COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Technologies and Telecommunications Systems

2. Date despre disciplină

2.1 Course name (ro) (en)				Inteligență artificială - Proiect Artificial Intelligence - Project			
2.2 Course Lecturer				Prof. Dr. Razvan Craciunescu			
2.3 Instructor for practical activities				Drd. Dan Curavale			
2.4 Year of studies	4	2.5 Semester	I	2.6. Evaluation type	V	2.7 Course regime	Op
2.8 Course type		S	2.9 Course code	04.S.07.A.209		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	1	Out of which: 3.2 course	0.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	14.00	Out of which: 3.5 course	0	3.6 seminary/laboratory	14
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					30
Tutoring					4
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	36.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Not the case
4.2 Results of learning	Not the case

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

5.1 Course	Not the case
5.2 Seminary/ Laboratory/Project	Workstations with Python, Git, Jupyter/VS Code; dataset access; connectivity to platforms (GitHub). Optional GPU for accelerated training.

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

This course guides students through the end-to-end development of an applied AI project (EEG classification, computer vision, or agentic LLM systems) from a well-defined problem statement and success criteria to a reproducible, well-reasoned implementation. Working in teams of 2-3, students build their own pipeline (exploratory data analysis, preprocessing/augmentation, model design and training, and evaluation with appropriate metrics such as F1, balanced accuracy, ROC/PR, or task-success for agents), then document results rigorously and present them convincingly. The emphasis is on reproducibility, best practices (clean repository structure), data ethics, and solid project organization, structured through intermediate milestones and culminating in clear deliverables: code, a written report, and an oral presentation.

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

Specific Competences	· Designing an **end-to-end ML pipeline** (data → EDA → preprocessing/augmentation → models → evaluation → reporting) · **Critical dataset analysis** (class distributions, imbalance, visuals) · Using **modern** methods / architectures (e.g., ResNet, simple CNNs; **EEGNet** for EEG; **agentic LLM**). · **Reproducibility**:clean repo, versioning, runbook; scientific documentation. · Technical presentation skills.
Transversal (General) Competences	· **Critical thinking and problem-solving:** Developing the ability to analyze complex problems and propose innovative solutions using AI. · **Multidisciplinary teamwork:** project management, technical communication. · **Adaptability to emerging technologies:** Rapid acquisition of knowledge on new trends and tools in the field of AI and cybersecurity. · **Literature review & synthesis**. · **Professional communication:** Clear and coherent presentation of the solutions developed, both in writing and orally, in professional contexts.

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

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* · **Explain** the parts of an end-to-end ML pipeline (problem framing, EDA, preprocessing, modeling, evaluation, reporting) and **justify** methodological choices given data/objectives. · **Describe** common preprocessing techniques (EEG windowing/filters, normalization, image augmentation, text/log cleaning for agents). · **Identify** suitable model families per track (EEGNet / light CNNs / visual transfer learning / agentic LLM flows with planner–executor–critic). · **Select** appropriate metrics:F1, balanced accuracy, ROC/PR; for agents: task-success rate, step count, runtime, #tool-calls. · **Recall** reproducibility best practices (repo structure, fixed seeds, versioning, README/runbook) and ethics/licensing requirements.
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* · **Build** a working pipeline in one track (EEG / CV / Agentic LLMs), from EDA through final evaluation. · **Implement** baselines and improved variants (transfer learning, ablations, hyperparameter tuning) and **compare** results rigorously. · **Instrument** experiments:logging, model checkpoints, plots/tables, cross-validation comparisons; **automate** key steps (scripts/Makefile). · **Integrate** code + data + results into a **reproducible repo** with run instructions and **write** a coherent technical report with correct figures/tables. · **Deliver** a public presentation (10–12 min) and **address** technical Q&A.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* · **Plans** and **executes** project work in a 2–3 person team, meeting S5/S7 milestones and owning roles/deadlines. · **Applies** ethics and academic integrity (proper citation, responsible LLM/pretrained use, license compliance). · **Reflects** critically on limitations and **proposes** improvements

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

The **AI** project is structured to encourage a student-centered approach, combining practical activities with individualized guidance. The activities are organized in such a way as to allow students to personalize their learning path, according to their interests and level of knowledge.

Teaching methods include consultation and mentoring sessions, where students talk to professors about their projects and receive personalized feedback. The practical work is emphasized by using real datasets and artificial intelligence platforms, such as TensorFlow, PyTorch or scikit-learn, applied to cybersecurity problems. Progress is monitored through intermediate deliverables (examples: project plan, preliminary models) that allow early identification of possible lags.

To support students with difficulties, additional tutoring sessions are organised, and the learning materials include practical examples and additional theoretical resources. The project promotes collaboration between students by forming teams working on similar topics, stimulating the exchange of ideas and the creation of innovative solutions. This methodology ensures the active involvement of students, supporting the learning process and achieving the objectives set in the project.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	The course culminates in an applied AI project chosen from EEG classification, computer vision, or agentic LLM systems. Teams build a reproducible end-to-end pipeline: problem and success criteria, dataset selection and EDA, preprocessing/augmentation, model design and training, experiment tracking and evaluation with appropriate metrics (F1, balanced accuracy, ROC/PR; for agents: task success, steps, time). Work is paced by milestones (S5 - problem + pipeline diagram + EDA; S7 -literature + experiment plan) and concludes with a reproducible repository, a technical report (~10 pages), and a presentation (10–12 min), emphasizing rigor, data ethics, and clear communication of results.	14
	Total:	14
Bibliography: Dan Curavale, Note de proiect		

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course			

11.5 Seminary/laboratory/project	• Knowledge and use of information source fundamentals: The ability to identify and access sources relevant to the field of AI for cybersecurity. • Assessing the quality and structure of the project documentation: Analysing the clarity, consistency and relevance of the information provided in the final report. • Bibliography: Selection of relevant sources and comparison of references to demonstrate a critical and rigorous understanding of the literature. • Presentation and speech quality: The ability to properly present a technical project and create appropriate presentation material.	The marking of this activity is in a verification regime on the way (with a grade from 1 to 10). For grading: - the manner of constituting the final report related to the research topic addressed will be assessed - an oral assessment of the students' knowledge of the field and topics addressed in the report will be carried out.	100%
11.6 Passing conditions			
Obtaining at least 50% of the total score.			

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

The course content aligns with current employer and professional-association expectations in IT&C:designing **reproducible ML pipelines**, working with **real datasets**, **sound performance measurement** (task-appropriate metrics), **version control and collaboration** on a shared repository, clear technical documentation, and **data ethics**. The selected tracks (EEG, computer vision, agentic LLM systems) mirror industry and research trends (transfer learning, experiment automation, scenario-based testing), preparing students for data/ML engineering and applied research roles. The methodology follows EHEA practices: **student-centred learning**, explicitly stated learning outcomes, **continuous milestone-based assessment** with transparent rubrics, and a capstone project that connects state-of-the-art scientific knowledge with real-world problem solving.

Date	Course lecturer	Instructor(s) for practical activities
20.09.2025	Prof. Dr. Ing. Razvan Craciunescu	drd

Date of department approval	Head of department
	Conf. Dr. Ing. Serban Obreja
Date of approval in the Faculty Council	Dean
	Prof. Dr. Ing. Mihnea Udrea