iuliana MARIN

Students are introduced to computer science and first and foremost to programming (the fundamental concepts and principles) and learn Java, chosen as the "support" language: basic notions, data types, variables, expressions, control structures, methods, recursions, basic concepts of object-oriented programming, relationships between classes: association, inheritance, polymorphism, abstract classes, input/output in Java.

Computer Aided Graphics - Teacher: Cristian PEREDERIC

The objective of the course and the practical work is to learn the international technical language (Technical Graphics) which is the basis of the training of engineers in all industrial fields, a language which makes it possible to express themselves and to transmit ideas is engineering projects. Learn the techniques and conventions of representation by projections for technical objects. Among the subjects of the course: projection systems, introduction to technical drawing with AutoCAD, dimensional description of parts: the scale of the drawing, dimensioning techniques.

Chemistry - Teacher: Ileana RAU

The course aims to impart, accumulate, and apply fundamental knowledge in chemical equilibria within homogeneous systems. The course focuses on the separation, concentration, and quantification of various chemical entities in solutions. It covers calculating concentrations of dilute and concentrated solutions, correlating concentration and activity of species in specific environments, and defining and identifying proton, electron, and ion or molecule exchange processes. Additionally, it provides guidelines for using operational parameters such as pH, redox potential, and ligand or common ion concentration to design methods for the separation, identification, and quantification of analytes of interest. Theoretical models and practical examples will help students achieve a realistic understanding of the environment, fill knowledge gaps essential for comprehending contemporary technological principles, and develop novel analytical identification methods.

Professional Communication 1 - Teacher: Fabiola POPA

The course aims to transmit to students the knowledge and know-how allowing them to communicate in situations related to the fields: educational, professional and public. It develops language communication skills in students, namely linguistic, pragmatic and sociolinguistic skills, allowing them to take courses in English, take notes, consult specialist documentation in English, write CVs, accounts reports, summaries, reports, make presentations, interact for professional and associative purposes in a multicultural environment. It trains communication skills, reception (oral, written) and interaction.

Physical Education 1 - Teacher: Carmen GRIGOROIU

The discipline responds concretely to the current requirements of development and evolution at the national and international level, contributing to the optimization of the state of health; the prevention of the appearance of global and segmental physical deficiencies, the formation and maintenance of the correct attitudes of the body; the stimulation of students' interest in the systematic and independent practice of physical exercise individually and collectively on a daily or weekly basis; create the habit of observing the standards of hygiene sports and accident prevention; develop the capacity for self-defense and self-improvement.

European Culture and Civilization 1 - Teacher: Adelin Costin DUMITRU

The primary objective of this course is to familiarize students with foundational issues in European philosophy and culture, providing a comprehensive understanding of the concept of Europe. Additionally, the course aims to cultivate independent thinking through analogies, debates, and analytical comparisons focused on key theoretical themes in European history and culture. Designed for undergraduate students, the course addresses significant topics in European history and philosophy to elucidate the meaning of being European. Texts will be examined both as contributions to the understanding of specific historical and cultural events and as means to analyze the relationships between different cultural assumptions. The course will explore the possibility of creating a "theoretical bridge" between conflicting values and cultural identities. Teaching will be interactive, involving discussions of key topics, theoretical problem-solving, and encouraging student debates and teamwork.

Foreign Language 1 **- Teacher: Daniela TANASE**

This discipline aims to facilitate the development of students' skills to use specific grammar and vocabulary elements of the French language, in a professional/technical-scientific context, as well as their ability to work individually and in a team.

The discipline addresses as a specific subject the basic notions of grammar,

lexicon and professional communication, all of which contribute to the training of students in professional communication skills in French. The study of this discipline facilitates the acquisition of skills to present and interpret concepts, facts and opinions, in oral and written form (listening, speaking, reading and writing) and the development of skills of mediation and intercultural understanding, so that the future engineer can interact appropriately in social, professional and culturally diverse contexts outside of school.

Romanian Language and Culture for Foreign Students 1 - Teacher: Silvana Diana STOICA

Course objectives:

- Develop students' communication skills by emphasizing the four fundamentalcomponents: listening, writing, reading and speaking.
- The ability to use in real contexts appropriate communication situations of simple orphraseological units that incorporate cultural and civilizational connotations.

Ability to use grammatical structures appropriately.

Educational Psychology - Teacher: Simona NEAGU

Course objectives:

- Understanding Psychological Principles: Equip students with a foundational understanding of key psychological theories and principles as they apply to educational contexts.
- Development of Communication Skills: Enhance students' abilities in listening, writing, reading, and speaking, focusing on how these skills are developed and can be improved in educational settings.
- Application of Psychological Concepts: Enable students to apply psychological concepts and theories in real-world educational scenarios, understanding how psychological principles can inform teaching strategies and student learning.
- Critical Thinking and Analysis: Foster critical thinking and analytical

skills by engaging with research and case studies in educational psychology, encouraging students to critically evaluate different educational practices and their psychological underpinnings.

- Classroom Management Techniques: Provide students with strategies and techniques for effective classroom management based on psychological principles, helping them to create a positive and conducive learning environment.
- Assessment and Evaluation: Teach students how to design, administer, and interpret various forms of educational assessments, using psychological principles to inform their understanding of student performance and learning needs.
- Cultural and Contextual Sensitivity: Develop students' awareness of cultural and contextual factors that influence education, emphasizing the importance of considering these factors in psychological assessment and intervention.
- Professional and Ethical Practices: Instill a strong sense of professional ethics and practices in the field of educational psychology, ensuring that students are prepared to handle ethical dilemmas and maintain professional standards in their work.

This course aims to blend theoretical knowledge with practical application, preparing students to effectively integrate psychological insights into their educational practice.

Volunteering 1

Effectively engage with communities, understanding their needs, and working collaboratively to address those needs through volunteer activities.

I Year, 2nd Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.F.02.I.131	F	1	2	**Calculus 2**	E	2	2			**5**
UPB.12.F.02.I.132	F	1	2	**Physics 1**	E	2	1	1		**4**
UPB.12.D.02.I.133	D	1	2	**Electrical Engineering 2**	E	2	2			**4**
UPB.12.D.02.I.134	D	1	2	**Electronic Devices and Analog Electronics 1**	E	2		2		**4**
UPB.12.D.02.I.135	D	1	2	**Data Structures and Algorithms**	V	2		2		**5**
UPB.12.S.02.I.136	S	1	2	**Web Programming 1**	V	2		2		**4**
UPB.12.C.02.I.137	C	1	2	**Professional Communication 2**	V		1			**2**
UPB.12.C.02.I.138	C	1	2	**Physical Education 2**	V		1			**2**
UPB.12.C.02.F.101	C	1	2	**European Culture and Civilisation 2**	V		2			**2**
UPB.12.C.02.F.102	C	1	2	**Foreign Language 2**	V		2			**2**
UPB.12.C.02.F.103	C	1	2	**Romanian Language and Culture for Foreign Students 2**	V		2			**2**
UPB.12.C.02.F.104	C	1	2	**Pedagogy I**	E	2	2			**5**
UPB.12.C.02.F.105	C	1	2	**Volunteering 2**	V				4	**3**

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Calculus II – Teacher: Mircea OLTEANU

This discipline aims to familiarize students with the fundamentals of mathematics and engineering, by acquiring the basic notions of differential calculus. Calculus 2 pursues the theoryof functions of a single variable (from middle school).

The classical course of Calculus 2 mainly contains the theory of the integral of functions of several real variables: improper integrals and integrals with parameters, double and triple integrals, curvilinear and surface integrals. Thanks to integral formulas (Green-Riemann, Gauss-Ostrogradski, Stokes), an introduction to field theory is made. The course also contains a brief introduction to the theory of metric spaces and applications of the fixed point principle.

Physics I - Teacher: Ana Maria POPOVICI

The discipline addresses the basic notions, concepts and principles specific to physics, all of which contribute to the formation of logical and scientific thinking in students. Among the topics covered: elements of Analytical Mechanics, principles of special relativity, electromagnetism and electromagnetic optics, electromagnetic field.

Electrical Engineering 2 - Teacher: Mihaela DROSU

Equip students with advanced knowledge and skills in electrical engineering, focusing on circuit analysis, signal processing, and system design. Enhance technical proficiency in electronics, digital systems, and power systems, emphasizing practical applications and problem-solving. Foster critical thinking, innovation, and ethical practices, preparing students for professional challenges and encouraging engagement in research and development activities to drive technological advancements.

Electronic Devices and Analog Electronics 1 - Teacher: Dan NECULOIU

The discipline addresses as a specific subject the following specific basic/advanced notions, concepts and principles, which all contribute to the transmission/training to/from the students of an overview of the methodological and procedural steps related to the field: elements of physics of semi- conductors, pn Junction, Diodes, TEC-J Transistors, Bipolar Transistors, MOS Transistors, Analog circuits with transistors and diodes.

Data Structures and Algorithms - Teacher: Maria-Iuliana DASCALU

This course aims to provide students with a comprehensive understanding of designing, developing, and implementing fundamental data structures and algorithms in C/C++. Students will learn to efficiently organize, manage, and process data using various data structures such as arrays, linked lists, stacks, queues, trees, and graphs. Additionally, the course will cover essential algorithms for sorting, searching, and manipulating data, emphasizing their real-world

applications and performance optimization. By the end of the course, students will be equipped with the skills to analyze algorithm efficiency, write robust code, and solve complex computational problems effectively.

Web Programming 1 - Teacher: Vlad POSEA

This course aims to equip students with the skills to develop a simple web application from start to finish, providing a solid foundation in the main software development methodologies for web projects. Students will gain hands-on experience with essential web technologies, including HTML for structuring web content, CSS for styling, JavaScript for client-side scripting, and PHP for server-side programming. Through practical exercises and projects, students will learn how to integrate these technologies to create dynamic and interactive web applications. Additionally, the course will cover best practices in web development, version control using Git, and an introduction to modern development frameworks and tools, ensuring students are well-prepared for real-world web development challenges.

Professional Communication 2 - Teacher: Fabiola POPA

The course aims to transmit to students the knowledge and know-how allowing them to communicate in situations related to the fields: educational, professional and public. It aims to develop language communication skills in students, namely linguistic, pragmatic and sociolinguistic skills, allowing them to take courses in English, take notes, consult specialist documentation in English, write CVs, accounts reports, summaries, reports, make presentations, interact for professional and associative purposes in a multicultural environment. It also aims to train communication skills relating to production (oral and written), reception (oral and written) and interaction, integrating the intercultural component. Develop written and oral comprehension skills allowing students to correctly decode various authentic documents (specialty articles, pressarticles, conferences), to identify their purpose and style. Perfect written production skills and perform a linguistic

upgrade so that students can produce different types of texts (write letters, reports, summaries, articles, essays).

Physical Education 2 - Teacher: Carmen GRIGOROIU

Goals :

- improving basic motor skills (strength, endurance, speed, coordination, flexibility);
- the acquisition and consolidation of basic elements and techniques in athletics, gymnastics, sports games, application sports and their application in conditions of competitions or bilateral games
- learning basic notions with the rules of organization and conduct of sports games (volleyball, basketball, handball, gymnastics) of the various competitions;
- stimulate students' interest in the systematic and independent practice of physical exercise individually and collectively on a daily or weekly basis;
- create the habit of respecting the standards of sports hygiene and accident prevention;
- development of self-defense capacity and self-improvement.

European Culture and Civilization II - Teacher: Adelin Costin DUMITRU

European Culture and Civilization II aims to equip students with a comprehensive understanding of the concept of "Europe" by exploring its philosophical and cultural foundations. The course fosters the development of critical thinking skills using analogies, debates, and analytical comparisons applied to key themes in European history and culture. By examining major historical and philosophical issues, students will grapple with the question of what constitutes European identity. The course structure emphasizes engagement with primary source texts, analyzing them both as reflections of specific historical and cultural events and as tools for revealing the relationships and tensions between different cultural assumptions. A critical aspect of the course is the exploration of the possibility of constructing bridges across these divides, fostering understanding and

reconciliation between seemingly conflicting values and cultural identities within Europe. Ultimately, this course provides undergraduate students with a solid foundation in European history, philosophy, and culture, encouraging them to critically analyze the concept of European identity and its evolution.

Foreign Language II - Teacher: Daniela TANASE

This discipline aims to facilitate the development of knowledge of the French language (grammar, lexicon, written expression, oral expression), to form ordinary and professional communication skills. Develop written and oral comprehension skills allowingstudents to correctly decode various authentic documents (specialty articles, press articles, conferences), to identify their purpose and style. Enrichment of the technical vocabulary specific to the different situations of professional conversation. Ability to use grammatical structures in situational contexts.

Romanian Language and Culture for Foreign Students 2 - Teacher: Silvana Diana STOICA

Course objectives:

- Develop students' communication skills by emphasizing the four fundamental components:listening, writing, reading and speaking.
- The ability to use in real contexts appropriate communication situations of simple orphraseological units that incorporate cultural and civilizational connotations
- Ability to use grammatical structures appropriately.

Pedagogy I - Teacher: Ramona BALANESCU

This course provides a foundational understanding of pedagogy, focusing on the core principles and theories that underpin effective teaching and learning practices. Students will explore the fundamentals of pedagogy, gaining insights into educational philosophies, teaching strategies, and classroom management techniques. Additionally, the course covers the theory and methodology of curriculum development, equipping students with the skills to design, implement, and evaluate curricula that meet diverse educational needs. By the end of the course, students will be prepared to apply pedagogical theories and curriculum

methodologies in real-world educational settings, fostering a supportive and effective learning environment.

Volunteering 2

Effectively engage with communities, understanding their needs, and working collaboratively to address those needs through volunteer activities.

IInd YEAR

IInd Year, 1st Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.F.03.I.131	F	2	1	**Special Mathematics**	E	2	2			**4**
UPB.12.F.03.I.132	F	2	1	**Probability Theory and Mathematical Statistics**	E	2	2			**4**
UPB.12.F.03.I.133	F	2	1	**Physics II**	E	2		1		**4**
UPB.12.D.03.I.134	D	2	1	**Electronic Devices and Analog Electronics 2**	E	2		1		**4**
UPB.12.D.03.I.135	D	2	1	**Electronică digitală/ Digital Electronics**	E	2		2		**4**
UPB.12.D.03.I.136	D	2	1	**Databases 1**	V	2		1	1	**4**
UPB.12.D.03.I.137	D	2	1	**Object Oriented Programming**	V	2		2		**4**
UPB.12.C.03.I.138	C	2	1	**Microeconomics**	V	1	1			**2**
UPB.12.C.03.F.101	C	2	1	**Foreign Language for Engineers 1**	V		2			**2**
UPB.12.C.03.F.102	C	2	1	**Romanian Language and Culture for Foreign Students 3**	V		2			**2**
UPB.12.C.03.F.103	C	2	1	**Physical Education and Sports 3**	V		2			**2**
UPB.12.C.03.F.104	C	2	1	**Technical Documents Advanced Processing 1**	V		2			**2**
UPB.12.C.03.F.105	C	2	1	**Pedagogy 2**	E	2	2		4	**5**

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Special Mathematics – Teacher: Valeriu PREPELITA

Operate fundamental notions in mathematics, engineering and computer science. Operate fundamental notions of advanced mathematics: Fourier series, Fourier transform, complex integrals, partial differential equations.

Probability Theory and Mathematical Statistics – Teacher: Andreea BEJENARU

The acquisition of knowledge in the field of Probability and Mathematical Statistics as well asthe ability to correctly use statistical models in theoretical and

practical problems. Objectives: correctly determine the factors that appear in the statistical modeling of phenomena; understand the theoretical and practical context of the use of the applications studied; adapt models and methods of statistical calculation to specific problems of engineering sciences.

Physics II – Teacher: Valerica NINULESCU

Course contents: elements of quantum physics, condensed matter physics, elements of nuclear physics. Objectives: working with the foundations of mathematics, engineering and computer science, designing hardware, software and communication components, finding solutions using the tools of computer science and engineering.

Object Oriented Programming – Teacher: Andrei VASILATEANU

Familiarizes students with the basics of object-oriented programming in the Java programming language. Familiarizes students with the main software development methodologies. Concepts covered: classes, objects, inheritance, polymorphism, abstract classes, threads, collections, graphical interfaces.

Digital Electronics – Teacher: Ionel PETRESCU

The course represents an introduction to digital electronics and its implementation using FPGA and VHDL circuits. The student acquires knowledge in digital electronics, minimizes logic circuits, uses combinatorial and sequential circuits, performs tests with simulation software, performs implementations and tests with FPGA devices.

At the end of the course, students will be able to:

- Use logic gates
- Optimization using Karnaugh diagrams
- Design using combinational logic circuits
- Design using sequential logic circuits

- Test with the Logisim simulator
- Implement and run simple VHDL circuits on Spartan FPGA boards
- Use output devices: LED, LCD, 7-segment, VGA, relay control and motors in thedevelopment environment

Use input devices: buttons, keyboard, mouse in the development environment.

Databases – Teacher: Dan GARLASU

Familiarizes the student with a framework for storing, processing and analyzing structured data in a relational database management system (RDBMS). Overview of enterprise RDBMS applications and the SQL standard in specific implementations.

Microeconomy – Teacher: Ana-Maria NEAGU

The subject aims to ensure the formation and assimilation of the economic way of thinking that allows the identification and application of entrepreneurial decisions at the micro level. Economy is related to the allocation of limited resources, scarcity and choice involves trade-offs and every decision would have an opportunity cost. The aim is to encourage the development of the ability to analyze and evaluate economic activity based on the interpretation of statistics and graphs.

Foreign Language for Engineers 1 – Teacher: Daniela TANASE

This discipline aims to facilitate the development of oral and written expression skills in French, the ability to use elements of language to describe and explain technical processes, the ability to understand specialist written / oral text, ability to work individually and as a team. Goals:

- The acquisition of skills to receive an orally transmitted message (understand the overall meaning of a message, extract factual information from a message), to produce an oral message (design of oral messaging referring to itself and to other activities / ideas) to receive a

message sent in writing (understand the overall meaning of a text read silently, synthesis of the information read), to produce a written message (write sentences /paragraphs / larger text on various subjects of general interest or in particular).

- Develop professional presentation skills.
- Various technical vocabulary conversation work situation.
- The ability to converse on professional/technical topics.

Romanian Language and Culture for Foreign Students 3 – Teacher: Silvana Diana STOICA

The practical course of the Romanian language for foreign students considers the development of the four fundamental components: written and oral comprehension, oral and written expression – listening, speaking, reading and writing.

Goals:

a) The development of foreign students' ability to understand written and verbal messages inRomanian. Vocabulary development and enrichment of grammar knowledge.

b) The development of students' communication skills. The development of oral fluency and precision. The development of the ability to use grammatical structures and notions of vocabulary in the students' own communication contexts.

c) Consolidation of grammar knowledge through academic writing activities and communication activities such as: discussions, presentations, descriptions, negotiations, telephone conversations.

d) The development of the ability to understand the cultural aspects and the Romanian civilization following their presentation within the framework of the Romanian language seminarfor foreign students.

Physical Education and Sports 3 – Teacher: Carmen GRIGOROIU

The discipline aims to help students maintain an optimal health condition of students practicing physical training to increase the work potential required by daily activities. Goals: development of basic physical abilities and specific abilities of the different sports disciplines; get into the habit of permanently and continuously practicing physical exercises and training during leisure time; educate the spirit of fair play, form efficient behavior and a positive attitude, as well as lead a disciplined life.

Technical Documents Advanced Processing 1 – Teacher: Fabiola POPA

Subjects discussed:

- Research Methodology (Introduction) and Scientific Popularization
- Practical activities (writing technical documents).
- writing science
- Which medium for which audience?
- Make a bibliography: cite sources

Study of news and scientific events.

Pedagogy 2 – Teacher: Sorina CHIRCU

Building on the foundations laid in Pedagogy I, this course delves deeper into advanced pedagogical theories and practices. Students will enhance their understanding of contemporary teaching methods, learning theories, and educational research techniques. The course also focuses on the practical application of these theories in diverse educational contexts, emphasizing differentiated instruction, assessment strategies, and inclusive education. By the end of the course, students will be able to critically analyze and apply advanced pedagogical concepts, design effective instructional strategies, and contribute to the development of innovative educational practices.

IInd Year, IInd Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.D.04.I.131	D	2	2	**Microprocessor Architecture**	E	2		2		**4**
UPB.12.S.04.I.132	S	2	2	**Mechanics and the Theory of Mechanisms**	V	2	1	1		**4**
UPB.12.F.04.I.133	F	2	2	**Numerical Methods**	E	2		2		**5**
UPB.12.D.04.I.134	D	2	2	**Operating Systems 2**	V	2		1		**5**
UPB.12.D.04.I.135	D	2	2	**Electronic Measurements, Sensors and Transducers**	E	2		1		**3**
UPB.12.D.04.I.136	D	2	2	**Systems and Signals Theory**	E	2	1	1		**3**
UPB.12.C.04.I.137	C	2	2	**Macroeconomics**	E	1	1			**2**
OPTIONAL PACKAGE										
UPB.12.D.04.O.131	D	2	2	**Fundamentals of Electrical Engineering 3**	E	2		2		**4**
UPB.12.D.04.O.132	D	2	2	**Data Acquisition and Processing**	E	2		2		**4**
OPTIONAL SUBJECTS										
UPB.12.C.04.F.101	C	2	2	**Romanian Language and Culture for Foreign Students 4**	V		2			**2**
UPB.12.C.04.F.102	C	2	2	**Foreign Language 4**	V		2			**2**
UPB.12.C.04.F.103	C	2	2	**Didactics of Specialization**	E	2	2			**5**
UPB.12.C.04.F.104	C	2	2	**Volunteering 4**	V				4	**3**

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Microprocessor Architecture – Teacher: Alexandru RADOVICI

This course aims to provide students with an in-depth understanding of microprocessor architecture, with a focus on programming and developing in Rust. Students will learn the fundamental concepts of microprocessor design, including instruction sets, memory hierarchy, and input/output mechanisms. The course will emphasize the application of these concepts using the Rust

programming language, known for its safety and performance features. Through practical projects and hands-on labs, students will gain experience in writing efficient and secure low-level code, optimizing performance, and understanding the intricacies of hardware-software interaction. By the end of the course, students will be equipped to design and implement robust microprocessor-based systems using Rust.

Mechanics and the Theory of Mechanisms

This course aims to provide students with a comprehensive understanding of the fundamental principles of mechanics and the theory of mechanisms. Students will explore the core concepts of statics, dynamics, and kinematics, gaining insights into the forces and motions that govern mechanical systems. The course will cover the analysis and design of various mechanisms, such as linkages, cams, and gears, emphasizing their applications in real-world engineering problems. Through theoretical lessons and practical projects, students will develop the skills to analyze mechanical systems, design efficient mechanisms, and solve complex mechanical challenges. By the end of the course, students will be well-prepared to apply the principles of mechanics and mechanism theory in diverse engineering contexts.

Numerical Methods – Teacher: Claudia IONITA

Learn the basic principles and fundamental methods for the numerical resolution of computational problems. Learn the main numerical methods for solving various categories of problems: solving nonlinear equations, solving systems of linear equations, functions and data approximation by interpolation and regression, derivatives and integrals approximation, solving differential equations. Implement numerical algorithms with the Matlab / Octave programming language.

Operating Systems 2 – Teacher: Iuliana MARIN

This course aims to deepen students' understanding of operating system concepts and their practical applications. Students will become familiar with the architecture, components, and functions of modern operating systems, exploring how these systems manage hardware and software resources. The course will introduce the main software development methodologies and techniques for interacting with the operating system interface, emphasizing system calls, process management, memory management, and file systems.

Students will engage with case studies and specific implementations on both Windows and Linux platforms, gaining hands-on experience in system programming. The programming assignments and projects will utilize C and Python to reinforce concepts and develop practical skills in writing efficient, robust code for system-level tasks. Key topics include:

- Understanding the core concepts of operating systems, including kernels, processes, threads, and multitasking.
- Learning how to use system calls and application programming interfaces (APIs) to perform tasks such as file manipulation, process control, and inter-process communication.
- Exploring how operating systems manage processes and threads, including context switching, scheduling algorithms, and synchronization mechanisms.
- Understanding memory allocation, paging, segmentation, and virtual memory.
- Examining file system structures, implementation, and management, including file operations and directory management.
- Learning how operating systems interact with hardware components through device drivers and interrupt handling.
- Studying mechanisms for protecting system resources and ensuring secure execution of processes.

By the end of the course, students will have a thorough understanding of operating system principles, practical experience with system programming on Windows and Linux, and the ability to apply software development methodologies effectively in the context of operating systems.

Electronic Measurements, Sensors and Transducers – Teacher: Mihaela ALBU

Topics covered: the principles of electrical and non-electrical measurements, architecture of measurement systems, signal conversion, data transmission protocols, virtual instrumentation, definition of the concepts of sensor, transducer and actuator, metrological classifications and characteristics, areas of use, determination of static and dynamic characteristics of sensors and actuators, presentation of signal conditioning blocks specific to the use of sensors and actuators in the field, networks of intelligent sensors, transmission of data in chains smart sensor-based measurement tools.

Systems and Signals Theory – Teacher: Simona HALUNGA

The course defines the basic notions and concepts of signals and systems theory. Analog signals and systems are processed. The course gives the basics of signal theory, and the general concepts and associated systems are presented. They are analyzed signals and systems in continuous time and discrete time. We want to create abilities to apply the basic notions relating to the concepts of the signal and the system to carry out specific functions in electronics. We present: Fourier analysis of periodic and non-periodic signals in continuous time, elements of distribution theory related to signals and systems, Hilbert transform for continuous-time signals, convolution and correlation of signals at continuous time, the Laplace transform, the sampling theorem, harmonic modulations, amplitude modulation, frequency modulation, phase modulation, system concepts, Fourier analysis of discrete signals in the periodic and non-periodic times, the z-transform and the discrete Fourier transform, the convolution and

correlation of discrete signals and the concepts of discrete-time systems.

Macroeconomics – Teacher: Ana-Maria NEAGU

The formation and assimilation of the economic way of thinking that allows the identificationand application of entrepreneurial decisions at the macro level. Knowledge of the macro-economic nomenclature how: multiplier, monetarism, the natural rate of unemployment, budgetary policy. Improving the ability to evaluate and interpret materials, articles or reports on macroeconomic topics. Work with macroeconomic concepts such as: inflation, unemployment, interest rate, gross domestic product, economic growth, exchange rate. Make correlations between specific macro-economic phenomena. Understand the main causes and effects of macroeconomic imbalances. Improvement of individual decisions on the solutions adopted in terms of macroeconomic imbalances. Working with the specific concepts of primary financial markets. Develop the ability to analyze and evaluate economic activity based on the interpretation of statistics and graphs. Present the mechanism of the market economy, macroeconomic balance and macroeconomic imbalances.

OPTIONAL PACKAGE

Fundamentals of Electrical Engineering 3 – Teacher: Mihaela DROSU

Contents: Formulation of electrical circuit problems. Calculation methods. Formulation of electromagnetic field problems. Description of stationary regimes. Methods of analysis and calculation. Use of various CAD software for modeling electrical circuits or electromagnetic field problems. Solving electrical circuits in different modes (direct current, alternating current, transient). The ability to model various applications of different electromagnetic devices in different regimes. Use, in the context of numerical modeling, of the knowledge acquired during the profile courses of the first and second semesters, for a better understanding of electromagnetic phenomena and for an awareness of the importance of simulating electrical circuit/field problems in computer-aided design. Apply learned theory to model electrical circuit/electromagnetic

field problems.

Data Acquisition and Processing – Teacher: Ionel PETRESCU

Assimilation of knowledge on the structure of data acquisition systems, on the basics of digital signal processing and the development of instrumentation software applications. Goals:

- Presentation of the architecture of modern intelligent instrumentation systems, trends instandardization and instrumentation buses, data purchasing and processing systems, signal conditioning, analog-to-digital signal conversion, communication in data acquisition systems, instrumentation control via the Internet.
- Introduction to signal processing in time and frequency.
- Assimilation of knowledge related to instrumentation software: the concept of the virtual tool, LabWindows / CVI, graphical programming in LabVIEW.
- Presentation of examples of application-oriented instrumentation systems.

OPTIONAL SUBJECTS

Romanian Language and Culture for Foreign Students 4 – Teacher: Silvana Diana STOICA

The practical course of the Romanian language for foreign students considers the development of the four fundamental components: written and oral comprehension, oral and written expression – listening, speaking, reading and writing.

Goals:

a) The development of foreign students' ability to understand written and verbal messages in Romanian. Vocabulary development and enrichment of grammar knowledge.

b) The development of students' communication skills. The development of oral

fluency and precision. The development of the ability to use grammatical structures and notions of vocabulary in the students' own communication contexts.

c) Consolidation of grammar knowledge through academic writing activities and communication activities such as: discussions, presentations, descriptions, negotiations, telephone conversations.

d) The development of the ability to understand the cultural aspects and the Romanian civilization following their presentation within the framework of the Romanian language seminar for foreign students.

Foreign Language 4 – Teacher: Daniela TANASE

This discipline aims to facilitate the development of oral and written expression skills in French, the ability to use elements of language to describe and explain technical processes, the ability to understand specialist written / oral text, ability to work individually and as a team. Objects:

- The acquisition of skills to receive an orally transmitted message (understand the overall meaning of a message, extract factual information from a message), to produce an oral message (design of oral messaging referring to itself and to other activities / ideas) to receive a message sent in writing (understand the overall meaning of a text read silently, synthesis of the information read), to produce a written message (write sentences /paragraphs / larger text on various subjects of general interest or in particular).
- Develop professional presentation skills.
- Various technical vocabulary conversation work situation.
- The ability to converse on professional / technical topics.

Didactics of Specialization – Teacher: Claudia OPRESCU

This course is designed to equip students with specialized teaching methodologies and pedagogical strategies tailored to their specific subject area. By focusing on the unique aspects of their specialization, students will learn to

effectively convey complex concepts and foster an engaging learning environment. Goals:

- Understand and apply teaching methods specific to the subject area, ensuring that instructional strategies align with subject-specific content and learning outcomes.
- Develop skills in designing and implementing a curriculum that meets educational standards and addresses the needs of diverse learners, incorporating relevant and up-to-date resources.
- Utilize innovative instructional strategies, including the integration of technology and interactive tools, to enhance student learning and engagement.
- Master various assessment techniques to measure student understanding and progress and learn how to provide constructive feedback that supports student growth.
- Explore effective classroom management practices tailored to the subject area, promoting a positive and productive learning environment.
- Learn to differentiate instruction to cater to diverse learning styles and abilities, ensuring that all students have equitable access to educational opportunities.
- Engage in reflective teaching practices to continually assess and improve instructional methods, fostering a mindset of continuous professional development.

By the end of the course, students will have a deep understanding of how to teach their specialized subject effectively, using targeted didactic approaches to create impactful and meaningful learning experiences for their students.

Volunteering 4

Effectively engage with communities, understanding their needs, and working collaboratively to address those needs through volunteer activities.

IIIrd YEAR

IIIrd Year, 1st Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.S.05.O.001	S	3	1	**Digital Signal Processing**	E	2		2		**4**
UPB.12.D.05.O.002	D	3	1	**Databases 2**	E	2		1		**4**
UPB.12.D.05.O.003	D	3	1	**Computer Networks**	E	2		2		**4**
UPB.12.D.05.O.004	D	3	1	**Image Processing**	V	2		1		**4**
UPB.12.D.05.O.005	D	3	1	**Software Engineering**	E	2		2		**4**
UPB.12.D.05.O.006	D	3	1	**Artificial Intelligence 1**	V	2		2		**4**
UPB.12.D.05.O.007	D	3	1	**Computer Architecture**	E	2		2		**4**
OPTIONAL PACKAGE										
UPB.12.C.05.A.008	C	3	1	**Accounting and Financial Information**	V	1	1			**2**
UPB.12.C.05.A.009	C	3	1	**Rights – Judicial Tools for Engineers**	V	1	1			**2**
OPTIONAL SUBJECTS										
UPB.12.C.05.F.010	C	3	1	**Computer Aided Training**	V	1		1		**2**
UPB.12.C.05.F.011	C	3	1	**Pedagogy Internship in Pre-Universitary Education 1**	V				3	**3**

"E/V" = evaluation form (E=exam in exam session, C or V = semester evaluation) "C" = Lectures (hours/week); "S" = Tutorial; "L" = Labwork; "P" = Project

Digital Signal Processing – Teacher: Ionel PAVALOIU

Presentation of analysis, synthesis and methods for the implementation of structures used in digital signal processing. We present the main methods for analyzing digital signals: the Fourier transform for discrete time signals and the Z transform. We also present the specific algorithms for the design of digital filters with finite impulse response and digital filters with impulse response infinite. The assimilation of techniques for the analysis and design of finite impulse response digital filters and infinite impulse response digital filters,

verification by simulation. Learning and using MATLAB software for design, analysis of digital signals and simulation of digital systems. The application of theoretical notions of digital signal processing in practical applications.The ability to design and analyze specific functional blocks. The use of MATLAB software in general and specifically in digital signal processing and digital algorithms.

Database 2

This course will introduce students to the growing field of data science (data analysis and visualization) and provide them with some of its basic principles and tools, as well as its general mindset. Basically, students will learn how to extract knowledge from data. In the treatment of topics related to data science, the emphasis will be on breadth more than depth, therefore on the integration and synthesis of concepts and their application to the resolution of real-life problems of various fields (business, education, medicine). Students will learn the concepts, techniques, and tools needed to address various aspects of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data visualization, data product creation, evaluation and effective communication. Students will learn to use R and Python to mine datasets.

Computer Networks – Teacher: Nicolae GOGA

Acquire the fundamental concepts of computer networks. This course gives students the necessary information to design a corporate network on different facets: wide area network linking the various sites of the company by means of the available operator offers, mobile network for nomadic users, and internal network to the company as interconnection of several local networks. It presents the basics of the technologies used in computer and telecommunications networks (architecture, access techniques, transmission), then details the data

transfer services offered to companies, including operators. It describes the main technologies used in corporate networks: local networks, metropolitan networks, wide-area networks, wireless networks (Wi-Fi), LAN interconnect equipment, and protocols used by the Open Systems Interconnection (OSI) standard view. It also describes the different mobile networks available (GSM, GPRS/EDGE, UMTS). This course gives a general view of the complementarity between networks and information systems and the information systems used by companies.

Image Processing

The objective of the course is to familiarize the students with the general techniques of grayscale image processing and analysis, namely the operations or the succession of operations which aim to improve the quality of the image (the processing) and to extract the characteristics of interest necessary for decision-making (the analysis). Thus, the course attacks the operators and the fundamental techniques of acquisition, improvement, filtering, image segmentation and parametric description of the components of real scenes, illustrating them through typical industrial systems and applications.
The purpose of the practical work and to illustrate to the students in an interactive way the techniques of image processing and analysis using a dedicated environment (Matlab).

Software Engineering – Teacher: Nicolae GOGA

This course provides a comprehensive perspective on the multifaceted field of software development, systematically covering all industry-related aspects. Students will gain an in-depth understanding of software engineering principles and practices, with a focus on applying these techniques to real-world applications. Goals:

- Understand the phases of the software development life cycle (SDLC), including requirements analysis, design, implementation, testing,

deployment, and maintenance.

- Learn to use Unified Modeling Language (UML) for software design, creating models that represent the architecture, components, and behavior of software systems.
- Study quality assurance practices and methodologies, including testing strategies, code reviews, and software metrics, to ensure the development of high-quality software.
- Explore configuration management techniques, focusing on version control systems, build automation, and release management to maintain consistency and control over software products.

Artificial Intelligence 1 – Teacher: Serban RADU

This course offers a comprehensive introduction to Artificial Intelligence (AI), covering fundamental concepts and techniques. Students will explore key topics such as uninformed and informed search strategies, game theory, propositional and predicate logic, and rule-based systems. The curriculum includes uncertain reasoning, automatic planning, network semantics, and machine learning algorithms, with a focus on both foundational methods and advanced techniques. Additionally, the course covers version space learning and natural language processing. Through a blend of theoretical insights and practical applications, students will develop a deep understanding of AI principles and gain the skills necessary for tackling real-world AI problems.

Computer Architecture – Teacher: Ionel PAVALOIU

The course presents the architecture of computer systems. We study the main components, the instruction set of the microprocessor and the assembly language, the information storage system, the input / output system, the optimization of the calculation process. The student acquires knowledge of the hardware, its design and the interface with the software, as well as on the methods of improvement of the performance. At the end of the course, students

should know:

- Intel 80x86 processor architecture
- The use of memory, buses and caches
- The use of hard disks and RAID
- Use interrupts and DMA
- Concepts such as pipeline, virtual memory, process, parallel architecture.

Students will learn assembly language programming for the 80x86 microprocessor.

OPTIONAL PACKAGE

Accounting and Financial Information – Teacher: Oana MIONEL

The course aims to familiarize you with the key terms, concepts and techniques specific to financial accounting. Knowledge of organizational forms of entities, users of accounting information. Knowledge and understanding of the basic principles of financial accounting. Understand recording transactions in accounting for fixed assets, inventories, receivables, cash, equity, income and expenses of an economic entity. The presentation and interpretation of financial statements to continue the decision-making process.

Rights – Judicial Tools for Engineers

The general objective of the course has two aspects:

Ob1 it aims first of all for the student to be able to identify and understand the main legal rules(whatever their sources) both for operators and for international trade operations

Ob2 recognize the basic rules of commercial and international contracts and implement therules through practical exercises and analysis of current events.

OPTIONAL SUBJECTS

Computer Aided Training

This course explores the use of computer technologies in designing and delivering training programs. Students will learn about the key concepts, tools, and techniques for creating effective computer-aided training materials. The curriculum covers instructional design principles, the development of multimedia content, and the integration of interactive elements to enhance learning experiences. Emphasis is placed on understanding different training modalities, evaluating the effectiveness of training programs, and utilizing software and platforms to support educational objectives. By the end of the course, students will be equipped to design and implement computer-aided training solutions that improve learning outcomes and efficiency.

Pedagogy Internship in Pre-University Education 1

This course provides hands-on experience in pre-university education through a structured pedagogy internship. Students will engage in practical teaching activities within pre-university educational settings, applying pedagogical theories and techniques learned in the classroom. The internship focuses on developing instructional skills, classroom management, and lesson planning. Students will gain real-world insights into educational practices, interact with students and educators, and reflect on their teaching experiences. By the end of the course, students will have acquired practical teaching competencies and a deeper understanding of the dynamics of pre-university education.

III[rd] Year, II[nd] Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.S.06.O.012	S	3	2	**Intelligent Systems Engineering**	E	2		1	1	**3**
UPB.12.S.06.O.013	S	3	2	**Applied Cryptography**	E	2		2		**3**
UPB.12.D.06.O.014	D	3	2	**Computer Graphics**	E	2		1		**2**
UPB.12.D.06.O.015	D	3	2	**Computer Networks - Project**	V				2	**2**
UPB.12.S.06.O.016	S	3	2	**Intelligent Electricity Distribution Networks**	E	2		1		**2**
UPB.12.D.06.O.017	D	3	2	**Artificial Intelligence 2**	V	2		1		**3**
UPB.12.D.06.O.018	D	3	2	**Logical Programming and Functional Programming**	E	2		1	1	**3**
UPB.12.C.06.O.019	C	3	2	**Digital Marketing**	E	1		1		**2**
UPB.12.DS.06.O.020	DS	3	2	**Internship**	V	360 (12 weeks * 6 hours / day)				**8**
OPTIONAL PACKAGE										
UPB.12.S.06.O.021	S	3	2	**Modern Industrial Logistic**	V	2		1		**2**
UPB.12.S.06.O.022	S	3	2	**Nanotechnology for IoT Industry**	V	2		1		**2**
UPB.12.S.06.O.023	S	3	2	**Robotics and Multi-Agents Systems**	V	2		1		**2**
OPTIONAL SUBJECTS										
UPB.12.S.06.O.024	S	3	2	**Human Computer Interaction**	V	2		1		**3**
UPB.12.C.06.O.025	C	3	2	**Student Class Management**	V	1	1			**3**
UPB.12.C.06.O.026	C	3	2	**Pedagogy Internship in Pre-Universitary Education 2**	V				3	**2**
UPB.12.C.06.O.027	C	3	2	**Study Finals Exam: Level 1**	E					**5**

"E/V" = evaluation form (E=exam in exam session, C or V = semester evaluation) "C" = Lectures (hours/week); "S" = Tutorial; "L" = Labwork; "P" = Project

Intelligent Systems Engineering

This course delves into the principles of intelligent systems and the critical role of systems engineering in their development. Intelligent systems, which integrate artificial intelligence to perform tasks that typically require human intelligence, demand a structured approach to ensure their effectiveness and reliability. Systems engineering is essential for managing the complexity of intelligent systems, providing a systematic framework for their development across various phases.

The course covers the life cycle model of a system, focusing on three key phases: the concept development phase, where the initial idea is formulated and feasibility assessed; the engineering development phase, which involves detailed design, prototyping, and iterative refinement; and the post-development phase, which encompasses deployment, maintenance, and eventual decommissioning.

Students will explore the intersection of systems engineering and project management, understanding how project management principles support the structured execution of systems engineering tasks. Key areas include risk management, which identifies and mitigates potential issues throughout the system's life cycle, and quality management, which ensures that the system meets predefined standards and requirements.

The course also provides practical training in using systems engineering tools essential for effective management and development. Students will gain hands-on experience with software such as MS Project for scheduling and tracking progress, risk planning tools for assessing and managing potential risks, and quality planning tools to maintain high standards. Additionally, students will learn to use SysML tools like Modelio and Visual Paradigm for modeling intelligent systems, developing Work Breakdown Structures (WBS), and creating Gantt charts for project planning and management.

By the end of the course, students will be equipped with the knowledge and skills necessary to design, develop, and manage intelligent systems.

Applied Cryptography

This course provides an in-depth exploration of applied cryptography, focusing on the modeling, characterization, selection, and testing of cryptographic solutions and algorithms tailored to various applications. Students will gain practical skills in applying cryptographic primitives to enhance security mechanisms, services, and high-security applications requiring robust protection and authentication.

Theoretical components cover the fundamental principles and techniques used in cryptography, including encryption, hashing, and digital signatures. Students will engage in hands-on experimentation with these cryptographic primitives, learning how to implement and evaluate them in real-world scenarios.

The course emphasizes the practical aspects of cryptography, including how to model security requirements, select appropriate cryptographic algorithms, and test their effectiveness in different contexts. By developing a deep understanding of both the theoretical and practical aspects of cryptography, students will be equipped to address security challenges and implement effective cryptographic solutions across various fields.

Computer Graphics – Teacher: Iulia STANICA

This course offers a comprehensive exploration of computer graphics, focusing on the mathematical foundations and practical applications of graphic transformations in two and three dimensions. Students will gain expertise in performing and combining these transformations for various visual purposes and understanding the graphics pipeline, or graphics strip, that processes and renders images.

The curriculum includes realistic rendering techniques such as algorithms for eliminating non-visible faces and methods for integrating light into 3D scenes. Students will learn to simulate reflection, refraction, shadows, transparency, and fog to enhance the realism of computer-generated images. An in-depth study of

global illumination models, including ray-tracing, will be covered to simulate complex lighting effects.

Practical skills will be developed using OpenGL for creating 2D and 3D graphics applications. In addition, students will gain hands-on experience with Unity, a powerful game development platform widely used for creating interactive 3D graphics and virtual environments. Unity will be utilized to design, implement, and deploy graphical applications, providing a robust framework for real-time rendering and interactive experiences.

By integrating both OpenGL and Unity into the coursework, students will deepen their theoretical knowledge and practical skills, applying their learning to develop sophisticated graphics applications and completing assignments that enhance their design and deployment capabilities in graphical applications.

Computer Networks – Project – Teacher: Ioan-Alexandru BRATOSIN

This course provides a comprehensive understanding of computer networks, equipping students with the knowledge necessary to design and implement various types of networks within a corporate environment. Students will explore fundamental concepts of computer networking and apply them to create robust network solutions for different scenarios, including long-distance connections between company sites, mobile networks for nomadic users, and internal networks for local interconnections.

The course covers the essential technologies used in computer and telecommunications networks, including network architecture, access techniques, and data transmission methods. Students will learn about key data transfer services provided by operators and examine technologies for local area networks (LANs), metropolitan area networks (MANs), wide area networks (WANs), and wireless networks (Wi-Fi).

The curriculum includes a detailed study of LAN interconnect equipment and protocols based on the Open Systems Interconnection (OSI) model.

Additionally, students will explore mobile network technologies such as GSM, GPRS/EDGE, and UMTS, gaining insight into their applications and integration with corporate systems.

Through practical projects, students will develop skills in designing and implementing network solutions, understanding the interplay between network infrastructure and information systems, and leveraging various network technologies to meet organizational needs. This course offers a holistic view of network design and management, preparing students for real-world challenges in corporate networking.

Intelligent Electricity Distribution Networks

- Knowledge of equipment and methods for planning and controlling emerging electrical systems for power distribution;
- The smart grid discipline provides students with the opportunity to learn new concepts, apply analysis methods, and design modern power distribution solutions, including microgrids, to analyze critically the performance of electrical energy storage, regulatory environments and standards for connection, operation and control of distributed generators at national and international levels.
- The course is a working guide for all university activity: in addition to the theoretical aspects, preponderant in a basic discipline, through the course exercises and the proposed homework, the discipline allows learners to understand a thought ingenious to find the elements of a control algorithm to solve a concrete problem.
- The applications are made to help the student to implement the theoretical notions acquired during the course. The applications consist of a variety of activities (performing laboratory work, interpreting results, evaluating the quality of the measurement process) through which the student obtains skills to later adapt to any job. To develop team spirit, the laboratory work and the associated report are developed by teams of 5 students.

Artificial Intelligence 2

This course offers an in-depth exploration of deep learning, covering both the theoretical foundations and practical applications necessary for designing and implementing advanced systems. Students will develop a clear understanding of deep learning architectures and algorithms, focusing on their use in addressing contemporary challenges such as image classification and processing large-scale data sets.

The curriculum provides comprehensive insights into the design and implementation of deep learning systems, with hands-on experience using Python and TensorFlow. Students will learn to build, train, and optimize deep learning models, applying them to real-world scenarios and projects. The course emphasizes the use of parallel computing techniques, including Graphics Processing Units (GPUs), to efficiently handle computationally intensive tasks and accelerate model training.

Additionally, students will explore the deployment of machine learning systems on small, cost-effective devices, such as embedded systems and Internet of Things (IoT) devices. This includes understanding the constraints and considerations for running deep learning models on limited hardware resources and optimizing performance for practical applications.

By integrating theoretical knowledge with practical skills, this course equips students with the tools and expertise needed to develop cutting-edge deep learning solutions and deploy them effectively in diverse environments.

Logical Programming and Functional Programming

This course provides a foundational introduction to the principles and practices of logic and functional programming. Students will explore the core concepts and techniques essential for developing programs that are both clear and concise. The curriculum covers the basics of logical programming, using languages such as Prolog, and functional programming, focusing on Scala.

Students will learn to apply logic programming techniques to solve problems based on formal logic and reasoning, while functional programming concepts will be used to design and implement programs that emphasize immutability, first-class functions, and declarative code. The course includes methods for transforming and optimizing these programs to improve their effectiveness and performance.

Hands-on experience with modern functional and logical programming languages is a key component of the course. Through practical exercises and projects, students will gain proficiency in writing and refining code in Scala and Prolog, developing skills to create robust, efficient programs and understand the theoretical underpinnings of these programming paradigms.

Digital Marketing

This course provides a comprehensive introduction to digital marketing, equipping students with the skills to effectively plan and execute promotional campaigns in the online environment. Students will learn to apply digital marketing concepts and terminology to create impactful and engaging campaigns. The course covers various aspects of digital advertising, including aesthetic considerations, visualization techniques, and methods for manipulating content to capture audience attention.

Key areas of focus include the strategic use of digital marketing tools and platforms to optimize campaign performance. Students will gain hands-on experience with tools for designing, executing, and analyzing promotional activities, including social media advertising, search engine marketing, and email marketing.

The course also offers insights into the organizational structure of a digital marketing team, including understanding team roles, hierarchical functions, and budgetary considerations. By integrating practical skills with strategic knowledge, students will be prepared to manage and execute successful digital

marketing campaigns, navigate the complexities of the digital advertising landscape, and contribute effectively to marketing teams.

Internship

This internship course is designed to bridge the gap between academic training and the labor market by providing students with hands-on experience in real-world settings. The primary objective is to enhance students' skills and facilitate their swift transition into professional roles. Through practical training in companies, organizations, and research units, students will engage with software engineering, systems engineering, and application development in a dynamic work environment.

The course emphasizes the development of key professional competencies, including conducting bibliographic research on specific topics, strengthening communication skills, and improving teamwork and project planning abilities. Students will also focus on effective time management and apply theoretical knowledge to practical problems.

The internship is structured as a comprehensive design experience, allowing students to integrate and apply their learning in a real-world context. By participating in this practical training, students will gain valuable industry insights, enhance their professional skills, and prepare for successful careers in their chosen fields.

OPTIONAL PACKAGE

Modern Industrial Logistic

This course provides an in-depth exploration of modern industrial logistics, focusing on the core concepts, principles, methods, and tools essential for effective logistics management in industrial settings. Students will learn to identify and apply industrial logistics concepts and utilize computer-assisted

graphics and digital technologies for designing and interpreting logistics systems.

The curriculum covers the use of basic computer knowledge in conjunction with graphics and digital tools to address design and operational challenges in industrial logistics. Students will engage in theoretical and experimental research, as well as computer processing of status information, to develop a comprehensive understanding of logistics systems.

Key areas of focus include the application of digital technologies for designing specific logistics systems, programming, database management, and the use of assisted graphics. Students will gain practical skills in acquiring and digitally processing data from industrial logistics systems, enhancing their ability to create and manage efficient logistics solutions. The course aims to equip students with the necessary skills to leverage digital technologies in the design, analysis, and optimization of modern industrial logistics operations.

Nanotechnology for IoT Industry – Teacher: Marian ENACHESCU

This course provides foundational knowledge in nanotechnology with a specific focus on its applications on the Internet of Things (IoT) industry. Students will explore the properties and uses of nanomaterials and nano-devices, gaining insight into how these advanced technologies can enhance IoT systems.

The curriculum is designed to build skills and competencies in analyzing and controlling nano-scale devices and systems used in IoT engineering. Students will learn techniques for the detection, operation, and integration of these devices, with a strong emphasis on practical applications and real-world scenarios.

In addition to technical knowledge, the course fosters creativity and encourages in-depth research. Through its content and approach, students will develop a keen interest in exploring innovative solutions and conducting research activities related to nanotechnology and IoT. By the end of the course, students will be

equipped to apply nanotechnology principles to design and optimize IoT systems, contributing to advancements in this cutting-edge field.

Robotics and Multi-Agents Systems

The course offers a comprehensive introduction to intelligent robotics and multi-agent systems, equipping students with the fundamental knowledge and skills required to design and analyze advanced robotic and agent-based systems. By the end of the course, students will:

- Gain foundational knowledge of intelligent robotics, including key principles and technologies that drive autonomous and semi-autonomous systems.
- Learn about core paradigms and approaches in intelligent robotics, including different types of robot behaviors and decision-making processes.
- Explore how to design control architectures for intelligent agents based on specific application needs, incorporating theories and models for effective agent behavior.
- Develop the capability to create intelligent agents that can tackle various problem types, leveraging techniques in autonomous decision-making and adaptive behavior.
- Learn to model and analyze behaviors using the Finite Automata formalism, applying this theoretical framework to practical scenarios.
- Gain skills in evaluating and interpreting finite automaton models to understand and optimize agent and robotic behaviors.

Additionally, the course emphasizes the importance of strong documentation skills. Students will practice writing detailed reports and presenting their work effectively, enhancing their ability to communicate complex concepts and solutions in the field of robotics and multi-agent systems.

OPTIONAL SUBJECTS

Human Computer Interaction – Teacher: Alin ALECU

This course provides foundational knowledge in the design and evaluation of human-machine interfaces, focusing on creating effective and user-friendly interactions between people and technology. Students will learn to design and produce simple, specific interfaces while understanding key concepts in human-computer interaction.

Goals:

- Explore how humans perceive and remember information, and how these cognitive processes influence interface design.
- Understand psychological principles relevant to user behavior, including motivation, emotion, and cognitive load.
- Learn techniques for designing interfaces that support effective reasoning and problem-solving by users.
- Study various hardware components used in interfaces, such as input devices, display technologies, and their impact on user interaction.
- Gain insight into core principles and best practices for designing intuitive and accessible interfaces, including layout, color theory, and typography.
- Apply established rules and heuristics for evaluating interface design to ensure usability and effectiveness.
- Learn methods for assessing the usability of interfaces, including user testing and evaluation techniques.
- Familiarize yourself with tools and software used in the implementation of interfaces, enabling the practical application of design concepts.

By the end of the course, students will be equipped to design and evaluate human-computer interfaces that enhance user experience and interaction, applying theoretical knowledge to practical design challenges.

Student Class Management – Teacher: Melania MACOVEI

The course offers a comprehensive approach to managing student classes effectively, focusing on strategies and techniques for creating a positive and productive learning environment. Students will gain practical skills and theoretical knowledge essential for successful classroom management and student engagement.

Goals:

- Learn to organize and structure the classroom environment to support learning, including physical layout, resources, and materials management.
- Develop techniques for managing student behavior, including setting clear expectations, implementing disciplinary procedures, and fostering a respectful classroom culture.
- Acquire skills in planning and delivering lessons that are engaging and effective, including setting objectives, designing activities, and adapting instruction to meet diverse student needs.
- Explore methods to enhance student motivation and engagement, using strategies to inspire participation and maintain interest in the subject matter.
- Learn to assess student performance and provide constructive feedback that supports learning and development.
- Gain techniques for resolving conflicts and improving communication between students, parents, and colleagues to create a harmonious learning environment.
- Understand how to integrate technology effectively into classroom management, including the use of educational software and online tools to enhance instruction and engagement.

By the end of the course, students will be well-prepared to manage classroom dynamics effectively, apply best practices in teaching and behavior management, and create an optimal learning environment for all students.

Pedagogy Internship in Pre-University Education 2

This course builds on the foundational experiences gained in the initial pedagogy internship, providing advanced, hands-on experience in pre-university educational settings. The focus is on refining teaching skills and applying pedagogical theories in real-world classrooms to enhance educational practices.

Goals:

- Further develop and implement advanced instructional strategies, including differentiated instruction, formative assessment, and interactive teaching methods tailored to diverse learning needs.
- Enhance skills in managing classroom dynamics, addressing complex behavioral issues, and creating a positive and inclusive learning environment.
- Design and execute detailed lesson plans that incorporate innovative teaching practices, integrate technology, and engage students effectively.
- Refine techniques for assessing student progress, providing feedback, and using assessment data to inform instructional decisions and support student development.
- Engage in reflective practice by analyzing teaching experiences, receiving and incorporating feedback, and continuously improving instructional approaches.
- Collaborate with mentor teachers, engage in professional development activities, and contribute to school or educational community projects.
- Develop skills in documenting teaching practices, preparing detailed reports, and presenting findings or reflections on the internship experience.

The course emphasizes practical application, encouraging students to integrate theoretical knowledge with classroom practice while addressing real-world challenges in pre-university education. By the end of the course, students will have deepened their teaching expertise, refined their pedagogical techniques, and prepared for a successful career in education.

Study Finals Exam: Level 1

This course is designed to prepare students for the Level 1 Study Finals Exam in Pedagogy, serving as a comprehensive review and assessment of pedagogical knowledge and practices acquired throughout their studies. The course focuses on consolidating theoretical understanding and practical skills essential for success in the final examination and professional teaching roles.

Goals:

- Revisit core pedagogical theories and frameworks, including constructivism, behaviorism, and instructional design principles, ensuring a deep understanding of their application in educational settings.
- Critically analyze and evaluate various teaching practices and methodologies, including lesson planning, classroom management, and assessment strategies.
- Engage in targeted review sessions covering key topics that will be examined, including curriculum design, educational psychology, and effective instructional techniques.
- Apply theoretical knowledge to practical scenarios through case studies, simulations, and problem-solving exercises that mirror potential exam questions.
- Enhance critical thinking and problem-solving skills necessary for the exam, focusing on interpreting and analyzing educational problems and solutions.
- Participate in mock exams to simulate the test environment, receive feedback, and refine exam techniques and strategies.
- Learn effective study and time management strategies to optimize preparation and performance during the finals.

The course provides a structured approach to revising key content areas and practicing exam skills, preparing students to demonstrate their pedagogical competence and achieve success in the Level 1 Study Finals Exam for Pedagogy.

IVth YEAR

IVth Year, 1st Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.S.07.O.001	S	4	1	**Interdisciplinary Project**	V				2	**2**
UPB.12.S.07.O.002	S	4	1	**Internet of Things**	E	2		1		**4**
UPB.12.D.07.O.003	D	4	1	**Design with Microprocessors**	V	2		1		**4**
UPB.12.D.07.O.004	S	4	1	**Mobile and Embedded Computing**	E	2		1	1	**4**
UPB.12.S.07.O.005	S	4	1	**e-Payment Systems Security**	E	2		2		**4**
OPTIONAL PACKAGE 1										
UPB.12.S.07.A.006	S	4	1	**Mobile Communications in Industry 4.0**	E	2		2		**4**
UPB.12.S.07.A.007	S	4	1	**Decision Support Systems**	E	2		2		**4**
UPB.12.S.07.A.008	S	4	1	**Big Data Analytics**	E	2		2		**4**
OPTIONAL PACKAGE 2										
UPB.12.S.07.A.009	S	4	1	**Applications and Software Design**	E	2		2		**4**
UPB.12.S.07.A.010	S	4	1	**Semantic Web**	E	2		2		**4**
OPTIONAL PACKAGE 3										
UPB.12.S.07.A.011	S	4	1	**IoT Systems Evaluation**	E	2		2		**4**
UPB.12.S.07.A.012	S	4	1	**Nonlinear Control Systems**	E	2		2		**4**
UPB.12.S.07.A.013	S	4	1	**Smart City**	E	2		2		**4**
OPTIONAL SUBJECTS										
UPB.12.S.07.A.014	S	4	1	**Sensing and Actuation from Devices in IoT**	V	2		1		**3**
UPB.12.S.07.A.015	S	4	1	**Cybersecurity**	V	2		1	1	**4**

"E/V" = evaluation form (E=exam in exam session, C or V = semester evaluation) "C" = Lectures (hours/week); "S" = Tutorial; "L" = Labwork; "P" = Project

Interdisciplinary Project

This interdisciplinary project course focuses on acquiring fundamental concepts and practical skills related to Internet of Things (IoT) systems. Students will engage in designing intelligent systems by exploring various facets of smart device integration and complex information systems.

Goals:

- Gain a thorough understanding of IoT systems, including the internet paradigm for smart devices and their role in creating interconnected and intelligent networks.
- Learn to design and specify intelligent systems, including developing comprehensive specifications and creating network designs that incorporate smart devices.
- Study the application of smart devices within complex information systems, focusing on how they interact, communicate, and contribute to overall system functionality.
- Develop skills in writing detailed specifications for intelligent systems, ensuring clarity and precision in system requirements and design.
- Apply theoretical knowledge to practical projects, involving the design and development of IoT systems and networks. This includes hands-on experience with real-world scenarios and problem-solving.
- Integrate fundamental concepts of computers, networks, and communication devices into the development of intelligent systems, understanding how these elements work together to create effective solutions.

The project-based approach of the course allows students to acquire essential know-how for developing and implementing IoT systems. By working on practical projects, students will enhance their ability to design, specify, and manage intelligent networks, bridging theoretical knowledge with practical application.

Internet of Things – Teacher: Dan GARLASU

This course provides an in-depth exploration of the Internet of Things (IoT), focusing on the integration and application of smart devices within complex information systems. Students will gain practical and theoretical knowledge essential for developing and implementing IoT solutions.

Goals:

- Study the internet paradigm for smart devices, including how these devices communicate and interact within complex information systems to create interconnected networks.
- Learn specific protocols and standards used for machine-to-machine (M2M) communication, including data exchange and interoperability among IoT devices.
- Engage in hands-on development of applications using development boards equipped with sensors and actuators. Gain experience in programming and deploying IoT solutions in practical scenarios.
- Understand the methods and technologies for connecting smart devices to the internet, including network configuration, data transmission, and security considerations.

By the end of the course, students will be equipped with the skills to design, develop, and deploy IoT applications, integrating smart devices into larger systems and utilizing specific protocols for efficient machine communication. The course combines theoretical knowledge with practical experience, preparing students to work effectively with IoT technologies.

Design with Microprocessors

The course offers a comprehensive introduction to designing and working with embedded systems using microprocessors. Students will explore microcontroller architectures, understand internal structures, and acquire practical skills in designing and programming embedded systems.

Goals:

- Familiarize students with the various architectures of microcontrollers, including their components, operational principles, and design considerations for embedded systems.
- Gain in-depth knowledge of the internal structure of microcontrollers, including processing units, memory organization, and peripheral interfaces.
- Study the essential support circuits and components required for embedded systems, such as power management, signal conditioning, and interfacing circuits.
- Learn to design embedded systems by integrating microcontrollers with various hardware components, creating functional and efficient systems based on specific requirements.
- Develop skills in programming microcontrollers using relevant languages and tools, including writing and debugging code to control hardware and implement system functionalities.

By the end of the course, students will have the expertise to design, implement, and program embedded systems effectively, leveraging their knowledge of microcontroller architectures and support circuits to develop practical and robust solutions.

Mobile and Embedded Computing

The course provides a comprehensive introduction to mobile and embedded computing, focusing on the fundamentals of programming for mobile devices and the methodologies for developing mobile applications. Students will gain practical experience and theoretical knowledge essential for creating effective mobile and embedded solutions.

Goals:

- Familiarize students with the core principles of programming on mobile devices, including understanding platform-specific environments,

development tools, and programming languages used for mobile application development.

- Explore the main software development methodologies relevant to mobile application projects, including agile practices, iterative development, and user-centered design approaches.
- Present real-world case studies to illustrate the application of theoretical concepts in practical scenarios. Students will implement various solutions based on these case studies, applying their knowledge to develop and refine mobile and embedded applications.

By the end of the course, students will be equipped with the skills to design, develop, and deploy mobile and embedded computing solutions. They will be able to apply industry-standard development methodologies and address real-world challenges through hands-on projects and case studies.

e-Payment Systems Security

The course provides an in-depth exploration of the security aspects of electronic payment systems, focusing on the mathematical foundations, cryptographic techniques, and regulatory frameworks essential for secure e-payment transactions. Students will gain comprehensive knowledge of the models, methods, and tools necessary for developing and managing secure electronic payment systems.

Goals:

- Understand the mathematical principles underlying cryptographic systems used in various types of bank cards and electronic payment systems, including encryption, hashing, and digital signatures.
- Delve into the models, methods, mechanisms, and tools used in the development and management of electronic payment systems. Learn about secure transaction protocols, authentication mechanisms, and fraud prevention strategies.
- Gain knowledge of the laws, regulations, and standards governing

electronic payment systems and their security infrastructures. Understand compliance requirements and industry best practices for ensuring secure transactions.

- Learn to implement cryptographic algorithms specific to electronic payment systems using the Java Card subset. Develop practical skills in securing transactions and protecting sensitive information.
- Understand and use tools for analyzing and testing magnetic and chip card fraud. Develop methods for detecting vulnerabilities and securing payment systems against various types of fraud.

By the end of the course, students will be proficient in securing electronic payment systems, equipped with the knowledge to implement effective cryptographic solutions, and capable of addressing regulatory and security challenges in the e-payment domain.

OPTIONAL PACKAGE 1

Mobile Communications in Industry 4.0

This course explores the principles and technologies behind mobile communications, with a focus on their applications within the context of Industry 4.0. Students will gain an understanding of mobile radio channels, multiple access techniques, and cellular networks, and learn to evaluate the performance of various mobile communication technologies through hands-on measurement and simulation.

Goals:

- Understand the characteristics and challenges of mobile radio channels, including signal propagation, interference, and channel modeling.
- Study the different multiple access methods used in mobile communications, such as Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), and Code Division Multiple Access (CDMA).
- Learn about the structure and operation of cellular networks, including

network components, coverage planning, and handover mechanisms.

- Explore specific mobile communication technologies such as GSM (Global System for Mobile Communications), DECT (Digital Enhanced Cordless Telecommunications), and TETRA (Terrestrial Trunked Radio). Understand their applications and relevance in various industrial contexts.
- Gain practical experience with measurement and simulation techniques used in mobile communications. Utilize tools and technologies such as GSM and UMTS (Universal Mobile Telecommunications System) to evaluate system performance and analyze communication parameters.

By the end of the course, students will have a solid understanding of mobile communication technologies and their application in Industry 4.0 environments. They will be able to perform measurements, simulations, and performance evaluations of mobile communication systems, applying their knowledge to real-world industrial scenarios.

Decision Support Systems

This course provides students with an in-depth understanding of quantitative techniques and methods used in decision management, focusing on systems modeling to aid the decision-making process. Students will learn to apply mathematical models and simulation techniques to analyze real-life scenarios and make informed decisions.

Goals:

- Learn the mathematical techniques and methods used in decision management, including optimization, statistical analysis, and data interpretation.
- Assimilate theoretical knowledge of systems modeling to understand and represent complex decision-making environments. Explore different modeling approaches and their applications in decision support.
- Develop skills in using various models to simulate real-world scenarios.

Apply rigorous quantitative analysis to evaluate different decision options and outcomes.

- Acquire practical skills in software development using tools such as R and MATLAB. Learn to implement and analyze decision support models and simulations within these platforms.

By the end of the course, students will be proficient in applying quantitative methods and systems modeling to support decision-making processes. They will have hands-on experience with simulation techniques and software development tools, enabling them to analyze complex scenarios and develop effective decision support systems.

Big Data Analytics – Teacher: Dan GARLASU

This course introduces students to the essential frameworks and technologies for storing, processing, and analyzing both structured and unstructured data. Emphasis is placed on big data concepts, enterprise RDBMS applications, and advanced technologies used in big data analytics.

Goals:

- Familiarize students with frameworks for managing structured data using Relational Database Management Systems (RDBMSs). Review SQL standards and their specific implementations in enterprise RDBMS applications.
- Introduce the concepts and technologies associated with handling unstructured data within the context of big data. Understand how big data differs from traditional data management approaches.
- Explore the Hadoop Distributed File System (HDFS) and its role in big data storage and processing. Learn how HDFS supports scalability and fault tolerance in distributed computing environments.
- Study NoSQL database technologies and their applications in managing large volumes of unstructured data. Understand the various types of NoSQL databases, including document, key-value, column-family, and

graph databases.

- Gain practical experience with big data tools and languages, including Hadoop ecosystem components and related technologies. Learn to apply these tools to analyze and interpret large datasets effectively.

By the end of the course, students will be equipped with the knowledge and skills to work with both structured and unstructured data, leveraging big data technologies and methodologies. They will be able to implement and utilize RDBMSs, HDFS, and NoSQL databases to handle and analyze large-scale data efficiently.

OPTIONAL PACKAGE 2

Applications and Software Design

This course provides students with a comprehensive understanding of software design techniques and essential skills in model management. It covers the fundamental principles and practices of software design within the software development life cycle, emphasizing object-oriented design, design patterns, architectural styles, and software reusability.

Goals:

- Describe the role and importance of software design within the software development life cycle. Understand the phases and activities involved in software design.
- Apply the principles of coupling and cohesion in object-oriented (OO) design. Learn to create well-structured and maintainable software components by optimizing these principles.
- Describe the main design patterns used in software development. Gain hands-on experience in applying design patterns to solve common design problems and improve software quality.
- Identify design decisions that can be costly to change. Understand how to make informed design choices to minimize future modifications and maintenance efforts.

- Describe the main architectural styles used in software design, such as layered, microservices, and event-driven architectures. Analyze and evaluate the architectural qualities and trade-offs associated with each style.
- Demonstrate a working knowledge of the value of software reusability. Learn techniques for designing reusable software components and understand the benefits of reusability in software development.

By the end of the semester, students will have a solid foundation in software design principles and practices. They will be equipped to describe, analyze, and apply design patterns and architectural styles, make informed design decisions, and appreciate the importance of software reusability in creating high-quality software applications.

Semantic Web

This course provides an in-depth exploration of the Semantic Web, focusing on its main characteristics, components, and applications. Students will learn how to exchange "intelligent" information using languages such as XML and RDF, define and use metadata, and work with ontologies. The course covers the foundational technologies and concepts of the Semantic Web, including metadata schemas, ontology engineering, and semantic services, and highlights the key applications of the Semantic Web in knowledge management and information retrieval.

Goals:

- Define the main characteristics of the Semantic Web and its essential components, including metadata, schemas, and ontologies.
- Learn to define and use metadata with technologies such as XML (Extensible Markup Language), RDF (Resource Description Framework), and OWL (Web Ontology Language). Understand how to use SPARQL for querying semantic data.
- Gain skills in defining and using ontologies, including OWL

specifications and ontology engineering. Learn techniques for aligning and merging ontologies to create integrated semantic models.

- Explore applications integrated into the Semantic Web, such as semantic services. Understand how these services facilitate intelligent information exchange and interoperability between systems.
- Highlight the main applications of the Semantic Web, focusing on knowledge management and information retrieval. Learn how Semantic Web technologies improve data organization, access, and usability.

By the end of the course, students will be proficient in using Semantic Web technologies to create and manage intelligent information systems. They will understand how to define and utilize metadata and ontologies, develop semantic services, and apply Semantic Web concepts to real-world applications in knowledge management and information retrieval.

OPTIONAL PACKAGE 3

IoT Systems Evaluation

This course equips students with the fundamental skills and knowledge to analyze and measure the performance of Internet of Things (IoT) systems. It covers the principles of performance evaluation and the specific considerations for evaluating IoT systems in commercial, public, and small and medium enterprises (SMEs).

Goals:

- Understand the fundamental principles and methods for analyzing the performance of computer systems, focusing on metrics such as latency, throughput, reliability, and scalability.
- Learn the specific techniques and tools used to evaluate the performance of IoT systems. Understand the unique challenges and requirements of IoT environments, including sensor networks, data collection, and real-time processing.
- Gain insights into the valuation activities for IoT systems in various

sectors, including commercial enterprises, public sector organizations, and SMEs. Understand how different contexts influence the evaluation criteria and performance metrics.

- Develop practical skills through case studies and hands-on exercises. Learn to use performance measurement tools and conduct comprehensive evaluations of IoT systems to ensure they meet the required standards and performance benchmarks.

By the end of the course, students will be proficient in the techniques and methodologies for evaluating the performance of IoT systems. They will be able to conduct detailed performance analyses and understand the valuation processes across different sectors, ensuring that IoT systems are optimized for their specific applications.

Nonlinear Control Systems

The course delves into the study of nonlinear servo systems, extending to certain aspects of nonlinear electronics, within the broader context of dynamical systems theory. It covers processes modeled by ordinary differential equations and recurrent equations, providing students with the knowledge and tools necessary for identifying, modeling, and solving nonlinear problems.

Goals:

- Understand the fundamental concepts and principles of nonlinear systems theory. Learn about the unique characteristics and behaviors of nonlinear systems compared to linear systems.
- Gain proficiency in modeling processes using ordinary differential equations and recurrent equations. Learn to identify and describe the characteristic phenomena of nonlinear systems.
- Develop an understanding of the cause-and-effect relationships in nonlinear systems. Learn to analyze how inputs influence system behavior and outputs in a nonlinear context.
- Study various control methods specific to nonlinear systems. Learn

techniques for managing and controlling nonlinear systems to achieve desired performance and stability.

- Learn strategies for minimizing undesirable effects in nonlinear systems. Understand how to mitigate issues such as instability, oscillations, and chaotic behavior through effective control and management techniques.

By the end of the course, students will have a comprehensive understanding of nonlinear control systems, equipped with the skills to model, analyze, and control nonlinear processes. They will be able to apply this knowledge to practical problems in various fields, ensuring effective and efficient management of nonlinear systems.

Smart City

The course provides comprehensive knowledge on smart technologies specific to electrical engineering and their application in developing smart communities and cities. It covers essential aspects of implementing the Smart City strategy, focusing on advanced monitoring systems, real-time data collection and processing, traffic monitoring, IoT technologies, renewable energy integration, and cloud computing.

Goals:

- Gain in-depth knowledge of the technologies that are integral to the development of smart cities. Learn about advanced monitoring systems, real-time data collection and processing, traffic monitoring, and smart lighting equipment.
- Understand the role of IoT technologies in creating interconnected and efficient urban environments. Learn how IoT devices can be used to monitor and manage various city functions.
- Study the integration of renewable energy sources into the smart city infrastructure. Explore the benefits and challenges of using renewable energy in urban settings.
- Learn about the technologies for automating distribution systems and the

use of cloud computing in managing smart city data and services. Understand how these technologies contribute to the efficiency and scalability of smart city operations.

- Acquire essential information on the implementation of Smart City strategies. Understand the planning and execution processes involved in transforming traditional cities into smart cities.
- Use modern technologies to design and implement systems that can be utilized in smart city networks. Gain hands-on experience through projects and case studies that simulate real-world smart city challenges and solutions.

By the end of the course, students will be equipped with the knowledge and skills to contribute to the development and management of smart cities. They will understand the various technologies and strategies involved in creating sustainable, efficient, and interconnected urban environments.

OPTIONAL SUBJECTS

Sensing and Actuation from Devices in IoT

This course provides fundamental knowledge related to the sensing and actuation of devices in IoT applications. It focuses on the methods and techniques for analyzing and controlling sensing and actuation processes within IoT engineering. The course is designed to develop practical skills, aptitudes, and creativity, fostering a deep interest in the field and encouraging engagement in research activities.

Goals:

- Acquire basic knowledge of the principles and mechanisms behind sensing and actuation in IoT devices. Understand the types of sensors and actuators commonly used in IoT applications.
- Learn the methods and techniques for analyzing and controlling sensing and actuation processes. Understand how to implement these methods in practical IoT scenarios.

- Gain insights into the integration of sensing and actuation devices within IoT systems. Learn how these devices interact with other components of an IoT network to enable smart functionalities.
- Develop essential skills and aptitudes required for working with IoT sensing and actuation technologies. Engage in hands-on activities and projects to apply theoretical knowledge to real-world applications.
- Foster creativity and a deep interest in the field of IoT sensing and actuation. Explore advanced topics and engage in research activities to further understanding and innovation in the field.

By the end of the course, students will have a solid foundation in the principles and practices of sensing and actuation in IoT applications. They will be equipped with the skills and knowledge to analyze, control, and integrate these technologies into IoT systems, and will be encouraged to pursue further research and innovation in the field.

Cybersecurity

The main objective of the course is to provide an overview of computer security. It will also make it possible to sensitize the students on the problems of a computer network and of a computer itself. At the end of the course, students will understand some basic concepts regarding network management and computer network security.

Topics :

- Network management

ob The infrastructure used for network management

ob The standard management framework used on the Internet: SMI, MIB, SNMP

- Security applied to computer networks

ob Network Security Principles: Cryptography, Message Integrity, Endpoint

Authentication ob Application security (email, DNS)

ob Security for TCP connections (SSL / TLS) ob Network Layer Security (IPsec)

ob Network access control (firewall / firewall)

ob Securing local networks (Wi-Fi and switched Ethernet)

IVth Year, 2nd Semester

Cod disciplina	F/D/ S/C	An	Sem	Denumire disciplina	E / V	C	S	L	P	Credite
UPB.12.S.08.O.016	S	4	2	**Integrated Computing Intelligence**	V	2		1	1	**4**
UPB.12.S.08.O.017	S	4	2	**Ethical Hacking and System Defence**	V	2		2		**4**
UPB.12.S.08.O.018	S	4	2	**Virtual and Augmented Reality**	V	2		1		**3**
UPB.12.C.08.O.019	C	4	2	**Entrepreneurship in Industry 4.0**	V	2		1		**3**
UPB.12.S.08.O.020	S	4	2	**Diploma Project Elaboration**	V				4	**4**
UPB.12.S.08.O.021	S	4	2	**Diploma Project Internship**	V	60 hours (2 weeks * 30 h/week)				**5**
OPTIONAL PACKAGE 1										
UPB.12.S.08.A.021	S	4	2	**Bioinformatics**	V	2		1		**3**
UPB.12.S.08.A.021	S	4	2	**Key Standards in Health Information Systems**	V	2		1		**3**
OPTIONAL PACKAGE 2										
UPB.12.S.08.A.022	S	4	2	**Environmental Impact and Ecological Concept of IoT Products**	V	2			1	**4**
UPB.12.S.08.A.022	S	4	2	**IoT Project Management**	V	2			1	**4**

"E/V" = evaluation form (E=exam in exam session, C or V = semester evaluation) "C" = Lectures (hours/week); "S" = Tutorial; "L" = Labwork; "P" = Project

Integrated Computing Intelligence

This course provides a comprehensive understanding of autonomous systems, which operate independently without human intervention. It covers the theoretical foundations for the conception, design, and implementation of such systems. Students will engage in developing practical projects and small-scale applications, such as autonomous mobile robots, to apply these concepts in real-world scenarios.

Goals:

- Gain a clear understanding of what constitutes an autonomous system

and its significance. Learn about the characteristics and functionalities that enable systems to operate independently.

- Study the theoretical basis for the conception, design, and implementation of autonomous systems. Understand the principles that govern their behavior and operation.
- Engage in hands-on projects to design and implement autonomous systems. Develop small-scale applications, such as autonomous mobile robots, to apply theoretical knowledge to practical scenarios.
- Learn the steps involved in designing and implementing autonomous systems. Understand the integration of hardware and software components necessary for the development of these systems.
- Explore the application of autonomous systems in various fields. Study real-world examples to understand how these systems are utilized in different industries and the challenges involved.

By the end of the course, students will have a solid understanding of autonomous systems and the theoretical knowledge required to design and implement them. They will gain practical experience through projects and applications, preparing them to develop and work with autonomous systems in real-world environments.

Ethical Hacking and System Defence

The objective of the course is to provide a first vision of computer security and to increase students' sensitivity to computer security. At the end of the course, students will understand the basic concepts of network management and computer network security:

oh Ethical hacking: security from an offensive point of view oh Analysis of security from an offensive point of view

oh Developing “outside the box” thinking

Computer security helps to understand how networks and computers can be

strengthened against virtual attacks. It is a growing field that may offer new jobs in the near future. The course aims to examine the basics of networks and computer systems, studying their vulnerabilities and determining how to protect them against attacks.

Virtual and Augmented Reality

The course will introduce students to the emerging fields of virtual reality and augmented reality, by introducing them to the different aspects of reality, the different categories of applications, the technologies and the devices used. Emphasis will be placed on applying the concepts in everyday life to solve problems that may arise in different fields (medicine, education, business). Students will learn the concepts, techniques and tools needed to create virtual or augmented reality applications. Students will be able to create graphical applications for the desktop, web or mobile using known 3D graphics engines (Unity, Unreal Engine). They will learn how to integrate multimodal virtual reality devices into their applications (Oculus Rift, HTC Vive, Google Cardboard, Leap Motion). Students will also be able to integrate the Vuforia SDK into augmented reality applications for mobile devices.

Entrepreneurship in Industry 4.0

This course aims to enhance entrepreneurship skills with a specific focus on Industry 4.0. It covers the principles of technological entrepreneurship and equips students with the necessary knowledge and skills to succeed in the rapidly evolving landscape of the fourth industrial revolution. The course includes both theoretical learning and practical application through real-world and simulated environments.

Goals:

- Gain an in-depth understanding of Industry 4.0 and its impact on entrepreneurship. Learn about the key technologies and trends driving

this industrial revolution, such as IoT, AI, robotics, and advanced manufacturing.

- Improve knowledge of technological entrepreneurship. Understand how to leverage cutting-edge technologies to create innovative products and services and develop sustainable business models.
- Enhance essential entrepreneurial skills such as leadership, strategic planning, marketing, financial management, and risk assessment. Learn how to identify opportunities and navigate the challenges unique to Industry 4.0.
- Apply the acquired knowledge and skills in real-world and simulated environments. Engage in hands-on projects, case studies, and business simulations to develop practical experience in launching and managing ventures in Industry 4.0.
- Foster innovation and creativity in the context of technological entrepreneurship. Learn to think critically and creatively to solve problems and capitalize on new opportunities.

By the end of the course, students will have a comprehensive understanding of entrepreneurship in the context of Industry 4.0. They will be equipped with the knowledge, skills, and practical experience to launch and manage successful ventures, leveraging the latest technologies and trends in the industry.

Diploma Project Elaboration

This course focuses on the application of fundamental and specialized knowledge to solve complex technical problems in applied electronic systems. Students will learn to execute their projects by identifying clear objectives, utilizing available resources efficiently, and adhering to timelines. The course also emphasizes the scientific writing skills necessary for composing a professional graduation project.

Goals:

- Apply both fundamental and specialized knowledge to address and solve

complex technical issues in the field of applied electronic systems.

- Learn to precisely identify project objectives, manage resources effectively, and adhere to project timelines. Develop the skills necessary for successful project planning and execution.
- Acquire the skills needed for scientific writing and documentation. Learn to write a comprehensive and professional graduation project that meets academic and industry standards.
- Enhance problem-solving skills by tackling real-world technical challenges. Learn to apply theoretical concepts to practical scenarios.
- Develop the ability to efficiently utilize available resources, including materials, time, and human resources, to achieve project goals.
- Learn to present your project findings and methodologies clearly and professionally, both in written and oral formats.

By the end of the course, students will be proficient in applying their technical knowledge to solve complex problems, managing projects effectively, and presenting their work in a scientifically rigorous manner. They will be prepared to undertake and complete their diploma projects with a high level of professionalism and competence.

Diploma Project Elaboration

This intensive internship is designed to provide students with hands-on experience in applying their academic knowledge to real-world technical projects. Over the course of two weeks, students will work on their diploma projects within a professional setting, dedicating 60 hours to the execution of their project tasks. This experience aims to bridge the gap between theoretical learning and practical application, enhancing students' technical, project management, and professional skills.

Goals:

- Apply fundamental and specialized knowledge in a real-world environment to solve complex technical problems relevant to the

student's diploma project.

- Develop and refine project management skills, including setting clear objectives, managing resources, and adhering to strict timelines.
- Gain firsthand experience in a professional setting, working alongside industry professionals and learning about workplace dynamics and expectations.
- Enhance technical skills through hands-on work, problem-solving, and direct application of theoretical concepts.
- Improve professional communication and collaboration skills by working as part of a team, presenting progress, and receiving feedback.
- Further develop scientific writing and documentation skills by maintaining detailed records of project progress and outcomes.

By the end of this internship, students will have gained significant practical experience, bridging their academic learning with industry practice. They will be better prepared to complete their diploma projects with a high degree of competence and professionalism, having applied their skills in a real-world context.

OPTIONAL PACKAGE 1

Bioinformatics

This course provides an in-depth exploration of bioinformatics, focusing on the computational methods and techniques used to analyze biological data. Students will learn various approaches for analyzing DNA sequences, genetic information, and evolutionary patterns. The course covers a broad range of topics essential for understanding and applying bioinformatics in research and practical scenarios.

Goals:

- Understand methods for analyzing genetic variation within and between populations, and the statistical tools used in these analyses.

- Learn the principles of information theory, including entropy, and how they apply to the analysis of biological data.
- Explore data structures used for storing and analyzing biological sequences, and methods for detecting information within text sequences.
- Gain skills in analyzing DNA sequences, including techniques for identifying genetic variations and mutations.
- Study sequence analysis using Markov chains and Hidden Markov Models (HMMs), including their application to biological sequence data.
- Learn about position-specific matrices (PSMs) and their use in identifying conserved motifs within biological sequences.
- Master techniques for sequence pair alignment and multiple sequence alignment, essential for comparing and understanding biological sequences.
- Understand the construction and interpretation of phylogenetic trees, which represent the evolutionary relationships between different species or genes.
- Explore methods for detecting patterns in DNA sequences, including algorithms for gene prediction and identifying functional elements.
- Study comparative genomics to understand the similarities and differences between genomes of different species, and the implications for evolutionary biology.

By the end of the course, students will have a comprehensive understanding of bioinformatics techniques and their applications in analyzing genetic and genomic data. They will be equipped to use these methods for various research and practical applications in the field of bioinformatics.

Key Standards in Health Information Systems

The purpose of this course is to learn the data, information, and knowledge standards essential to the successful implementation of local, regional, and national health information systems. The target skills consist of identifying the

appropriate level of HITSP standards for an IT problem and selecting the appropriate standard within that level; create use cases and an organizational process to define an interoperability standard for a specific health/regional situation; participate in a national standards development process; be able to understand key concepts and use HL7 and ISO/IEEE 11073 medical device standards. Standard clinical terminology including SNOMED, clinical terms version 3 (reading codes), UMLS, ICD-9-CM, ICD-10-CM and ICD- 10-PCS, CPT/HCPCS, medical linguistics, medical vocabulary standards, natural language processing and the role of Healthcare vocabularies and clinical terminologies in the electronic health record will be taught. In the lab, students will use clinical terminology classifications, define use cases and an organizational process to define an interoperability standard similarly to HITSP standards for a specific health/regional situation, build applications based on HL7 and ISO/IEEE 11073 standards for medical device communications. Medical vocabulary standards, natural language processing, and the role of healthcare vocabularies and clinical terminologies in the electronic health record will be taught. In the lab, students will use clinical terminology classifications, define use cases and an organizational process to define an interoperability standard similarly to HITSP standards for a specific health/regional situation, build applications based on HL7 and ISO/IEEE 11073 standards for medical device communications.

Medical vocabulary standards, natural language processing, and the role of healthcare vocabularies and clinical terminologies in the electronic health record will be taught. In the lab, students will use clinical terminology classifications, define use cases and an organizational process to define an interoperability standard similarly to HITSP standards for a specific health/regional situation, build applications based on HL7 and ISO/IEEE 11073 standards for medical device communications.

OPTIONAL PACKAGE 2

Environmental Impact and Ecological Concept of IoT Products

This course explores the environmental impact and ecological considerations associated with Internet of Things products. It provides students with the knowledge and tools necessary to conduct environmental assessments, perform life cycle analyses, and apply eco-design principles to IoT products. The course emphasizes understanding the ecological footprint of IoT systems and implementing strategies for reducing environmental impact.

Goals:

- Understand the components involved in assessing the environmental impact of IoT products and systems. Learn about the various indicators used to evaluate the ecological footprint of technological solutions.
- Gain insight into the key indicators for eco-design, which guide the development of environmentally friendly products. Learn how to apply these indicators to the design and manufacturing processes.
- Develop the skills to perform a comprehensive environmental life cycle analysis. Understand how to assess the environmental impact of IoT products from raw material extraction through to disposal or recycling.
- Learn to incorporate sustainable practices in the design of IoT products. Explore strategies for minimizing waste, reducing energy consumption, and enhancing recyclability.
- Be able to critically evaluate the ecological impact of IoT products and propose improvements based on the assessment findings.
- Apply theoretical knowledge to practical scenarios by analyzing real-world case studies and developing strategies for reducing the environmental impact of IoT products.

By the end of the course, students will be proficient in evaluating the environmental impact of IoT products, performing life cycle analyses, and applying eco-design principles to create sustainable and environmentally friendly technology solutions.

IoT Project Management

This course describes the different stages of designing a software project, from programming to user training. Principle and management of the software project. Management of requirements engineering, management of design engineering, code construction engineering, testing strategies, software maintenance and evolution. Principle and techniques of management specific to the development of software engineering projects, including measurement and estimation, process improvement, quality engineering, development support tools and configuration management. Application of software engineering standards (including ISO, IEEE and industry standards) for the planning, management, and execution of software engineering projects.

The objective of the course will be to acquire a global vision of the life cycle of a software project and the associated management techniques and tools and to acquire a first vision of management techniques. Software development projects are often complex, diverse and constantly changing. The successful conduct of these projects requires strong team management and effective project control. This training provides the tools to organize project goals, create realistic plans, and build and manage a competent team through each phase of the lifecycle.

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The objective is to enable participants to assimilate and retain the "best practices" associated with project management and to be able to implement them quickly in the company. Directed workshop where the concepts and methods

seen in the software engineering program are applied to the realization of a project. Students will analyze a project, carry out its planning and implementation, carry out tests and measure the quality of the software produced. For each step the student will use the appropriate software tools.