



WP2			
D 2.2		Mutually Agreed Learning Goals and Outcomes for pilot degree programmes	
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## **Pilot Programme's Methodologies to Reach Frameworks of Mutually Agreed Learning Outcomes**

Developing the ENHANCE *European Education Pathways* constitutes the main objective of the One Campus WorkPackage within the ENHANCE project. The ENHANCE Alliance has decided initially to test this innovative concept on three pilot Degree programmes (from now on, PPs): the BSc and MSc in Mechanical Engineering, the MSc in Computer Science, the MSc in Energy Engineering. Later on, a fourth pilot programme was added as a pilot tester for developing the *European Education Pathways*.

The ENHANCE *European Education Pathways's* (EEPs) aim is to provide students with a subject and competence mapping tool to select courses across the entire educational offer of the partner Institutions, with automatic recognition guaranteed. Moreover, and in agreement with the stated goal, the Alliance aspires to enhance the teaching offers at each partner institution while complying with the ambition of increasing a new form of students mobility. This attempt will lead to customized, innovative joint learning programmes.

Working groups responsible for planning and implementing the EEPs have investigated the most efficient way to reach the stated objectives. The relevant working groups at stake are constituted by: two WorkingPackage coordinating Professors from PoliMi (one for the PPs of Energy and Mechanical Engineering, and another for the PPs of Computer Science and Urban Planning), a Research Fellow from PoliMi and a Mobility Officer from TUB engaged explicitly for the ENHANCE project, plus, for each relevant pilot Degree programme, two/three coordinating Professors or core figures of each partner Institution. These working groups, relevantly subdivided per pilot programme, have designed and are following three different strategies for progressing towards the stated long-term ambitions. Below will follow a brief sketch of the three methods, each of which is succeeded by a short description of how each pilot program is advancing with it.

It is noteworthy that the original project envisions that each pilot programme involved in the Alliance provides a common, shared list of Learning Goals (LGs) or Learning Outcomes (LOs) specific to that pilot programme. However, not all chosen approaches have anticipated agreeing on a common list of LGs and LOs for the relevant pilot programme. The Energy Engineering pilot programme has decided to support and follow the project's guidelines as foreseen initially. The other programmes have adopted different strategies to reach the same long-term objective. Nonetheless, implementing different methods does not seem to be an obstacle to achieving the goals of this Work Package (i.e., the WP2). Not agreeing on a common list of LGs and LOs is not preventing the partner Universities from selecting the courses from the other Institutions of the Alliance and enriching the teaching offer. Those working groups who have adopted paths that go a bit astray from what was conceived in the original project are planning to come up with that shared LGs/LOs list in the near future to be able to characterize a common line in view of the possible future release of a joint European Degree. Specifics follow below.

## The Three Approaches and Their Development

1. The Top-Down Approach. This model is the one designed by the Energy Engineering and Mechanical Engineering PPs and the one that mirrors the original project proposal the most. This strategy focuses on enhancing the teaching offers at each partner Institution by defining *ex-ante* a list of common LGs and LOs for the selected PPs, to associate, at a later stage, the appropriate LG or LO with each of the courses offered at the relevant partner University. All LOs are categorized according to the Dublin Descriptors (DDs)<sup>1</sup>, as envisioned by the project guidelines. Below is how the two programmes proceed.

- **Pilot Programme in Energy Engineering:** The existing (expected) LOs that each partner Institution associates with their Degree programme have been mapped, clustered, and harmonized into a common list uploaded onto a shared, common Excel file. The resulted list (see attachments), following approval, has become the one shared by all partners for the specific study programme. Each partner University is currently in the process of completing matching each of the courses it plans to offer within the Alliance with the relevant LOs from the common list. This mapping process helps select the learning provisions that each partner Institution will propose as their enriched teaching offer. The selected courses will be implemented onto the IT platform and supplied as actual choices for ENHANCE students.
- **Pilot Programme in Mechanical Engineering:** The existing (expected) LGs or LOs that all partner Institutions associate with their Degree programme have been mapped and uploaded onto a common Excel file (see attachments). These lists have not been harmonized into a common one yet. However, the relevant working group is selecting the relevant learning provisions to enrich their teaching offer using other relevant information (e.g., semester in which the course is offered, form of participation, n. of ECTS, etc.) provided in a shared, modifiable Excel file. The selected courses will be implemented onto the IT platform and supplied as actual choices for ENHANCE students.

2. The Bottom-Up Approach. This model is the one designed by the Computer Science PP. This strategy focuses on reaching the ultimate objective of enriching the teaching offers at partner Institutions by looking at the existing courses and evaluating whether and how they are similar or complementary in content. Instead of starting from a common, shared list of (expected) Learning Goals and Learning Outcomes for the

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<sup>1</sup> The Dublin Descriptors are the cycle descriptors (or "level descriptors") presented in 2003 and adopted in 2005 as the Qualifications Framework of the European Higher Education Area. They offer generic statements of typical expectations of achievements and abilities associated with awards that represent the end of each of a (Bologna) cycle or level. [Dublin Descriptors - ECapeia \(ecahe.eu\)](http://ecapeia.eu)

PP, the focus is placed directly on the correspondences or differences among each partner University's learning provisions to "enhance" the teaching proposals accordingly. Below is how the programme proceeds.

#### **Pilot Programme in Computer Science:**

Lists of key-words to identify the contents of the relevant courses are used to map each Institution's teaching offer. The available teaching offer and the correspondent lists of key-words have been uploaded onto a shared, common Excel file (see attachments).

Evaluating correspondences or differences among courses thanks to the specified key-words, each partner institution is selecting their enriched teaching offer by listing a number of:

- "Equivalent courses", i.e. courses that are similar in content to the ones already offered at one's Institution;
- "Additional" or "new courses", i.e. courses offered by an ENHANCE partner University (not already included in one's teaching offer) and deemed appropriate to enrich one's teaching offer (for the courses are complementary, specific, or specializing).

3. The Hybrid Approach. This model is the one designed by the Urban Planning PP, i.e. the programme that was not part of the original work plan but included later. This model basically combines the two approaches described above. The basic idea of this approach is to work around four possible thematic clusters (suggested through a short video designed *ad hoc* (link: <https://sho.co/1ECRP>) to create new, specific study programmes to be offered within the Alliance. The proposed thematic clusters are: Sustainable cities and regions: energy, environment, community; Urban design for a livable built environment at different scales; Urbanization in the global South: spatial and social challenges; and, Policy design: pluralism, conflict, and decision making in the city. Each partner University selects relevant courses that characterize or are innovative at that Institution and may contribute to shaping each proposed thematic cluster. The ultimate purpose is to develop a course list complementing, integrating, and intensifying the existing teaching offer, which, upon agreement, will constitute the joint enriched teaching offer for ENHANCE students. Below is how the programme proceeds.

#### **Pilot Programme in Urban Planning:**

Lists of key-words or Learning Outcomes that characterize the relevant courses are used to map each Institution's teaching offer. The available teaching offer has then been uploaded onto a shared, common Excel file (see attachments). By combining the top-down and the bottom-up strategies, this hybrid approach can efficiently select the courses to be implemented onto the IT platform and supplied as actual choices for ENHANCE students.

## ATTACHMENTS

### Dublin Descriptors and Learning Outcomes for Energy Engineering

The Learning Objectives (LOs) expressed by the Board have been classified and grouped according to the Dublin Descriptors (DD).

The following sections provide the DD definitions for MSc level and the proposed aggregation of the various LOs.

#### Knowledge and Understanding (DD 1) and Applying Knowledge and Understanding (DD 2)

DD 1) Have demonstrated knowledge and understanding within the main field of study, implementing methodologies appropriate for solving complex problems, both systematically and creatively.

DD 2) Ability to critically, independently and creatively solve problems with some originality in new or unfamiliar environments within a multidisciplinary context related to their field of study.

#### Learning Outcomes for DD 1 and DD 2

##### After completion of the course, the learner should be able to

- 1) Explain the physical principles related to energy conversion and storage and describe the related processes

1.1	Identify the transport phenomena relevant to real specific processes and/or apparatuses
1.2	Formulate the equations describing transport phenomena at the macro and micro scale
1.3	Solve the governing equations by means of analytical/numerical methods
1.4	Explain the concept of indoor and outdoor thermal comfort and the reasons behind the choice of desired conditions in the winter and the summer.
1.5	Discuss the specific fundamentals, concepts, and methods necessary for solving technical problems in the area of conventional and zero CO <sub>2</sub> emissions (hydrogen, nuclear, renewable...) energy systems
1.6	Describe the characteristics of biomaterials and biofuel and methods to use them energetically
1.7	Knowledge of components, thermodynamics, and performance of vapor-compression cycles for heating and/or cooling
1.8	Knowledge of components, energy balances, and heat transfer in low temperature solar thermal installations
1.9	Knowledge of components, heat transfer, and performance in concentrating solar power for electricity generation
1.10	Knowledge of components, thermodynamics, and performance of thermal power plants
1.11	Knowledge of components, working principles, and performance of photovoltaics
1.12	Knowledge of components, working principles, and performance of wind energy

- 2) Analyze and design energy systems and related components

2.1	Analyse and design components and systems for heat and mass transfer
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2.2	Explain the operation, the main characteristics, and the operating constraints of an I electrical power system.
2.3	Explain the methods of operation and the associated constraints of the electric generators and converters required for the operation of the electrical power system.
2.4	Explain the methods of operation and construction with the associated constraints of thermal and mechanical energy conversion systems
2.5	Plan and design energy distribution networks, including their operation
2.6	Explain the working principle of centralized and decentralized heating, cooling, ventilation and air-conditioning systems and acquire knowledge about the corresponding configurations.
2.7	Plan the development, design, and operation of components, facilities, and conventional and zero CO <sub>2</sub> emissions (hydrogen, nuclear, renewable...) energy systems
2.8	Identify and develop innovative solutions in energy technology

3) Understand and analyze the interaction of different disciplines, including non-technical aspects in the design and management of energy systems

3.1	Explain the problems and opportunities associated with using different primary energy resources, conversion, storage, transportation, and end-use technologies (including renewable energy technologies)
3.2	Define the major challenges facing energy systems from local and global perspectives
3.3	Define the economic and policy drivers that shape energy conversion, storage, transportation, and end-use management decisions
3.4	Describe, analyze and optimize energetic, economic, and ecologic characteristics of power plants
3.5	Design, develop and operate processes and systems based upon the society's sustainable goals of economic, social, and sustainable development
3.6	Plan, design, evaluate, assess, and optimize renewable energy systems and explain how to integrate these into existing supply structures
3.7	Knows and understands basic terms and rules connected with industrial property protection and copyright, as well as the need for intellectual property management

### Making Judgment (DD 3), Communication Skills (DD 4) and Learning Skills (DD 5)

DD 3) synthesize and integrate knowledge; Ability to deal with complex issues both systematically and creatively, make sound judgments even based on incomplete or restricted information.

DD 4) Communicate conclusions and recommendations with the argumentation of the knowledge and rationale underpinning these to both specialist and non-specialist audiences clearly and unambiguously.

DD 5) Take responsibility for further professional development.

### Learning Outcomes for DD 3, 4 and 5

JCL 1	Integrate interdisciplinary knowledge and model, simulate, predict and evaluate cases also with limited or incomplete information
JCL 2	Design and develop energy processes and systems based upon society's goal on economic, social, and sustainable development

JCL 3	Communicate results, conclusions, and underpinning rationale, in written and oral form, in the form of account and debate, also in international contexts
JCL 4	Carry out bibliographic searches, consult and use criteria databases and other sources of information
JCL 5	Consult and apply codes of good practice and/or security
JCL 6	Carefully plan and carry out experimental investigations, interpret data judiciously and draw conclusions
JCL 7	Formulate judgments that include reflecting on scientific, social, and ethical responsibilities in the contexts of energy systems, conversion, transport, and end-use of energy and related environmental impact
JCL 8	Work collaboratively in international and multicultural groups with different compositions
JCL 9	Continue to study in a largely self-directed and autonomous manner and contribute to the learning process of other people and to R&D

Mechanical Engineering - Lists of Learning Outcomes

#	Dublin Descriptors	Chalmers	NTNU	POLIMI	RWTH	UPV	TUB	WUT (SIMR)
DD1	Have demonstrated knowledge and understanding within mechanical engineering, implementing methodologies appropriate for solving complex problems, both systematically and creatively.	Have an insight into basic principles of classical physics with a focus on	Broad basic knowledge in Mathematics, Science, Technology and Computer Science as a basis for understanding methods, applications, professional renewal and adaptations	Solid basics and scientific, economic, practical-technical background	Students master the scientific methods to analyze problems in their basic structure as well as the engineering practices to set up physical models. With the help of mathematical methods, they are able to set up models and computationally analyze the technical processes they represent.	Knowledge and ability to calculate and design industrial structures and constructions.	To recognize, understand and evaluate scientific and technical relationships in the development, design, manufacture, sales, services, and disposal of machines and processes.	Has knowledge in the area of mathematics and algebra, analysis, calculus of probability, including mathematical and numeric methods indispensable to: 1) describe and analyze kinematic and dynamic models of material points, rigid body, set of material and rigid body points, set of rigid bodies, 2) describe and analyze the operation of electric circuits, electronic elements, as well as basic phenomena that occur with them, 3) describe and analyze the operation of chemical sources of current, as well as basic phenomena that occur within them, 4) describe and analyze the systems for generating, transforming and accumulating energy of those systems, as well as basic physical phenomena that occur within them;
		showing deep insight in the fundamentals of probability theory and statistics and being able to plan experiments with respect to statistical variations,	<b>Broad engineering- and research-based knowledge in Mechanical Engineering, with depth knowledge within a more limited area connected to active research, including sufficient professional insight to make use of new research results</b>	deep technical understanding of machine design and construction, how they operate, the resistance of their components, the energy transformation process inside them, the materials to build them, involved fluid mechanics and necessary transformation processes	<b>They have become acquainted with exemplarily selected fields of technology and have built bridges between engineering fundamentals and applications related to the professional field.</b>	<b>Knowledge and skills for the calculation, design and testing of machines.</b>	<b>To understand technological change in research, development and application.</b>	has well-ordered and theoretically-based knowledge in physics, including dynamics of material point and rigid solid, thermodynamics, electricity and magnetism, in the area necessary to understand basic phenomena occurring the systems for generating, transforming and accumulating energy in hybrid power trains and their components;
		being able to describe thermodynamic principles when it comes to transformations between different forms of energy within a system,		<b>Postgraduates must prove they acquired the knowledge and understanding skills typical of their specialisation track other than those characterising the industrial engineering field. In detail, the postgraduate in Mechanical Engineering is required to:</b>	<b>Furthermore, they have acquired extracurricular qualifications that sensitize them to the non-technical requirements of a professional job.</b>	<b>Knowledge for carrying out measurements, calculations, evaluations, appraisals, appraisals, studies, reports, work plans and other similar works.</b>	<b>To recognize and to evaluate the influences and mutual relationships between technology, society and the environment.</b>	has basic knowledge in physics including oscillating and undulating motion, electrodynamics, relativistic and quantum mechanics, wave optics;
		showing basic knowledge of the structure of solid materials and be able to explain how this affects the material's properties		Have deep knowledge and understanding of the basic principles of industrial engineering and, more precisely, mechanical engineering;		<b>Knowledge and skills to apply the fundamentals of elasticity and resistance of materials to the behavior of real solids.</b>	<b>To recognize, understand and assess scientific and technical contexts as well as their further development and application.</b>	has basic knowledge in the area of material mechanics, in terms of state of stress and strain of elements of mechanical construction, indispensable to perform strength analysis;
		<b>Understand the fundamental mechanical engineering subject areas of materials science and technology, strength of materials, fluid mechanics, machine elements, mechatronics and automatic control engineering in order to be able to solve technically relevant problems, and other challenges.</b>		Critically analyse and learn the latest updates in the fields of the same industry;		<b>Applied knowledge of thermal engineering.</b>		has well-ordered knowledge in the area of materials used in construction of hybrid vehicles, their components and systems for generating, transforming and accumulating energy;
		Being able to explain and simulate the movement and forces of fluids through pipes, heat-exchangers and gas turbines as well as its movement around geometrically simple bodies.		Understand and solve problems in emerging fields linked to their specialisation;		Knowledge of applied thermodynamics and heat transmission. Basic principles and their application to solving engineering problems.		has well-ordered knowledge in the area of preparing technical documentation for elements and sets of machines and vehicles;



		Being able to explain the most common versions of actuators and sensors and apply them in the construction of mechanical products, both physically and virtually.		Understand and learn how to conceptualise models, systems and processes of mechanical and, generally speaking, industrial engineering;		Knowledge of the fundamentals of materials science, technology and chemistry. Understand the relationship between microstructure, synthesis or processing and the properties of materials.		has detailed knowledge in programming methodology and techniques
		Being able to observe, analyse, simulate and control linear dynamic systems.		Know how to find innovative solutions when looking for a solution to a problem.		Knowledge and use of the principles of circuit theory and electrical machines.		has detailed knowledge in the area of multi-source drive analysis methods, system for generating, transforming and accumulating energy, including computer systems,
		Being able to describe and exemplify the methods and tools for producing a computer aided design (CAD)				Knowledge of the fundamentals of electronics.		has basic knowledge on life cycle of electric vehicles, knows issues connected with the impact of electric and hybrid vehicles on the natural environment
		Be able to describe what knowledge is and the different views on knowledge and				Knowledge of the principles of machine and mechanism theory.		has basic knowledge in terms of organizing and conducting engineering project processes,
		<b>Be able to identify the available energy resources (renewable and non-renewable) and explain how these can be transformed to other energy forms, along with their limitations and environmental impact.</b>				Basic knowledge of production and manufacturing systems.		has basic knowledge in the area of technological processes used in the production process of components of electric and hybrid vehicles, including production preparation processes,
		<b>Being able to describe different intellectual properties rights and to describe critical times and actions to ensure relevant intellectual property protection.</b>				Basic knowledge and application of environmental technologies and sustainability.		has well-ordered and theoretically based knowledge in the area of construction and design of mechanical and electric drives for vehicles and construction machinery,
						Applied knowledge of business organization.		has well-ordered and theoretically based knowledge in terms of control and automatic control,
						Knowledge and skills to apply graphic engineering techniques.		has basic knowledge in the basics of communication networks in vehicles and machines
						Knowledge and ability to calculate and design industrial structures and constructions.		has basic knowledge in metrology, knows and understands methods of measuring and obtaining basic values characterizing elements and mechanical, electric and electronic systems, has detailed knowledge in the area of computational methods and IT tools for analyzing results of an experiment,
						Applied knowledge of the fundamentals of fluid-mechanical systems and machines.		knows and understands production processes of elements of systems for generating, transforming and accumulating energy,
						Applied knowledge of manufacturing, metrology and quality control systems and processes.		knows and understands design and manufacture processes of simple systems for generating, transforming and accumulating energy,
						Knowledge of the basic principles of fluid mechanics and their application to problem solving in the field of engineering. Calculation of pipes, channels and fluid systems.		knows and understands design methodology of elements of systems for generating, transforming and accumulating energy, as well as methods and techniques applied in the design process, knows languages of equipment description and computer tools for design and simulation of systems,
						Knowledge of the fundamentals of automation and control methods.		is aware of the current condition and the latest trends in systems for generating, transforming and accumulating energy, hybrid and electric drives, their components and infrastructure,
						Knowledge and use of the principles of resistance of materials.		has basic knowledge on life cycle and degradation processes of systems for generating, transforming and accumulating energy as well as hybrid and electric drives and their components,

						Knowledge and skills for the application of materials engineering.		has basic knowledge indispensable to understand non-technical aspects of engineering activity; knows basic health and safety rules for working with systems for generating, transforming and accumulating energy, as well as hybrid and electric drives,
								has basic knowledge on basic terms and principles in the field of industrial and intellectual property protection and copyright law; knows how to make use of patent information
								has basic knowledge in management, including quality management and running a business,
								knows general rules of creating and developing forms of individual entrepreneurship, using knowledge from the area of generating, transforming and accumulating energy, as well as hybrid and electric drives,
DD2	Ability to critically, independently and creatively solve problems with some originality in new or unfamiliar environments within multidisciplinary context related to mechanical engineering.	Be able to apply mathematics and fundamental science within applied mechanics with a focus on	Define, model and break down complex engineering problems, including choosing relevant models and methods, and carrying out calculations and solutions independently and critically	Postgraduates must know how to solve engineering problems according to their level of acquired knowledge and understanding, which may involve taking into account something out of their specialisation field. The analysis may include different stages: identifying a problem, clearly defining its specifics, selecting the correct method and its best application. Graduates can use several numerical and experimental methods while being aware of the importance of the social, health, security, environmental and market limitations.	Using the problem-solving skills students have learned, they are able to formulate problems and take on the resulting tasks in teams organized on the basis of division of labor, to work on them independently, to assimilate the results of others.	Ability to draft, sign and develop projects in the field of industrial engineering whose purpose is: the construction, reform, repair, conservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical installations and electronics, industrial facilities and plants, and manufacturing and automation processes.	To apply and use scientific and technical relationships in the development, design, manufacture, sales, service, and disposal of machines and processes.	can use known methods and mathematical models, as well as computer simulations to analyze and evaluate operation of elements of systems for generating, transforming and accumulating energy, an hybrid and electric drives,
		being able to solve linear and nonlinear systems of algebraic equations by numerical methods,	Develop comprehensive solutions to engineering problems, including the ability to develop solutions in an inter-disciplinary context, and carry out an independent, particular engineering research and development project under academic supervision	Apply the acquired knowledge and understanding skills to identify, formulate and solve engineering problems using well-established methods (skills developed during exercise courses and lab activities);	In particular, they are able to use the methods of their chosen specialization to identify, analyze and solve challenging tasks in their special discipline. For this purpose, they have learned to use systems and methods of the subject in a goal-oriented way.	Knowledge and skills to apply the fundamentals of elasticity and resistance of materials to the behavior of real solids. Knowledge and ability to calculate and design industrial structures and constructions.	To formulate problems and resultant tasks in interdisciplinary collaborative teams.	can analyze signals and simple systems for transforming signals in terms of time and frequency, using digital techniques and proper programming and hardware tools,
		being able to solve ordinary differential equations of the following types; separable, inhomogeneous with constant coefficients and Euler's,		Choose and apply the appropriate analytical and modelling methods when developing projects (the syllabus of many course establish that every year individual or group projects will be assigned to the students);	They creatively apply their knowledge in this field and develop innovative approaches to meet future market requirements as well as with regard to the vehicle requirements catalogue, for example in relation to mechatronic systems.	Knowledge and skills for the calculation, design and testing of machines.	To work on problems and resultant tasks independently and creatively.	can compare design solutions of elements and systems in terms of given usability and economic criteria,
		being able to solve by numerical methods linear and nonlinear ordinary differential equations including reformulating to a first order system,		Follow systematic plans to design mechanical systems and components by using tools for virtual modelling and applying structural, dynamics and functional design analysis principles (exercise courses and design laboratories);	Graduates use the design and development tools from construction design, simulation, test bench and road trials in a target-oriented manner and according to the latest research findings. They apply and further develop the appropriate, scientifically based development methods and process steps. They create effective project plans to achieve milestones in the research and development process.	Ability to handle mandatory specifications, regulations and standards.	To acquire methodical competence to solve synthesis problems, especially in the context of of higher complexity under balanced consideration of technical, economic and societal and societal constraints.	can use properly chosen programming environments, simulators and tools of computer aided design to simulate, design and verify elements of systems for generating, transforming and accumulating energy, as well as hybrid and electric drives,

		being able to solve the eigenvalue problem for continuous and discrete systems,		Design and carry out experimental evaluations and resulting data analysis (exercise courses and lab activities);		<b>Organizational and planning capacity in the field of the company, and other institutions and organizations.</b>		can use properly chosen methods and techniques that make it possible to measure basic values characterizing elements of systems for generating, transforming and accumulating energy, as well as hybrid and electric drives,
		being able to use the Finite Element method to solve partial differential equations,		Evaluate the performance of the materials based on their use and product lifecycle;		<b>Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer.</b>		can plan and execute simulations and measurements of electrical, mechanical and magnetic characteristics, as well as obtain basic parameters characterizing materials, elements of hybrid and electric drives; can present obtained results in both graphic and numerical graphic forms, interpret the results and draw proper conclusions,
		being able to apply thermodynamic principles when it comes to transformations between different forms of energy within a system,		Identify and define the transformation processes to turn semifinished into finished products and select and identify the parameters that establish the production costs and quality of the finished product.		<b>Knowledge for carrying out measurements, calculations, evaluations, appraisals, expert opinions, studies, reports, work plans and other similar works.</b>		can design a testing process for elements and systems of hybrid and electric drives, and in case of detecting defects, knows how to diagnose them,
		being able to estimate the life length of products and structures due to stochastic excitations,		<b>Be able to apply the acquired knowledge, understanding and problem-solving skills when facing unknown topics out of their comfort zone included when facing broader or multidisciplinary contexts somehow linked to their academic path</b>		<b>Ability to apply the principles and methods of quality.</b>		can formulate specification of simple systems for generating, transforming and accumulating energy on the level of performed functions,
		being able to apply Newton's laws in order to determine the forces and motions in material systems,		autonomously develop projects for product and process innovation in the industrial field or advanced service industry				can design electric and mechanical elements and simple multi-source systems, according to given usability and economic criteria, using proper methods, techniques and tools,
		being able to program solutions based on given models and mathematical formulas, including graphic presentations of engineering problems in Matlab and/or Python.						can design simple multi-purpose multi-source sets and systems with energy accumulation
		<b>Be able to apply the fundamental mechanical engineering subject areas of materials science and technology, strength of materials, fluid mechanics, machine elements, mechatronics and automatic control engineering in order to be able to solve technically relevant problems, and other challenges.</b>						can design a simple multi-source system, using specialized software
		Being able to determine the loads and stresses on entire designs or parts of designs,						can design a process for the execution of a simple multi-source system; can estimate its costs,
		Being able to determine dimensions for fractures, plasticity, stability, endurance/fatigue and vibrations when applied to ordinary load-carrying elements and joints such as rods, axles, beams, plates, joints, bolted joints, shrinkage fit assemblies, weldings, straight-glued joints, and layers and						can build, start and test a designed set or a simple multi-source system,
		Being able to analyze, simulate, specify and choose ordinary assemblies, joints, transmissions, brakes and bearings in mechanical designs.						can formulate an algorithm, using proper IT tools for developing algorithms operating multi-source system with energy accumulation,
		Being able to model, simulate and dimension automatically controlled systems in mechanical products, both physically and virtually.						while formulating and solving problems involving design of elements, sets and multi-source systems with energy accumulation, can see their non-technical aspects, including environmental, economic and legal aspects,

		Be able to lead and participate in the development of new products, processes and systems using a holistic approach for the entire process: from stating requirements and formulating the concept, to design, manufacturing, operations and phase-out/shut-down. This is done by following a systematic development process that is adapted for the current situation. This requires for instance:						
		ability to apply the fundamental mechanical engineering subjects for product development, industrial engineering and machining practice,						
		being able to generate suggestions for new products and production systems,						
		being able to create CAD-models (both parts and complete products) and using these to create the foundations and blueprints for manufacturing a prototype or a finished product.						
		Be able to formulate theoretical models and set up equations to describe the models. Solve equations in order to simulate reality and assess the reasonableness of the choice of model along and the solution's level of accuracy.						
		Be able to analyze, solve and simulate advanced mechanical engineering problems by up-to date industrial computer-based tools and from these, selecting the most appropriate ones.						
		Be able to plan and conduct experiments in applied mechanics, materials science and technology, automatic control engineering, energy technology and environmental technology. Be able to evaluate results, make conclusions and compare these to observations and simulations.						
		Be able to benefit from information available in technical and scientific literature and follow/make use of new developments in knowledge within the area of mechanical engineering.						
		Be able to use industrial project management methods to independently and in groups conduct industrial product development projects.						
DD3	Ability to synthesize and integrate knowledge; Ability to deal with complex issues both systematically and creatively, make sound judgments even on the basis of incomplete or restricted information.	Be able to apply scientific methodology and reflect on your own knowledge production in engineering, development or research projects.	Understand the role of engineer in a comprehensive societal perspective, have insight in ethical requirements and consideration of sustainable development, and be able to analyse ethical problems connected to engineering work, and contribute to innovation and entrepreneurship	Ability to improve understanding and application skills acquired during the undergraduate programme to conceive and apply original ideas, in a research-like situation;	Students have acquired the methodological competence to successfully solve synthesis problems, especially in the context of complex systems, with balanced consideration of technical, economic and social conditions.	Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of Industrial Engineering.	To be able to integrate the results of others when working on problems and resultant tasks.	can use catalogue sheets and application notes in order to properly choose components of a designed set or system,

		Be able to lead and participate in the development of new products, processes and systems using a holistic approach for the entire process: from stating requirements and formulating the concept, to design, manufacturing, operations and phase-out/shut-down. This is done by following a systematic development process that is adapted for the current situation. This requires for instance:	insight in selected social science, humanistic, and other non-technical disciplines of relevance to the exercise of the engineering profession, and as a basis for developing a broad perspective on the engineering discipline's role and challenges in the society	Ability to integrate learnt concepts and handle the complexity, along with making judgments having only partial or incomplete information while being aware of the social and ethical responsibility linked to what comes from applying both these knowledge and judgments;	Graduates will have the ability to independently develop research questions and designs, especially using the physical correlations of vehicle dynamics (longitudinal, lateral, vertical), vehicle acoustics, vehicle safety, driver assistance, overall vehicle design, drive system design and energy efficiency.	Ability to apply knowledge about occupational health and safety, prevention of occupational risks and safety in machines, according to current regulations on passive and active protection against fires, and aspects of noise pollution	To actively influence technological change in research, development and application.	can obtain information from literature, data bases and other sources, can integrate obtained information, interpret it, critically evaluate it, draw conclusions and formulate factual opinions,
		familiarity with and an ability to use the most common economic concepts and models in order to be able to analyze a company's financial situation and be able to assess the financial consequences of various decisions,	Understand possibilities and limitations when using information and communication technology, including juridical and societal aspects		With their qualification, graduates are also able to evaluate logistical processes and transport services of different modes of transport as well as to research their interaction.	Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.	To work scientifically and to expand the current limits of knowledge.	can evaluate the usability of routine methods and tools for solving simple engineering problems, typical of mechanics and electronics and choose and apply proper methods and tools
		being able to select materials with an understanding of how such choices will affect the manufacturing process, product behaviour and environmental impact during the life of the product,				Ability to analyze and assess the social and environmental impact of technical solutions.		is able to think and act in an entrepreneurial manner
		being able to compare and evaluate different product suggestions based on function, environmental impact, production and finances,				Possess a social-historical culture and aesthetic sensibility.		is aware of the importance of professional conduct, observing work ethics and respecting cultural differences, as well as differences in opinions
		being able to analyze, design and select production systems and machining processes with consideration to efficiency, work motivation, safety and work environment,						
		Be able to independently and creatively identify and formulate problems in the mechanical engineering field, to plan and carry out advanced tasks within given time frames and thereby contribute to the development of knowledge and to evaluate this work						
		Analyze, make visible and problematize the importance of gender equality aspects in the development of products, processes and systems.						
		Discuss and reflect on gender equality, equality and diversity based on the professional role as an engineer.						
		Be able to describe the most common professional roles of Mechanical engineers with an understanding of the multifaceted roles that engineers in mechanical engineering holds.						
		Be able to make judgements with regard to relevant scientific, social and ethical aspects within the field of mechanical engineering, and demonstrate an awareness of ethical aspects of research and development						
		take responsibility for your results, documenting well and make sure that the results are based on physical and mathematical laws and / or guiding principles and proven experience.						

		Identify and handle ethical problems and dilemmas in mechanical engineering context.						
		be able to act professionally in an internationalized environment,						
		Be able to describe and estimate the economic, societal and environmental consequences of product development.						
		Be able to understand and estimate how human behaviour affects on earth's climate and ecosystem.						
DD4	Can communicate their conclusions and recommendations with the argumentation of the knowledge and rationale underpinning these, to both specialist and non-specialist audiences clearly and unambiguously.	Be able to communicate in English and Swedish (written and spoken) in dialogue with different groups and clearly present and discuss conclusions and the knowledge and arguments behind the conclusions and to present results with graphs, images and simulations.	Ability to lead and motivate co-workers, including having an international perspective on his/her profession, and develop ability to international orientation and collaboration.	Be able to communicate their conclusions clearly and without ambiguity, including the concepts and ratio behind them, to experts and non	Students have the ability to communicate their own results.	Ability to work in a multilingual and multidisciplinary environment	To be able to communicate one's own results.	can work individually as well as a member of a team, can estimate the amount of time needed to perform a task, can prepare and execute a schedule of work ensuring that the deadlines are met
		Be able to work in and lead a multidisciplinary project group, where it is necessary to formulate and solve open problems.	Ability to disseminate, communicate and cooperate inter-disciplinary on engineering problems and solutions to specialists and the general public					can prepare documentation on the execution of an engineering task and prepare a text describing the results of the task execution
		Be able to analyze behaviour and interaction in group collaborations from an inclusive perspective.						can prepare and give a brief presentation on the results of execution of an engineering task
		Be able to apply communicative strategies to promote social sustainability.						has a command of English sufficient to communicate, comprehend reading data sheets, catalogue notes, manuals of devices and IT tools and similar documents,
		Be able to explain the requirements for knowledge, skills and attitudes of a general nature (eg teamwork, communication, labor standards, and organizational and management structures) placed on the newly graduated engineer in profession..						can work in an industrial environment, exhibiting discipline, responsibility and a proper attitude towards work, abiding by health and safety rules connected with the job
		Be able to interact with professional engineers and other professionals in the mechanical engineering industry to implement industrial development projects.						is aware of the importance and understands non technical aspects and results of an engineer's activity, including its influence on environment and the responsibility for the made decisions that arises from it
DD5	Responsibility for further professional development.		Be able to renew and adapt professionally, including develop professional competence on his/her own initiative	Be able to easily learn more whenever required when engaging in their working activities		Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and gives them the versatility to adapt to new situations.	To work and to act socially responsibly.	has an ability to self-study, among others in order to improve professional qualifications,
				Be able to develop the learning skills that lead to an autonomous and self-directed lifelong learning process			To creatively cooperate in interdisciplinary teams.	understands the need and knows the prospects for constant learning (second and third degree studies, post-graduate studies, courses) – improving professional, personal and social competences

								<p>To acquire a comprehensive general education.</p>	<p>is aware of the social role of a technical University graduate, in particular understands the need to formulate and convey to a society, especially via mass media, information and opinions relating to achievements in the field of vehicle and machine mechatronics and other aspects of engineering activity; tries to convey such information in a commonly understandable manner.</p>
								<p>To acquire gender competence.</p>	

**Computer Science - Lists of Courses and Correspondent Keywords**

Course ID	OFFERED BY (UNIVERSITY)	COURSE NAME	MACRO-AREA	KEY WORDS	LANGUAGE	ECTS	LINK TO COURSE PAGE
P-1	POLITECNICO di MILANO	SOFTWARE ENGINEERING 2 (054443)	Software engineering	Requirements Engineering; Software Design; Software verification and validation; Formal specification; Project Management	English	5	<a href="https://aunicalogin.polimi.it/aunicalogin/getservizi_o.xml?id_servizio=178&amp;c_classe=743888">https://aunicalogin.polimi.it/aunicalogin/getservizi_o.xml?id_servizio=178&amp;c_classe=743888</a>
P-2	POLITECNICO di MILANO	DISTRIBUTED SYSTEMS (090950 )	Software engineering	Distributed software architectures; Naming; Distributed synchronization; Fault tolerance; Consistency and replication	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744092&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=7d241551cf4f4ee7ab85cee806b70dab">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744092&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=7d241551cf4f4ee7ab85cee806b70dab</a>
P-3	POLITECNICO di MILANO	DESIGN AND IMPLEMENTATION OF MOBILE APPLICATIONS (093212)	Software engineering	Mobile application design; Flutter; ReactNative; Android; iOS	English	5	<a href="#">Programma Dettagliato (polimi.it)</a>
P-4	POLITECNICO di MILANO	DISTRIBUTED SOFTWARE DEVELOPMENT (054447)	Software engineering	Distributed software engineering; Agile development methods; Tools for software development; Project management techniques; Distributed collaboration and communication	English	5	<a href="#">Programma Dettagliato (polimi.it)</a>
P-5	POLITECNICO di MILANO	MIDDLEWARE TECHNOLOGIES FOR DISTRIBUTED SYSTEMS (052533)	Software engineering	Big Data; Stream Processing; Internet of Things; Edge computing; Networked Systems	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=743721&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=f3e786391bcff8fde56edfb3c30b8bc9">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=743721&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=f3e786391bcff8fde56edfb3c30b8bc9</a>
P-6	POLITECNICO di MILANO	PRINCIPLES OF PROGRAMMING LANGUAGES (095943)	Programming Languages	programming languages; programming paradigms; functional programming; concurrency	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744009&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=f7408e0c22bcc02cd7d9f5b94924075a">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744009&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=f7408e0c22bcc02cd7d9f5b94924075a</a>
P-7	POLITECNICO di MILANO	FORMAL METHODS FOR CONCURRENT AND REAL-TIME SYSTEMS (088882)	Software engineering	Model Checking; Transition systems; Concurrent system verification; Real-time system verification; Program Correctness; Timed Automata	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=745225&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=6963dff8c0b24aa521f7daab6dad353d">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=745225&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=6963dff8c0b24aa521f7daab6dad353d</a>
P-8	POLITECNICO di MILANO	ALGORITHMS AND PARALLEL COMPUTING (052496)	Software engineering		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744214&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=1e434d9fe3601d19398ba2375360fd44">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744214&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=1e434d9fe3601d19398ba2375360fd44</a>
P-9	POLITECNICO di MILANO	FORMAL LANGUAGES AND COMPILERS (089182)	Programming Languages	Regular Expressions; Context-free Grammars; Finite-state and Push-down Automata; Parsing and Translation; Compiler Structure and Design	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744238&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=8d108de3644d5febda288ffc3fc09e1">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744238&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=8d108de3644d5febda288ffc3fc09e1</a>
P-10	POLITECNICO di MILANO	THEORETICAL COMPUTER SCIENCE (089181)	Software engineering	Formal languages and grammars; Automata; Logic; Computability; Complexity	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744136&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=bc1697302f65b5bea440b83848e0b65c">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744136&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=bc1697302f65b5bea440b83848e0b65c</a>
P-11	POLITECNICO di MILANO	ADVANCED ALGORITHMS AND PARALLEL PROGRAMMING (095946)	System Design and Operation	randomization; parallel languages; Parallel patterns; performance profiling; Dynamic Programming	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744827&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=d15569a0cfa249538bd4215003b570cf">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744827&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=d15569a0cfa249538bd4215003b570cf</a>



P-12	POLITECNICO di MILANO	PROCESS AND SERVICE DESIGN (095948)	Information Systems	Process modeling; Process automation; Service based systems; REST; BPMN	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=745246&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=34212b508605f1b4d90f14ee7138b096">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=745246&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=34212b508605f1b4d90f14ee7138b096</a>
P-13	POLITECNICO di MILANO	CODE TRANSFORMATION AND OPTIMIZATION (090957)	Programming Languages	Compilers; Code Generation; Code Optimization; Compiler Structure and Design;	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744487&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=d6d80de27c4c17a3ee2276a14372989e">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744487&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=d6d80de27c4c17a3ee2276a14372989e</a>
P-14	POLITECNICO di MILANO	COMPUTER SECURITY (055633)	Security	Cybersecurity; Malware; Network security; Software vulnerabilities; Exploitation	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=745827&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=8545c6cf44fadf058b146af2ed813df4">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=745827&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=8545c6cf44fadf058b146af2ed813df4</a>
P-15	POLITECNICO di MILANO	BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGIES: PRINCIPLES, APPLICATIONS, AND RESEARCH CHALLENGES (056489)	Security		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=746342&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=ba90dc7e0a4c3f50a3e4098ef4bcb414">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=746342&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=ba90dc7e0a4c3f50a3e4098ef4bcb414</a>
P-16	POLITECNICO di MILANO	ADVANCED CYBERSECURITY TOPICS (054308)	Security		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744469&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=901e61f364b5e95c82af726b61fa423">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744469&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=901e61f364b5e95c82af726b61fa423</a>
P-17	POLITECNICO di MILANO	CRYPTOGRAPHY AND ARCHITECTURES FOR COMPUTER SECURITY (095947)	Security	Cryptography; Cryptanalysis; Secure Computing Architectures; Side Channel Attacks; Cryptographic Protocols	English	5	<a href="https://aunicalogin.polimi.it/aunicalogin/getservizio.xml?id_servizio=178&amp;c_classe=744576">https://aunicalogin.polimi.it/aunicalogin/getservizio.xml?id_servizio=178&amp;c_classe=744576</a>
P-18	POLITECNICO di MILANO	HUMAN-COMPUTER INTERACTION FOR AI (HCI4AI) (056494)	Artificial Intelligence and Robotics		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=746347&amp;_pi0=0&amp;_pj1=001789181301f5ca9c3df2e10988c5b1">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=746347&amp;_pi0=0&amp;_pj1=001789181301f5ca9c3df2e10988c5b1</a>
P-19	POLITECNICO di MILANO	CRYPTOGRAPHY AND ARCHITECTURES FOR COMPUTER SECURITY (095947)	Artificial Intelligence and Robotics	Neural Networks; Deep learning; Convolutional Neural networks; Recurrent neural networks; Tensorflow / Keras	English	5	<a href="https://aunicalogin.polimi.it/aunicalogin/getservizio.xml?id_servizio=178&amp;c_classe=743758">https://aunicalogin.polimi.it/aunicalogin/getservizio.xml?id_servizio=178&amp;c_classe=743758</a>
P-20	POLITECNICO di MILANO	APPLIED QUANTUM MACHINE LEARNING (056488)	Artificial Intelligence and Robotics		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=746341&amp;_pi0=0&amp;_pj1=ac9c8b5a7f370689adc955b35f1d145f">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=746341&amp;_pi0=0&amp;_pj1=ac9c8b5a7f370689adc955b35f1d145f</a>
P-21	POLITECNICO di MILANO	MACHINE LEARNING (093212)	Artificial Intelligence and Robotics	machine learning; supervised learning; reinforcement learning; kernel methods; learning theory	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744394&amp;_pi0=0&amp;_pj1=a3481df05030f4a4c587cd8041ab09a4">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744394&amp;_pi0=0&amp;_pj1=a3481df05030f4a4c587cd8041ab09a4</a>
P-22	POLITECNICO di MILANO	AUTONOMOUS AGENTS AND MULTIAGENT SYSTEMS (089169)	Artificial Intelligence and Robotics		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744391&amp;_pi0=0&amp;_pj1=4b575f226e89179f23cf6d0cf27a41c1">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c_classe=744391&amp;_pi0=0&amp;_pj1=4b575f226e89179f23cf6d0cf27a41c1</a>
P-23	POLITECNICO di MILANO	DATA MINING AND TEXT MINING (055632)	Artificial Intelligence and Robotics	Data Science; Exploratory Data Analytics; Predictive Analytics; Clustering; Explainability	English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETAGLIO_RIGA_A_MANIFESTO=evento&amp;k_corso_la=474&amp;k_indir=Z2D&amp;idItemOfferta=150796&amp;idRiga=258180&amp;codDescr=055632&amp;semestre=1&amp;aa=2020&amp;lang=IT&amp;jaf_curentWfID=main">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETAGLIO_RIGA_A_MANIFESTO=evento&amp;k_corso_la=474&amp;k_indir=Z2D&amp;idItemOfferta=150796&amp;idRiga=258180&amp;codDescr=055632&amp;semestre=1&amp;aa=2020&amp;lang=IT&amp;jaf_curentWfID=main</a>

P-24	POLITECNICO di MILANO	IMAGE ANALYSIS AND COMPUTER VISION (099993)	Computer Graphics	Computer Vision; Image Analysis; 3D Shape Reconstruction; Multi-view Geometry; Feature extraction and matching	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744244&amp;_pj_0=0&amp;_pj1=fbe9a674dc17090c5e9974ab5897def5">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744244&amp;_pj_0=0&amp;_pj1=fbe9a674dc17090c5e9974ab5897def5</a>
P-25	POLITECNICO di MILANO	NATURAL LANGUAGE PROCESSING (088946)	Artificial Intelligence and Robotics	natural language processing; text and speech analysis; text and speech synthesis; conversational agents; affective computing	English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETAGLIO_RIGA_MANIFESTO=EVENTO&amp;c_insegn=088946&amp;aa=2020&amp;k_cf=225&amp;k_corso_la=471&amp;ac_ins=0&amp;k_indir=BIF&amp;lang=EN&amp;tipoCorso=ALL_TIPO_CORSO&amp;semestre=1&amp;idItemOfferta=150531&amp;idGruppo=4169&amp;idRiga=254672&amp;codDescr=088946">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETAGLIO_RIGA_MANIFESTO=EVENTO&amp;c_insegn=088946&amp;aa=2020&amp;k_cf=225&amp;k_corso_la=471&amp;ac_ins=0&amp;k_indir=BIF&amp;lang=EN&amp;tipoCorso=ALL_TIPO_CORSO&amp;semestre=1&amp;idItemOfferta=150531&amp;idGruppo=4169&amp;idRiga=254672&amp;codDescr=088946</a>
P-26	POLITECNICO di MILANO	RECOMMENDER SYSTEMS (052534)	Artificial Intelligence and Robotics	Personalization; User modeling; Machine learning; Information retrieval; Data mining	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744390&amp;_pj_0=0&amp;_pj1=0a1165faf505e0a671188f22f0b2a0b0">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744390&amp;_pj_0=0&amp;_pj1=0a1165faf505e0a671188f22f0b2a0b0</a>
P-27	POLITECNICO di MILANO	ROBOTICS (089013)	Artificial Intelligence and Robotics	Mobile Robot Kinematics; Simultaneous Localization and mapping; Bayesian Filtering; Mobile robot navigation; Robot Operating System	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=745305&amp;_pj_0=0&amp;_pj1=96abe79df3b6dcfab0850fe119b7dcba">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=745305&amp;_pj_0=0&amp;_pj1=96abe79df3b6dcfab0850fe119b7dcba</a>
P-28	POLITECNICO di MILANO	ROBOTICS AND DESIGN (093217)	Artificial Intelligence and Robotics	Robot; Product Design; Behavior Engineering; Sensors; Software design; Human-Robot Interaction	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744901&amp;_pj_0=0&amp;_pj1=de971ec20666192c5052571368decdb0">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744901&amp;_pj_0=0&amp;_pj1=de971ec20666192c5052571368decdb0</a>
P-29	POLITECNICO di MILANO	ARTIFICIAL INTELLIGENCE (089214)	Artificial Intelligence and Robotics		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744392&amp;_pj_0=0&amp;_pj1=23cd741f2e0d9e50b6433f7a66802764">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744392&amp;_pj_0=0&amp;_pj1=23cd741f2e0d9e50b6433f7a66802764</a>
P-30	POLITECNICO di MILANO	SOFT COMPUTING (052536)	Artificial Intelligence and Robotics		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=743791&amp;_pj_0=0&amp;_pj1=1c06bc00f14e2a3509534cfded5d36d0">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=743791&amp;_pj_0=0&amp;_pj1=1c06bc00f14e2a3509534cfded5d36d0</a>
P-31	POLITECNICO di MILANO	MODEL IDENTIFICATION AND DATA ANALYSIS (051587) - 1st module	Artificial Intelligence and Robotics	Black-box models; statistical models; dynamical models; system identification; machine learning	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=745244&amp;_pj_0=0&amp;_pj1=86692e0fd3f2963c89460f0fc12bce0">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=745244&amp;_pj_0=0&amp;_pj1=86692e0fd3f2963c89460f0fc12bce0</a>
P-32	POLITECNICO di MILANO	MODEL IDENTIFICATION AND DATA ANALYSIS (051587) - 2nd module	Artificial Intelligence and Robotics	statistical learning; SW-sensing; variable estimation; Kalman Filter; time-series	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=745244&amp;_pj_0=0&amp;_pj1=86692e0fd3f2963c89460f0fc12bce0">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=745244&amp;_pj_0=0&amp;_pj1=86692e0fd3f2963c89460f0fc12bce0</a>
P-33	POLITECNICO di MILANO	ECONOMICS AND COMPUTATION (054756)/097688)	Artificial Intelligence and Robotics		English		<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744701&amp;poli_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=be000101706613dc4d66f0d7b9f677a8">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?&amp;evn_default=evento&amp;c_classe=744701&amp;poli_device_category=DESKTOP&amp;_pi0=0&amp;_pj1=be000101706613dc4d66f0d7b9f677a8</a>
P-34	POLITECNICO di MILANO	ADVANCED COMPUTER AND ARCHITECTURES (88949)	Hardware Design	processor architectures; parallel architectures; memory architectures; mutiprocessors / manycores; Runtime Support	English	5	<a href="#">Manifesti degli Studi (polimi.it)</a>

P-35	POLITECNICO di MILANO	ADVANCED USER INTERFACES (097685)	HCI	Human-computer Interaction; Multimodal interaction; Virtual/Augmented/Mixed Reality; Conversational Agents; Smart Objects/Smart Spaces	English	5	<a href="http://www.polimi.it/manifesti-degli-studi">Manifesti degli Studi (polimi.it)</a>
P-36	POLITECNICO di MILANO	BUSINESS INFORMATION SYSTEMS 1 (091023)	Information Systems	ERP; CRM; operational DB; business intelligence; KPI	English	5	<a href="http://www.polimi.it/manifesti-degli-studi">Manifesti degli Studi (polimi.it)</a>
P-37	POLITECNICO di MILANO	COMPUTER GRAPHICS (090958)	Computer Graphics		English	5	<a href="http://www.polimi.it/manifesti-degli-studi">Manifesti degli Studi (polimi.it)</a>
P-38	POLITECNICO di MILANO	COMPUTING INFRASTRUCTURES (095898)	System Design	Data Centers; Virtualization; Cloud Computing; Performance; Reliability	English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=263&amp;k indir=MMi&amp;iditemOfferta=155049&amp;idGruppo=4245&amp;idRiga=267920&amp;codDescr=095898&amp;semestre=2&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=263&amp;k indir=MMi&amp;iditemOfferta=155049&amp;idGruppo=4245&amp;idRiga=267920&amp;codDescr=095898&amp;semestre=2&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main</a>
P-39	POLITECNICO di MILANO	DATA BASES 2 (089183)	Data Management	Transactional systems and concurrency control; Triggers (active databases); Object Relational Mapping; Physical structures and query optimization; Approximate queries	English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=263&amp;k indir=MMi&amp;iditemOfferta=155049&amp;idGruppo=4245&amp;idRiga=267917&amp;codDescr=089183&amp;semestre=1&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=263&amp;k indir=MMi&amp;iditemOfferta=155049&amp;idGruppo=4245&amp;idRiga=267917&amp;codDescr=089183&amp;semestre=1&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main</a>
P-40	POLITECNICO di MILANO	DATA MANAGEMENT FOR THE WEB (094743)	Data Management	information retrieval for the web; web data search and management; crowd computing; social analytics; concept design & startups for the web	English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=481&amp;k indir=T2A&amp;iditemOfferta=156912&amp;idGruppo=4336&amp;idRiga=271089&amp;codDescr=094743&amp;semestre=1&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=481&amp;k indir=T2A&amp;iditemOfferta=156912&amp;idGruppo=4336&amp;idRiga=271089&amp;codDescr=094743&amp;semestre=1&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main</a>
P-41	POLITECNICO di MILANO	DESIGN OF HARDWARE ACCELERATORS (056903)	Hardware Design	hardware accelerators; system-level design; application profiling; design space exploration; hw/sw co-design	English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=476&amp;k indir=SS&amp;iditemOfferta=156563&amp;idGruppo=4341&amp;idRiga=275789&amp;codDescr=056903&amp;semestre=2&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIG A_MANIFESTO=evento&amp;k corso_la=476&amp;k indir=SS&amp;iditemOfferta=156563&amp;idGruppo=4341&amp;idRiga=275789&amp;codDescr=056903&amp;semestre=2&amp;aa=2021&amp;lang=IT&amp;jaf_currentWFID=main</a>
P-42	POLITECNICO di MILANO	DIGITAL FORENSICS AND CYBERCRIME (055812)	Security	computer forensics; cybercrime; fraud detection; incident response; threat analysis	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=765256&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=a3ed76ce394d00a3e3503273079cf313">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=765256&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=a3ed76ce394d00a3e3503273079cf313</a>
P-43	POLITECNICO di MILANO	EMBEDDED SYSTEMS (056899)	Hardware Design	Embedded Applications; Energy Aware Design; Hw/Sw Systems; Real-Time Software; Edge Computing	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=766639&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=5ffdd3567eb16a4d35820071f78ed0fc">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=766639&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=5ffdd3567eb16a4d35820071f78ed0fc</a>
P-44	POLITECNICO di MILANO	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE (056889)	Artificial Intelligence and Robotics	Search Problems; Constraint Satisfaction Problems; Adversarial Search; Reasoning; Planning	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=766646&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=7bb3aa16ed3c5e1b1bbfbdbe5cfe7a7e">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=766646&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=7bb3aa16ed3c5e1b1bbfbdbe5cfe7a7e</a>
P-45	POLITECNICO di MILANO	GPUs AND HETEROGENEOUS SYSTEMS (056902)	Hardware Design	GPU architecture; Heterogeneous system architecture; GPU programming; CUDA; OpenCL	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=766684&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=a4ec82c508d8684413e182d535b4d178">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPubblica.do?evn_default=evento&amp;c classe=766684&amp;polij_device_category=DESKTOP&amp; pi0=0&amp; pj1=a4ec82c508d8684413e182d535b4d178</a>

P-46	POLITECNICO di MILANO	HYPERMEDIA APPLICATIONS (WEB AND MULTIMEDIA) (089318)	Data Management	Web application design; Usability; Accessibility; Front-end web technology; VueJS/NuxtJS	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=765373&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=245b6c30f23dad7578746dbf4cdcdf6">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=765373&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=245b6c30f23dad7578746dbf4cdcdf6</a>
P-47	POLITECNICO di MILANO	MULTIAGENT SYSTEMS (056893)	Artificial Intelligence and Robotics	autonomous agents; coalition formation; multiagent planning; distributed constraint optimization; distributed constraint optimization	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=766633&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=d8fd8d541e6a0f0bb7ec597e409ff90f">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=766633&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=d8fd8d541e6a0f0bb7ec597e409ff90f</a>
P-48	POLITECNICO di MILANO	OFFENSIVE AND DEFENSIVE CYBERSECURITY (56896)	Security	cybersecurity; hardware security; exploitation techniques; vulnerabilities; mitigations	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=766637&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=f988b23db67d6d5bdf5f95a88a659ebc">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=766637&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=f988b23db67d6d5bdf5f95a88a659ebc</a>
P-49	POLITECNICO di MILANO	PERFORMANCE EVALUATION AND APPLICATION (056897)	System Design		English	5	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETAGLIO_RIGA_A_MANIFESTO=evento&amp;k_corso_la=481&amp;k_indir=T2D&amp;idItemOfferta=156945&amp;idRiga=275425&amp;codDescr=056897&amp;semestre=1&amp;aa=2021&amp;lang=IT&amp;jaf_curentWFID=main">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DETAGLIO_RIGA_A_MANIFESTO=evento&amp;k_corso_la=481&amp;k_indir=T2D&amp;idItemOfferta=156945&amp;idRiga=275425&amp;codDescr=056897&amp;semestre=1&amp;aa=2021&amp;lang=IT&amp;jaf_curentWFID=main</a>
P-50	POLITECNICO di MILANO	STREAMING DATA ANALYTICS (056895)	Data Management	data stream management systems; event-based systems; stream processing languages; complex event recognition and processing; event-driven architectures; streaming machine learning; time-series analytics; continual artificial intelligence	English	5	<a href="#">Programma Dettagliato (polimi.it)</a>
P-51	POLITECNICO di MILANO	SYSTEMS AND METHODS FOR BIG AND UNSTRUCTURED DATA (056901)	Data Management	Big data; NoSql; non relational databases; Data Science; Databases	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=766663&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=537a543d1e0a7b94a852793f280a2f81">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=766663&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=537a543d1e0a7b94a852793f280a2f81</a>
P-52	POLITECNICO di MILANO	VIDEOGAME DESIGN AND PROGRAMMING (089175)	Artificial Intelligence and Robotics	Game Design; Game Development; Artificial Intelligence; Procedural Content Generation; Unity	English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=764796&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=a8f6d6ea2423bc803c4976f29e42562f">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=764796&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=a8f6d6ea2423bc803c4976f29e42562f</a>
P-53	POLITECNICO di MILANO	DATA INTELLIGENCE APPLICATIONS (052557/054444)	Artificial Intelligence and Robotics		English	5	<a href="https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=744817&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=f753a2eb0a31e372125c5288dd525ab5">https://www11.ceda.polimi.it/schedaincarico/schedaincarico/controller/scheda_pubblica/SchedaPublic.do?evn_default=evento&amp;c_classe=744817&amp;polij_device_category=DESKTOP&amp;_pi0=0&amp;_pi1=f753a2eb0a31e372125c5288dd525ab5</a>
N-1	NTNU	Introduction to Artificial Intelligence (TDT4136)	AI	heuristic search, knowledge representation languages, predicate logic, frames, semantic nets, rule based reasoning		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4136/">http://www.ntnu.no/studier/emner/TDT4136/</a>
N-2	NTNU	Cognitive Architectures (TDT4137)	AI	short-term memory, long-term memory, representation of mental structures, functional processes, learning mechanisms, evaluation of user interfaces in terms of cognitive complexity analysis, advanced multimodal user interaction		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4137/">http://www.ntnu.no/studier/emner/TDT4137/</a>
N-3	NTNU	Machine Learning (TDT4173)	AI	principles and methods for automatic learning in computer systems, classical syntax-based learning methods, symbolic methods. Statistical generalizations, time series methods, ensemble methods, and deep learning. Learning methods in case-based reasoning		7,5	<a href="http://www.ntnu.no/studier/emner/TDT4173/">http://www.ntnu.no/studier/emner/TDT4173/</a>

N-4	NTNU	Recommender Systems (TDT4215)	AI	Content based and collaborative filtering methods. Similarity and prediction functions. Evaluation methods of recommender systems. Knowledge management in web-based applications. Semantic Web and ontologies. Open linked data for sharing and collaboration. Linguistic and statistical techniques for text mining and content analysis. Semantic recommender systems.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4215/">http://www.ntnu.no/studier/emner/TDT4215/</a>
N-5	NTNU	Deep Learning (IT3030)	AI	deep learning, mathematical and computational foundation for deep learning, software frameworks for deep learning , low-level coding in Python or similar languages.	7.5	<a href="http://www.ntnu.no/studier/emner/IT3030/">http://www.ntnu.no/studier/emner/IT3030/</a>
N-6	NTNU	Artificial Intelligence Programming (IT3105)	AI	Implementation of classic AI algorithms. A* algorithm, means-ends analysis, decision-tree learning, genetic algorithms, neural networks, bayesian classification, case-based reasoning, boosting and bagging	7.5	<a href="http://www.ntnu.no/studier/emner/IT3105/">http://www.ntnu.no/studier/emner/IT3105/</a>
N-7	NTNU	Bio-Inspired Artificial Intelligence (IT3708)	AI	Intelligent systems inspired by the natural world, in particular biology. Evolutionary algorithms. Theory and practice of bio-inspired artificial intelligence.	7.5	<a href="http://www.ntnu.no/studier/emner/IT3708/">http://www.ntnu.no/studier/emner/IT3708/</a>
N-8	NTNU	Artificial Intelligence Methods (TDT4171)	AI	rule-based reasoning , modelbased reasoning , case based reasoning. Basis for learning systems (machine learning). Bayesian networks, decision graphs, and neural networks.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4171/">http://www.ntnu.no/studier/emner/TDT4171/</a>
N-9	NTNU	Information Retrieval (TDT4117)	DB	Automatic document (sounds, images and text) storage and retrieval. File organising, query operations, document operations and knowledge-based textual and multimedia information retrieval.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4117/">http://www.ntnu.no/studier/emner/TDT4117/</a>
N-10	NTNU	Very Large, Distributed Data Volumes (TDT4225)	DB	Large and distributed data volumes, distributed techniques. Data models and query languages. Indexing and storage techniques. Encoding of data. Replication, partitioning and transactions. Fault models, consistency and consensus.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4225/">http://www.ntnu.no/studier/emner/TDT4225/</a>
N-11	NTNU	Advanced Database Management Systems (TDT4150)	DB	Architecture of database systems. Query optimization. Parallel and distributed database systems. New database architectures and query operators.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4150/">http://www.ntnu.no/studier/emner/TDT4150/</a>
N-12	NTNU	Big Data Architecture (TDT4305)	DB	Frameworks for Big Data processing (MapReduce, Spark, Storm, etc.), mining Big Data, data streams and analysis of time series, recommender systems, and social network analysis.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4305/">http://www.ntnu.no/studier/emner/TDT4305/</a>
N-13	NTNU	Data Warehousing and Data Mining (TDT4300)	DB	Data warehouses and data analysis using data mining. Data quality and methods and techniques for preprocessing of data. Algorithms for classification, clustering and association rule analysis.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4300/">http://www.ntnu.no/studier/emner/TDT4300/</a>
N-14	NTNU	Software Security and Data Privacy (TDT4237)	Security	To incorporate security in each software developmen phase (requirements, design, implementation, and testing). Software security for web-based applications and mobile apps. Data privacy and GDPR.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4237/">http://www.ntnu.no/studier/emner/TDT4237/</a>

N-15	NTNU	Web Development (IT2810)	Software Engineering (SE, IS, HCI)	Technologies and methods used in the development of web-based solutions. Frameworks, architectures, languages, formats and standards used in the development of web-applications and services.	7.5	<a href="http://www.ntnu.no/studier/emner/IT2810/">http://www.ntnu.no/studier/emner/IT2810/</a>
N-16	NTNU	Information Systems (TDT4175)	Software Engineering (SE, IS, HCI)	Taxonomies for various types of information systems. ERP systems, IS strategy, process improvement. Methods for IS development: analysis of organisations' needs, modelling of business processes (as-is and to-be situation), quality evaluation for models and systems.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4175/">http://www.ntnu.no/studier/emner/TDT4175/</a>
N-17	NTNU	Software Architecture (TDT4240)	Software Engineering (SE, IS, HCI)	Define and explain central concepts within software architecture. Design and architectural patterns. Methods to design software architectures, methods to achieve software qualities, methods to document software architectures, and methods to evaluate software architectures.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4240/">http://www.ntnu.no/studier/emner/TDT4240/</a>
N-18	NTNU	Empirical research methodologies in IT and digitalization (IT3010)	Software Engineering (SE, IS, HCI)	Empirical research methods in IT and digitalization. Approaches to empirical research, research design, data generation and analysis. Case studies, design science, surveys, and experiments. Research ethics and managing user data, writing and reviewing research articles, and doing peer reviews.	7.5	<a href="http://www.ntnu.no/studier/emner/IT3010/">http://www.ntnu.no/studier/emner/IT3010/</a>
N-19	NTNU	User Interface Design (IT3402)	Software Engineering (SE, IS, HCI)	Project-based teamwork. Iterative design/redesign of user interfaces with prototyping and usability testing with video.	7.5	<a href="http://www.ntnu.no/studier/emner/IT3402/">http://www.ntnu.no/studier/emner/IT3402/</a>
N-20	NTNU	Advanced Software Design (TDT4250)	Software Engineering (SE, IS, HCI)	Generic techniques for modeling, design and implementation of modular software, focussing on industrial techniques and domains. Component-based design, component-based architectures and frameworks, distributed component-based systems. Model-driven development of software, code generation and domain-specific languages. Testing, continuous integration, deployment and governance.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4250/">http://www.ntnu.no/studier/emner/TDT4250/</a>
N-21	NTNU	Enterprise Architecture for Enterprise Innovation (TDT4252)	Software Engineering (SE, IS, HCI)	The role of information systems in an organizational context. Digital ecosystems. The needs of organisations and users, the processes and the roles that the systems support in an organizational and work context. How IT can support innovation and new services design and bring value to an organization. Methods for business modelling, service design and enterprise modelling that are complementary to systems modelling. Methods related to modelling and quality assurance of models. Enterprise Architecture methods.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4252/">http://www.ntnu.no/studier/emner/TDT4252/</a>
N-22	NTNU	Applied Data Science (TDT4259)	Software Engineering (SE, IS, HCI)	Development of knowledge of, skills in and competence of the most used methods and technologies for mining, aggregating and analysing data. Use of methods readily available in commodified technologies in the form of open source.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4259/">http://www.ntnu.no/studier/emner/TDT4259/</a>

N-23	NTNU	Advanced Software Engineering (TDT4242)	Software Engineering (SE, IS, HCI)	Software engineering for smart, critical, and complex software-intensive systems. Requirements specifications methods to transit from user requirements to high-quality technical requirements. Testing management and testing strategies. Code quality and code analysis, code review, and code refactoring. Verification and validation of complex software systems.		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4242/">http://www.ntnu.no/studier/emner/TDT4242/</a>
N-24	NTNU	Digital Service Innovation (TDT4257)	Software Engineering (SE, IS, HCI)	Three aspects of digital service innovation: Service ecosystem (roles, business models, institutional setting), Service platform (technical platform, architecture, layered model), and Co-created value (for whom? Experienced value, situated value)		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4257/">http://www.ntnu.no/studier/emner/TDT4257/</a>
N-25	NTNU	Game+ (IT3021)	Software Engineering (SE, IS, HCI)	Gameflow, intrinsic motivation for learning, gamer types, the effect of using audio and points, various types of games+ (serious games), and existing game technologies. Practical introduction to the use of methods and techniques related to design, development and user testing of games+ (serious games) through a project.		7.5	<a href="http://www.ntnu.no/studier/emner/IT3021/">http://www.ntnu.no/studier/emner/IT3021/</a>
N-26	NTNU	Participatory design (IT3022)	Software Engineering (SE, IS, HCI)	Theoretical and practical knowledge on participatory design of digital technologies and related services. User empowerment in design of technology and services. Stakeholder analysis, co-design techniques (personas, scenarios, service blueprints, prototyping), facilitation of design activities, the role of the facilitator, qualitative analysis of results from participatory design activities, challenges related to participatory design and realization of results		7.5	<a href="http://www.ntnu.no/studier/emner/IT3022/">http://www.ntnu.no/studier/emner/IT3022/</a>
N-27	NTNU	Research Methods in Human-Computer Interaction (IT3024)	Software Engineering (SE, IS, HCI)	To read and write scientific papers in HCI. Research ethics in HCI. Experiments in HCI. Developing research questions in HCI. Analysis of quantitative and qualitative data in HCI. Validity. Theoretical frameworks for user experience. How to measure user experience. Important theoretical frameworks in HCI (Cognitive Psychology, Ecological Psychology (Gibson), Phenomenology, Interaction aesthetics. Theoretical and historical basis for critical design.		7.5	<a href="http://www.ntnu.no/studier/emner/IT3024/">http://www.ntnu.no/studier/emner/IT3024/</a>
N-28	NTNU	Cooperation Technology and Social Media (TDT4245)	Software Engineering (SE, IS, HCI)	Social media, Computer supported cooperative Work (CSCW), support for cooperation among mobile users, design and evaluation of cooperative technologies.		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4245/">http://www.ntnu.no/studier/emner/TDT4245/</a>
N-29	NTNU	Learning Technology and Analytics (IT3023)	Software Engineering (SE, IS, HCI)	Fundamental knowledge of learning systems and learning analytics. Design and development of contemporary learning systems. Assesses the effectiveness and efficiency of a learning technology.		7.5	<a href="http://www.ntnu.no/studier/emner/IT3023/">http://www.ntnu.no/studier/emner/IT3023/</a>

N-30	NTNU	Programming Languages (TDT4165)	Misc	Introduction to language paradigms, semantics and computational models. Language models supporting declarative, functional, logic, lazy, dataflowbased, object-oriented, distributed, constraint-based and parallel programming. Programming language syntax, interpretation and semantics.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4165/">http://www.ntnu.no/studier/emner/TDT4165/</a>
N-31	NTNU	Visual Computing Fundamentals (TDT4195)	Misc	Image synthesis (computer graphics). Image analysis (image processing). Graphics: graphical primitives, rasterization, anti-aliasing, clipping, geometric transformations, viewing transformations, hierarchical scene modelling, culling and hidden surface elimination, colour representation, illumination models and algorithms. C/C++ OpenGL labs. Image processing: introduction to and examples of image processing and simple image analysis applications. Intro to deep learning based image interpretation and understanding (fully-connected neural networks and CNNs). Filtering and image enhancement in both the spatial domain as well as in the frequency / Fourier domain. Various image segmentation methods and mathematical morphology.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4195/">http://www.ntnu.no/studier/emner/TDT4195/</a>
N-32	NTNU	Parallel Computing (TDT4200)	Misc	Optimizing algorithms for both single and multi-processors systems as well as accelerators such as GPUs. Choosing numerical algorithms, use of optimized libraries, compiler optimizations and program profiling. How to take advantage of PC-clusters and graphics cards for computationally large tasks which cannot be run on a single processor system. Parallel programming assignments.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4200/">http://www.ntnu.no/studier/emner/TDT4200/</a>
N-33	NTNU	Graphics and Visualization (TDT4230)	Misc	Geometric models and their simplification. Modeling with parametric curves and surfaces. Geometry culling. Illumination models and ambient occlusion in 3D and in screen space. Texture mapping. Ray tracing. Animation techniques. Shadow generation. Visualization principles. Visualization algorithms. Virtual and augmented reality.	7.5	<a href="http://www.ntnu.no/studier/emner/TDT4230/">http://www.ntnu.no/studier/emner/TDT4230/</a>



N-34	NTNU	Computer Vision and Deep Learning (TDT4265)	Misc	The human eye and the image formation process, filtering in the spatial and frequency domain, segmentation and mathematical morphology, Hierarchical Structures and Scale space, Principal Components Analysis (PCA), feature extraction (e.g. Harris, SIFT) and matching (e.g. RANSAC), unsupervised and supervised classification and recognition as well as various machine learning methods, stereo vision and essential & fundamental matrixes, optical flow, tracking (Kalman/Particle) and last but not least deep learning for vision, i.e. fully connected feedforward NNs (Shallow ANNs, forward pass, matrix-based notation and activation functions etc.), learning (cost functions, gradient descent and backpropagation etc.), generalization (overfitting, regularization, initialization, hyper-parameters, vanishing gradients / unstable gradients and deep NNs etc.), CNNs and Image Classification (different layers, especially the conv layer, learning features and sharing parameters, AlexNet and later versions etc.), object detection and semantic segmentation (R-CNN, Fast R-CNN, Faster R-CNN, R-FCN, YOLO / YOLO v2, SSD and Mask R-CNN etc.).		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4265/2020">http://www.ntnu.no/studier/emner/TDT4265/2020</a>
N-35	NTNU	Low-Level Programming (TDT4258)	Misc	Embedded system fundamentals, properties, and design flow. Embedded system hardware design: CPU, caches, memory, buses, input/output. Embedded system software design: low level programming in C and ARM assembly, resource constrained programming techniques, and tools for embedded programming. Introduction to compilation and code optimizations, operating system, embedded system design using ARM mbed platform, and power management in embedded systems		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4258/2020">http://www.ntnu.no/studier/emner/TDT4258/2020</a>
N-36	NTNU	Compiler Construction (TDT4205)	Misc	Techniques for the construction of compilers (programming language translators) and some insight in how to build systems software, more generally. Grammars, lexical and syntactic analysis, semantic analysis, optimizations, code generation, interpreters and abstract machines, linkers and run time systems.		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4205/2020">http://www.ntnu.no/studier/emner/TDT4205/2020</a>
N-37	NTNU	Algorithm Construction (TDT4125)	Misc	Advanced algorithmic techniques, e.g., for solving and handling especially hard (e.g., NP-complete) problems.		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4125/2020">http://www.ntnu.no/studier/emner/TDT4125/2020</a>
N-38	NTNU	Computer Design (TDT4255)	MSc	Advanced topics in processor microarchitecture. Detailed discussion and implementation of simple pipelined CPUs. Introduction to the design and analysis of Instruction Set Architectures (ISAs). In-depth review of out-of-order execution, branch prediction, speculative execution, and performance modeling. Introduction to memory system design and computer arithmetic.		7.5	<a href="http://www.ntnu.no/studier/emner/TDT4255/2020">http://www.ntnu.no/studier/emner/TDT4255/2020</a>

W-1	WUT	Knowledge representation and reasoning 1120-INSZI-MSA-0012	Artificial Intelligence/Data Science	Automated theorem proving in classical logic. Non-classical logics in Artificial Intelligence: modal logics and epistemic logics, agent-oriented logics. Representation and reasoning about actions and time, models of dynamic systems, action languages and query languages. Reasoning methods in multi-agent systems. Non-monotonicity, default and abductive reasoning.	English	5	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/876001">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/876001</a>
W-2	WUT	Neural networks 1120-INSZI-MSA-0013	Artificial Intelligence/Data Science	artificial neural networks, neuro-physiological background, introduced models of and artificial neuron, neural network models, Hopfield, Grossberg, Hamming, Kohonen, Eldman, MLP, pattern recognition, data classification, solving combinatorial optimization problems, implementation of logic operations, time series prediction, game playing, pattern recognition, data classification problems	English	5	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/876002">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/876002</a>
W-3	WUT	Image and speech recognition 1120-INSZI-MSA-0116	Artificial Intelligence/Data Science	pattern (image or speech) processing, pattern segmentation and object (or spoken word) recognition, basic feature space transformations PCA, LDA and ICA, pattern clustering approaches (k-means, X-means, EM), classifier types (potential function based, SVM, the Bayes classifier, k-NN, MLP, mixture of experts and boosting), viewing geometry, camera calibration, color spaces and image compression, image binarization, normalization and filtering. Among image segmentation methods we introduce algorithms for edge following and line segment detection, Hough transforms, homogeneous region detection, texture- and shape description	English	5	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/875999">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/875999</a>
W-4	WUT	Programming in logic and symbolic programming 1120-INSZI-MSA-0117	Artificial Intelligence/Data Science	Basic knowledge on programming in Lisp. Introduction to symbolic programs. Logic in Prolog. Automated reasoning. Data bases in Prolog. Simple expert systems	English	4	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/876000">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/876000</a>
W-5	WUT	Data compression 1120-INSZI-MSA-0113	Artificial Intelligence/Data Science	Lossless and lossy compression. Memoryless codes – prefix sets, Kraft vectors, Kraft's inequality. Compact codes, Huffman codes (design, optimality). information theory – entropy (definition, properties, axiomatic definition), entropy bounds for Huffman codes. Codes with memory - block prefix codes, finite memory codes, finite-state codes. Arithmetic coding. Dictionary techniques – Lempel-Ziv codes. Lossy coding . Scalar quantization – uniform quantization, adaptive quantization (Jayant quatizer), non uniform quantization, image compression. Vector quantization. Fractal - based image compression	English	3	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/890214">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/890214</a>
W-6	WUT	Advanced Machine Learning 1120-DS000-MSA-0121	Artificial Intelligence/Data Science		English	6	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882910">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882910</a>

W-7	WUT	Optimisation in Data Analysis 1120-DS000-MSA-0125	Artificial Intelligence/Data Science	<p>numerical methods for unconstrained optimization, Gauss-Newton and Levenberg-Marquardt methods.</p> <p>Nonlinear least squares methods.</p> <p>Incremental gradient methods.</p> <p>Kalman filter.</p> <p>Optimality conditions in constrained optimization.</p> <p>Convex programming and duality.</p> <p>Interior point methods in cone programming.</p> <p>Introduction to mixed integer optimization methods.</p> <p>SVM.</p> <p>Linear regression models based on LASSO approach.</p> <p>Subgradient proximal methods.</p> <p>Optimization methods with stochastic gradients.</p> <p>Parallel and distributed optimization methods.</p>	English	6	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882909">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882909</a>
W-8	WUT	Deep Learning 1120-DS000-MSA-0124	Artificial Intelligence/Data Science	<p>artificial neural networks, gradient-based learning, transfer functions, deep learning strategies (error functions, training set size, mini-batch size, vanishing gradient, pre-training, post-tuning, ReLU units, regularization, dropout), deep unsupervised learning, convolutional neural networks, deep recurrent networks (LSTM), generative models (GAN, VAE, DBM)</p>	English	5	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882911">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882911</a>
W-9	WUT	Data Exploration and Visualisation 1120-DS000-MSA-0123	Artificial Intelligence/Data Science	<p>One-dimensional and Two-dimensional data exploration techniques,</p> <p>data exploration techniques, dimension reduction techniques in data exploration, visualization of single variable distribution, visualization of variable pair distribution, visualization of the distribution of relationships between variable sets</p>	English	4	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882914">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882914</a>
W-10	WUT	Natural Language Processing 1120-DS000-MSA-0234	Artificial Intelligence/Data Science	<p>information theory, NLP / text mining methods, statistics, linguistics, issues in the text processing process: lemmatization, stemming, text corpora, Models of text representation, incl. vector models, Grammar analysis (POS tagging, parsing), information extraction, NER (named-entity recognition), relationship extraction, information semantics, Information search: inverted index, similarity measures, result ranking, link analysis (PageRank, HITS), commercial system architectures, measuring the quality of returned results, visualization of search results, architecture of commercial information search systems / knowledge bases</p>	English	6	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/884975">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/884975</a>

W-11	WUT	Social Networks and Recommendation Systems 1120-DS000-MSA-0235	Artificial Intelligence/Data Science	<p>Databases of networks. Real networks and their analysis.</p> <p>Historical overview of the complex network science.</p> <p>Graph visualization algorithms.</p> <p>Network's metrics overview.</p> <p>Random graphs, Erdosa-Renyi model.</p> <p>Barabasi-Albert model.</p> <p>Percolations and network's vulnerability to attacks and failures.</p> <p>Properties of the real-world networks.</p> <p>Community detection algorithms.</p> <p>Hierarchical, layer and temporal networks.</p> <p>Agent-based modeling, random walks and other dynamics on networks.</p> <p>Recommendation systems.</p>	English	5	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/884976">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/884976</a>
W-12	WUT	Big Data Analytics 1120-DS000-MSA-0231	Artificial Intelligence/Data Science	<p>Key aspects of Big Data storage and their relationship to data analysis methods.</p> <p>Architecture of Big Data systems and the role of data analysis and hardware implementation in these systems.</p> <p>Selected large-scale data analysis frameworks.</p> <p>Processing Big Data in batch and stream mode.</p> <p>Selected issues of data pre-processing.</p> <p>Machine learning and batch processing vs. data stream processing.</p> <p>Advanced issues of machine learning and stream mining.</p> <p>Selected non-technical aspects of data analysis</p>	English	4	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/884974">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/884974</a>
W-13	WUT	Advanced algorithms 1120-INSZI-MSA-0112	Software engineering	<p>greedy algorithms, Huffman codes, matroids, dynamic programming, longest common subsequence problem, recursion elimination, divide and conquer algorithms, running time estimation, integer multiplication, matrix multiplication, algorithms of computational geometry, finding the closest pair of points, convex hull construction, advanced string matching algorithms, approximation algorithms, approximate scheduling, approximate packing, approximate covering.</p>	English	4	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/875989">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/875989</a>
W-14	WUT	IT projects management 1120-IN000-MSA-0112	Software engineering	<p>IT projects. Stakeholders.</p> <p>Preparation of project card. Scope of the project.</p> <p>Decomposition of the scope of the project. Project schedule – suggested methods/techniques.</p> <p>Controlling progress and budget. Risks management and communication.</p> <p>Ethical aspects of work of project manager.</p> <p>Procurement management. Competition among providers and offer selection. Negotiation and selling of IT project: internal and external customers.</p> <p>IT system support: ITIL.</p> <p>Overview of different methodologies in practice (PMBOK, PRINCE2, ITIL, IBM RUP, Scrum).</p> <p>Organization maturity based on CMMI standards</p>	English	4	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/875995">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/875995</a>

W-15	WUT	Cloud Computing 1120-DS000-MSA-0122	Software engineering	<p>Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) models</p> <p>Basic components and default architectures of cloud solutions</p> <p>Benefits of cloud computing, the impact of architecture design choices on Total Cost of Ownership (TCO)</p> <p>Security and access controls in the cloud</p> <p>Solution scaling and load balancing</p> <p>Migration of traditional on premises solutions to cloud environment</p> <p>High availability of cloud environment</p> <p>Automatic deployment of cloud solutions and configurations</p> <p>Big Data processing in the cloud</p> <p>Best practices and design patterns for cloud solutions</p>	English	5	<a href="https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882912">https://ects.coi.pw.edu.pl/menu3/view2/idPrzedmiot/882912</a>
W-16	WUT	Distributed Computing and Systems (103A-CSCSN-MSA-EDCS)	Software engineering	<p>communication, collaboration and synchronization</p> <p>problems of distributed systems, transactions, distributed memory, replication, clusters, catalog services and web services</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EDCS&amp;callback=g_8dc954f0">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EDCS&amp;callback=g_8dc954f0</a>
W-17	WUT	Parallel Numerical Methods (103A-CSCSN-MSA-EPNM)	Software engineering	<p>linear algebra methods (finite and iterative), contraction mappings, unconstrained optimization methods (gradient, Newton and quasi_newton methods) and constrained optimization methods (decomposition methods), global optimization methods (clustering and genetic algorithms) and algorithms for finding association mining rules in large data bases</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EPNM&amp;callback=g_73347fdb">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EPNM&amp;callback=g_73347fdb</a>
W-18	WUT	Cryptography and Data Security (103A-CSCSN-ISA-ECRYP)	Security	<p>ciphers, cryptographic protocols, private and public key cryptography, digital signatures, hash functions</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-ISA-ECRYP">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-ISA-ECRYP</a>
W-19	WUT	Data Mining (103B-CSCSN-MSA-EDAMI)	Artificial Intelligence and Robotics	<p>frequent patterns and association rules, sequential patterns and sequential rules, contrast patterns, (rough set) decision rules, similarity and distance measures of objects, clustering, classification</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103B-CSCSN-MSA-EDAMI&amp;callback=g_8dc954f0">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103B-CSCSN-MSA-EDAMI&amp;callback=g_8dc954f0</a>
W-20	WUT	Evolutionary Algorithms (103A-CSCSN-MSA-EEVAL)	Artificial Intelligence and Robotics	<p>importance of the model, the representation, the objective and the evaluation function, modern heuristic methods, for global search, simulated annealing, tabu search, controlled random search</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EEVAL&amp;callback=g_8dc954f0">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EEVAL&amp;callback=g_8dc954f0</a>
W-21	WUT	Image and Speech Recognition (103A-CTCSN-MSA-EIASR)	Artificial Intelligence and Robotics	<p>image compression and segmentation, image classification, object recognition and motion detection in image sequences, speech signal representation and segmentation, phoneme-based classification and isolated word recognition</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTCSN-MSA-EIASR&amp;callback=g_8dc954f0">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTCSN-MSA-EIASR&amp;callback=g_8dc954f0</a>
W-22	WUT	Intelligent Information Systems (103A-CSCSN-MSA-EINIS)	Artificial Intelligence and Robotics	<p>Basic Notions (data, information, knowledge, information systems), Information System Ontology, What's Intelligence, Knowledge and Knowledge Representation, Knowledge Discovery and Data Mining</p>	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EINIS&amp;callback=g_8dc954f0">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EINIS&amp;callback=g_8dc954f0</a>

W-23	WUT	Pattern Recognition (103C-CSCSN-MSA-EPART)	Artificial Intelligence and Robotics	data acquisition and preprocessing, feature vector, grouping, direct classification, PCA and LDA analysis, Bayesian classification, Support Vector Machines, neural networks classification, syntactic methods	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103C-CSCSN-MSA-EPART&amp;callback=g_73347fdb">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103C-CSCSN-MSA-EPART&amp;callback=g_73347fdb</a>
W-24	WUT	Systems for Internet of Things (103A-CSCSN-MSA-ESIT)	Artificial Intelligence and Robotics	hardware, software, communication and computing systems to create components of measurement networks, hardware platforms, software frameworks, real time operating systems, debugging in real time, communication protocols, security issues, cloud computing, all these in the context of IoT	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-ESIT&amp;callback=g_73347fdb">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-ESIT&amp;callback=g_73347fdb</a>
W-25	WUT	Adaptive Image Recognition (103A-TCTCM-MSA-EADIR)	Artificial Intelligence and Robotics	adaptive image processing, image analysis, pattern recognition, image object detection, classification, and indexing	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-TCTCM-MSA-EADIR&amp;callback=g_2caaf0db">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-TCTCM-MSA-EADIR&amp;callback=g_2caaf0db</a>
W-26	WUT	Digital Signal Processor Architecture and Programming (103A-CSCSN-MSA-EDSPA)	Misc	digital signal processor (DSP) architecture and applications, DSP programming techniques, real time operating systems	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EDSPA&amp;callback=g_8dc954f0">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-MSA-EDSPA&amp;callback=g_8dc954f0</a>
W-27	WUT	Methodological and Ethical Aspects of Research (103A-xxxx-MSA-EMAR)	Misc	methodological and ethical, the philosophy of science, research ethics, and the methodology for resolving methodological and ethical dilemmas related to research activities problems related to research practice	English	3	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-xxxx-MSA-EMAR&amp;callback=g_6095b480">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-xxxx-MSA-EMAR&amp;callback=g_6095b480</a>
W-28	WUT	Professional Communication for Engineers (103A-xxxx-MSA-EPROC)	Misc	communication process in modern organizations and contemporary society, common patterns of communication at the workplace	English	3	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-xxxx-MSA-EPROC&amp;callback=g_6095b480">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-xxxx-MSA-EPROC&amp;callback=g_6095b480</a>
W-29	WUT	Queueing Theory (103A-CTTCM-MSA-EQUTH)	Misc	queueing theory, modeling and analysis of telecommunication systems, probabilistic modeling, Markovian processes, queueing systems	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTTCM-MSA-EQUTH&amp;callback=g_5737dbd5">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTTCM-MSA-EQUTH&amp;callback=g_5737dbd5</a>
W-30	WUT	Computer Architecture (103A-CTxxx-ISA-ECOAR)	Misc	structural and logical concepts of contemporary computers, definitions and taxonomies of computer architectures, application programming model, structure of execution unit and memory hierarchy, system topics - principles and implementation of resource protection and management and basic information on the structure of contemporary computers.	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTxxx-ISA-ECOAR&amp;callback=g_fc05d45f">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTxxx-ISA-ECOAR&amp;callback=g_fc05d45f</a>
W-31	WUT	Computer Graphics (103A-CSCSN-ISA-ECOGR)	Misc	presenting images on raster devices, image rendering algorithms, 2D and 3D viewing, transformations, stereovision, colorimetry, rendering colour images	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-ISA-ECOGR&amp;callback=g_393f494a">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-ISA-ECOGR&amp;callback=g_393f494a</a>
W-32	WUT	Computer Networks (103B-CTxxx-ISA-ECONE)	Misc	7 layered OSI ISO model, TCP/IP network model, TCP/IP, BSD socket interface, Ethernet networks, hosts, switches, bridges and routers, virtual local networks and virtual private networks	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103B-CTxxx-ISA-ECONE&amp;callback=g_fc05d45f">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103B-CTxxx-ISA-ECONE&amp;callback=g_fc05d45f</a>
W-33	WUT	Data Bases (103A-CSCSN-ISA-EDABA)	Misc	database management systems (DBMS), DDL and DML language constructions, relational databases, relational query languages	English	6	<a href="https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-ISA-EDABA&amp;callback=g_fc05d45f">https://usoweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CSCSN-ISA-EDABA&amp;callback=g_fc05d45f</a>

W-34	WUT	Operating Systems (103B-CSCSN-ISA-EOPSY)	Misc	processes, threads, interprocess communication, scheduling, memory management, swapping, virtual memory, page replacement algorithms, segmentation, I/O hardware, and software, files, directories, the security environment, introduction to cryptography, user authentication, protection mechanisms, trusted systems	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103B-CSCSN-ISA-EOPSY&amp;callback=g_7de6eb25">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103B-CSCSN-ISA-EOPSY&amp;callback=g_7de6eb25</a>
W-35	WUT	Discrete Random Processes (103A-CTxxx-MSA-EDRP)	Misc	stochastic processes, branching processes, Poisson processes and their applications, simple queuing systems, renewal processes	English	6	<a href="https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTxxx-MSA-EDRP&amp;callback=g_dc433fc1">https://usosweb.usos.pw.edu.pl/kontroler.php?action=katalog2/przedmioty/pokazPrzedmiot&amp;prz_kod=103A-CTxxx-MSA-EDRP&amp;callback=g_dc433fc1</a>
C-1	Chalmers	DAT231 - Requirements engineering	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30819">https://www.student.chalmers.se/sp/course?course_id=30819</a>
C-2	Chalmers	DAT321 - Software quality	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30707">https://www.student.chalmers.se/sp/course?course_id=30707</a>
C-3	Chalmers	TDA384 - Principles of Concurrent Programming	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31242">https://www.student.chalmers.se/sp/course?course_id=31242</a>
C-4	Chalmers	TDA497 - Interaction design methodology	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30672">https://www.student.chalmers.se/sp/course?course_id=30672</a>
C-5	Chalmers	DAT246 - Empirical software engineering	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30458">https://www.student.chalmers.se/sp/course?course_id=30458</a>
C-6	Chalmers	DAT220 - Advanced software architecture	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31307">https://www.student.chalmers.se/sp/course?course_id=31307</a>
C-7	Chalmers	DAT240 - Software language engineering for domain-specific languages	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30131">https://www.student.chalmers.se/sp/course?course_id=30131</a>
C-8	Chalmers	DAT262 - Model-based testing	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31017">https://www.student.chalmers.se/sp/course?course_id=31017</a>
C-9	Chalmers	DAT280 - Parallel functional programming	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31271">https://www.student.chalmers.se/sp/course?course_id=31271</a>
C-10	Chalmers	EDA397 - Agile development processes	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31188">https://www.student.chalmers.se/sp/course?course_id=31188</a>
C-11	Chalmers	DAT265 - Software evolution project	SE		English	15	<a href="https://www.student.chalmers.se/sp/course?course_id=30660">https://www.student.chalmers.se/sp/course?course_id=30660</a>
C-12	Chalmers	TDA294 - Formal Methods in Software Development	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30878">https://www.student.chalmers.se/sp/course?course_id=30878</a>
C-13	Chalmers	TIN093 - Algorithms	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30820">https://www.student.chalmers.se/sp/course?course_id=30820</a>
C-14	Chalmers	TDA251 - Algorithms, advanced course	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30145">https://www.student.chalmers.se/sp/course?course_id=30145</a>
C-15	Chalmers	TDA594 - Software engineering principles for complex systems	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31202">https://www.student.chalmers.se/sp/course?course_id=31202</a>
C-16	Chalmers	TDA342 - Advanced functional programming	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30927">https://www.student.chalmers.se/sp/course?course_id=30927</a>
C-17	Chalmers	DAT151 - Programming language technology	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31181">https://www.student.chalmers.se/sp/course?course_id=31181</a>
C-18	Chalmers	TDA362 - Computer graphics	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30306">https://www.student.chalmers.se/sp/course?course_id=30306</a>
C-19	Chalmers	DAT278 - Sustainable computing	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31197">https://www.student.chalmers.se/sp/course?course_id=31197</a>
C-20	Chalmers	DAT415 – Computability	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30634">https://www.student.chalmers.se/sp/course?course_id=30634</a>
C-21	Chalmers	TDA452 - Functional programming	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30443">https://www.student.chalmers.se/sp/course?course_id=30443</a>
C-22	Chalmers	TDA206 - Discrete optimization	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30665">https://www.student.chalmers.se/sp/course?course_id=30665</a>

C-23	Chalmers	TME285 - Intelligent agents	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30731">https://www.student.chalmers.se/sp/course?course_id=30731</a>
C-24	Chalmers	TDA283 - Compiler construction	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31157">https://www.student.chalmers.se/sp/course?course_id=31157</a>
C-25	Chalmers	DAT350 - Types for programs and proofs	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30280">https://www.student.chalmers.se/sp/course?course_id=30280</a>
C-26	Chalmers	DAT060 - Logic in computer science	SE		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31353">https://www.student.chalmers.se/sp/course?course_id=31353</a>
C-27	Chalmers	EDA263 - Computer security	Security	introduction, definitions, terminology, unix security, authentication, access control, malware, viruses, worms, buffer overflows, security mechanisms, intrusion detection systems, security models, BLP, Biba, Chinese wall, database security, ethics, security metrics, firewalls, secure operating systems	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32617&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32617&amp;parsergrp=3</a>
C-28	Chalmers	EDA491 - Network security	Security	network attacks, encryption, random number generation, analysis of weaknesses of TCP, etc, DoS, Access control, authentication, radius, AAA, PKI, key distribution, Kerberos, identity mangament, certificates, security protocols, security in wireless networks, network design, firewalls, NAT, ingress, egress, VPN, VLAN	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=31687&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=31687&amp;parsergrp=3</a>
C-29	Chalmers	TDA602 - Language-based security	Security		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30421">https://www.student.chalmers.se/sp/course?course_id=30421</a>
C-30	Chalmers	TDA352 – Cryptography	Security	CIA, symmetric key, block ciphers, stream ciphers, modes of operation, MAC, public key, asymmetric, signatures, attack models, protocols	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32581&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32581&amp;parsergrp=3</a>
C-31	Chalmers	TDA596 - Distributed Systems	Distributed Systems	distributed systems, naming, mutual exclusion, election, clocks, time, consistency, replication, fault tolerance, selected applications	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=31654&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=31654&amp;parsergrp=3</a>
C-32	Chalmers	DAT405 - Introduction to data science and AI	AI/DSc/ML	introduction, statistical methods and AI, stochastic models, naive Bayes, HMM, machine learning, neural networks	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32800&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32800&amp;parsergrp=3</a>
C-33	Chalmers	DAT410 - Design of AI systems	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30554">https://www.student.chalmers.se/sp/course?course_id=30554</a>
C-34	Chalmers	DAT340 - Applied Machine Learning	AI/DSc/ML	supervised learning, regression, classification, neural networks, clustering, nlp, image processing, bioinformatics, ecommerce	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32450&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32450&amp;parsergrp=3</a>
C-35	Chalmers	DAT440 - Advanced topics in machine learning	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31473">https://www.student.chalmers.se/sp/course?course_id=31473</a>
C-36	Chalmers	SSY340 - Deep machine learning	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30309">https://www.student.chalmers.se/sp/course?course_id=30309</a>
C-37	Chalmers	FFR135 - Artificial neural networks	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30959">https://www.student.chalmers.se/sp/course?course_id=30959</a>
C-38	Chalmers	DAT346 - Techniques for large-scale data	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31314">https://www.student.chalmers.se/sp/course?course_id=31314</a>
C-39	Chalmers	MVE441 - Statistical learning for big data	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31513">https://www.student.chalmers.se/sp/course?course_id=31513</a>
C-40	Chalmers	MVE187 - Computational methods for Bayesian statistics	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30308">https://www.student.chalmers.se/sp/course?course_id=30308</a>
C-41	Chalmers	MVE550 - Stochastic processes and Bayesian inference	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31015">https://www.student.chalmers.se/sp/course?course_id=31015</a>
C-42	Chalmers	RRY025 - Image processing	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31120">https://www.student.chalmers.se/sp/course?course_id=31120</a>
C-43	Chalmers	TMS016 - Spatial statistics and image analysis	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31312">https://www.student.chalmers.se/sp/course?course_id=31312</a>



C-44	Chalmers	SSY130 - Applied signal processing	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30537">https://www.student.chalmers.se/sp/course?course_id=30537</a>
C-45	Chalmers	TMA881 - High performance computing	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30831">https://www.student.chalmers.se/sp/course?course_id=30831</a>
C-46	Chalmers	TIN093 – Algorithms	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30820">https://www.student.chalmers.se/sp/course?course_id=30820</a>
C-47	Chalmers	TDA251 - Algorithms, advanced course	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30145">https://www.student.chalmers.se/sp/course?course_id=30145</a>
C-48	Chalmers	TDA233 - Algorithms for machine learning and inference	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31448">https://www.student.chalmers.se/sp/course?course_id=31448</a>
C-49	Chalmers	DAT450 - Machine learning for natural language processing	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31525">https://www.student.chalmers.se/sp/course?course_id=31525</a>
C-50	Chalmers	EEN020 - Computer vision	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31369">https://www.student.chalmers.se/sp/course?course_id=31369</a>
C-51	Chalmers	MVE172 - Basic stochastic processes and financial applications	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31443">https://www.student.chalmers.se/sp/course?course_id=31443</a>
C-52	Chalmers	TMS088 - Financial time series	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31392">https://www.student.chalmers.se/sp/course?course_id=31392</a>
C-53	Chalmers	TDA357 – Databases	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31151">https://www.student.chalmers.se/sp/course?course_id=31151</a>
C-54	Chalmers	TDA507 - Computational methods in bioinformatics	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30834">https://www.student.chalmers.se/sp/course?course_id=30834</a>
C-55	Chalmers	TMA521 - Large scale optimization	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=31040">https://www.student.chalmers.se/sp/course?course_id=31040</a>
C-56	Chalmers	TIF150 - Information theory for complex systems	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30136">https://www.student.chalmers.se/sp/course?course_id=30136</a>
C-57	Chalmers	MVE165 - Linear and integer optimization with applications	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30256">https://www.student.chalmers.se/sp/course?course_id=30256</a>
C-58	Chalmers	TME290 - Autonomous robots	AI/DSc/ML		English	7.5	<a href="https://www.student.chalmers.se/sp/course?course_id=30523">https://www.student.chalmers.se/sp/course?course_id=30523</a>
C-59	Chalmers	TDA297 - Distributed Systems, advanced course	Distributed Systems	replication, concurrency control, recovery, fault tolerance, multicast, distributed algorithms, sensors networks, denial of service attacks	English	7.5	<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=31795&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=31795&amp;parsergrp=3</a>
R-1	RWTH Aachen, CS Department	1222882 - Model-Based Systems Engineering	Software Engineering	Models, SysML, UML, class diagrams, statecharts, sequence diagrams , agility, testing, methods	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/1178267/254?Scx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/1178267/254?Scx=design=ca;lang=en</a>
R-2	RWTH Aachen, CS Department	1216957 - Software Language Engineering	Software Engineering	Models, modelling, modelling language, MontiCore, semantics code generation, transformation, synthesis	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339446/254?Scx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339446/254?Scx=design=ca;lang=en</a>
R-3	RWTH Aachen, CS Department	1212349 - Communication Systems Engineering	Software Engineering	Network programming, TCP extensions QUIC, protocol building blocks, kernel, testing, discrete event simulation, active and passive measurements	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336073/254?Scx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336073/254?Scx=design=ca;lang=en</a>
R-4	RWTH Aachen, CS Department	1212666 - Formal Methods for Logic Control Software	Software Engineering	Static analysis, Abstract Interpretation, Specification and Model Checking, Logical Characterisation and Symbolic Reasoning	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/371032/254?Scx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/371032/254?Scx=design=ca;lang=en</a>
R-5	RWTH Aachen, CS Department	1212353 - Functional Safety and System Dependability	Software Engineering	Design and analysis methods supporting the dependability and safety of embedded systems, Dependability/safety modelling, measures and analyses, Software faults, software failure, Mechanisms of HW/SW fault tolerance, Risk analysis, risk acceptance criteria, Safety norms	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339415/254?Scx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339415/254?Scx=design=ca;lang=en</a>

R-6	RWTH Aachen, CS Department	1220524 - Microcontroller Programming and Debugging	Software Engineering	Compiler tool-chain, assembler and the programming language C, Embedded software architectures, Coding guidelines and Formal methods, Modell-based software development, Advanced languages for embedded programming, Debugging,	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/777490/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/777490/254?ScTx=design=ca;lang=en</a>
R-7	RWTH Aachen, CS Department	1215690 - Embedded Systems	Software Engineering	Microcontrollers, Programmable logic controllers (PLCs) & their programming languages, Data buses, Real-time requirements & operating systems, Model-based development & Simulink, Characteristics of embedded software design	German (but English recording available; excises and exam can be done in English)	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336081/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336081/254?ScTx=design=ca;lang=en</a>
R-8	RWTH Aachen, CS Department	1212643 - Theory of Distributed and Parallel Systems	Software Engineering (Theory)	Parallel coloring, edge coloring, selection, merging, sorting. Algorithm of Cole, P-completeness, lower bounds. Distributed routing, finger tables, broadcast and gossip	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339250/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339250/254?ScTx=design=ca;lang=en</a>
R-9	RWTH Aachen, CS Department	1212328 - Introduction to Model Checking	Software Engineering (Theory)	Transition Systems, Safety and Liveness, Fairness, Linear Temporal Logic, Computation Tree Logic, Bisimulation, Partial-Order Reduction, Binary Decision Diagrams, Bounded Model Checking	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295245/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295245/254?ScTx=design=ca;lang=en</a>
R-10	RWTH Aachen, CS Department	1212646 - Concurrency Theory	Software Engineering (Theory)	CCS, Interleaving Semantics, Hennessy-Milner Logic, Trace Equivalence, Bisimulation, Refinement and Compositionality, Petri Nets, True Concurrency Semantics, Branching Processes, Net Unfoldings, Comparative Semantics	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339199/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339199/254?ScTx=design=ca;lang=en</a>
R-11	RWTH Aachen, CS Department	1212650 - Probabilistic Programming	Software Engineering (Theory)	Probabilistic Guarded Commands, Formal Semantics, Markov Chains, Bayesian Networks, Conditioning, Probabilistic Weakest Preconditions, Probabilistic Loop Invariants, Termination and Runtime Analysis	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339237/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339237/254?ScTx=design=ca;lang=en</a>
R-12	RWTH Aachen, CS Department	1212330 - Static Program Analysis	Software Engineering (Theory)	Dataflow Analysis, Fixpoint Solution, MOP Solution, Bytecode Verification, Abstract Interpretation, Galois Connections, Predicate Abstraction, Abstraction Refinement, Interprocedural Analysis	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295017/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295017/254?ScTx=design=ca;lang=en</a>
R-13	RWTH Aachen, CS Department	1212329 - Semantics and Verification of Software	Software Engineering (Theory)	Operational/Denotational/Axiomatic Semantics, Fixpoint Theory, Hoare Logic, Soundness, Relative Completeness, Compiler Correctness	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339193/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339193/254?ScTx=design=ca;lang=en</a>
R-14	RWTH Aachen, CS Department	1212339 - Modeling and analysis of hybrid systems	Software Engineering (Theory)	Hybrid systems, Formal methods, Modeling, Verification, Algorithmic analysis, Reachability analysis, Timed automata, Hybrid automata	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/292003/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/292003/254?ScTx=design=ca;lang=en</a>
R-15	RWTH Aachen, CS Department	1211393 - The Logic of Knowledge Bases	Artificial Intelligence	Modal logic, epistemic states, representations of knowledge, only-knowing, default reasoning, knowing about, tractable reasoning, knowledge and action	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339916/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339916/254?ScTx=design=ca;lang=en</a>
R-16	RWTH Aachen, CS Department	1212361 - Introduction to Knowledge Representation	Artificial Intelligence	First-order logic, resolution, Horn logic, procedural representations, answer set programming, production systems, description logics, defaults, abduction, action and change, planning, expressiveness vs. tractability	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336157/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336157/254?ScTx=design=ca;lang=en</a>

R-17	RWTH Aachen, CS Department	1215750 - Automatic Speech Recognition	Artificial Intelligence	automatic speech recognition, time alignment, isolated word recognition, connected speech recognition, large vocabulary continuous speech recognition, sequence classification, statistical sequence modeling, machine learning, dynamic programming, beam search, digital signal processing, speech signal analysis	English	8	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336008/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336008/254?ScTx=design=ca;lang=en</a>
R-18	RWTH Aachen, CS Department	1211901 - IT-Security 1 - Network Security	Security	Cryptographic basics: Symmetric Encryption, Integrity protection, Asymmetric Encryption, Digital Signatures, Certificates and Public Key Infrastructures, Authentication and Key Agreement. Network Security: Kerberos, IPsec, TLS protocol, SSH, DNS Security, Email Security, Phishing Attacks.	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340003/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340003/254?ScTx=design=ca;lang=en</a>
R-19	RWTH Aachen, CS Department	1212358 - Algorithmic Cryptography	Security	DES, AES, public key, rabin, rsa, el-gamal, elliptic curves, ZKP, sharing secrets, electroinc elections, bit-coins, electroinc money, and more protocols	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339881/253?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339881/253?ScTx=design=ca;lang=en</a>
R-20	RWTH Aachen, CS Department	1212677 - Privacy Enhancing Technologies for Data Science	Security	Privacy, Security, Privacy Enhancing Technologies (PET), Anonymisation / Anonymization, Secure Multi-Party computation, Multi-Party computation, Differential Privacy, Privacy by Design, Privacy Engineering, Homomorphic Encryption, Threat Modeling	English	4	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340053/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340053/254?ScTx=design=ca;lang=en</a>
R-21	RWTH Aachen, CS Department	1212327 - Algorithmic Graph Theory	Other	Intersection graphs, perfect graphs, chordal graphs, bandwidth, path width, tree width, broadcast and gossip	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339152/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339152/254?ScTx=design=ca;lang=en</a>
R-22	RWTH Aachen, CS Department	1212645 - Online Algorithms	Other	Sky rental, file allocation, paging, k-server, coloring, rucksack problem, Yao's principle, randomized online algorithms and online algorithm with advice. Lower bounds.	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295091/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295091/254?ScTx=design=ca;lang=en</a>
R-23	RWTH Aachen, CS Department	1215688 - Advanced Internet Technology	Other	P2P concepts, Chord, Cloud Computing, Cassandra, Map/Reduce, privacy in cloud computing, sensors, routing in sensor networks, 6LoWPAN, IoT security, SDN, QoS concepts	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336066/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336066/254?ScTx=design=ca;lang=en</a>
R-24	RWTH Aachen, CS Department	1212346 - Mobile Internet Technology	Other	Signal propagation in wireless networks, modulation, convolutional coding, MAC approaches, hidden station problem, Wi-Fi, xG networks, routing in ad-hoc and mesh networks, Mobile IP, Host identity Protocol	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295023/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295023/254?ScTx=design=ca;lang=en</a>
R-25	RWTH Aachen, CS Department	1212678 - Social Computing	Other	social computing infrastructures, social computing engineering processes, computational social science, in particular recommender systems and community detection, crowdsourcing, collective intelligence, the dark web, mixed reality, mobile social computing, science 2.0	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295071/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295071/254?ScTx=design=ca;lang=en</a>
R-26	RWTH Aachen, CS Department	1212675 - Semantic Web	Other	History of the Web and Semantic Web; RDF syntax and data model; RDF Schema and formal semantics of RDF(S); Ontologies in OWL and formal semantics of OWL; RDF databases, triple and knowledge stores, query languages; Linked Data Web and Semantic Web applications.	English	4	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339912/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339912/254?ScTx=design=ca;lang=en</a>

R-27	RWTH Aachen, CS Department	1212359 - Web Science	Other	algorithms for web page ranking (like PageRank , HITS, s community detection algorithms), like cloud computing, peer-to-peer, XMPP and WebRTC, Web Services, RESTful implementation	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339902/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339902/254?Sc tx=design=ca;lang=en</a>
R-28	RWTH Aachen, CS Department	1211903 - Introduction to Bioinformatics	Other	Genome and Sequences (DNA sequences, Algorithms for sequence comparison, Sequence databases, Patterns and motifs, Phylogenetic trees); Proteins and Structures (3D modelling, Protein databases, Protein structure analysis and prediction); Protein Expression and Function (DNA chip technology, Gene expression analysis, Clustering, Proteomics); Pathways and Systems (Metabolic networks, Pathway analysis, Cell simulation).	English	4	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340043/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340043/254?Sc tx=design=ca;lang=en</a>
R-29	RWTH Aachen, CS Department	1215691 - CSCW and groupware: concepts and systems for computer supported cooperative work	Other	shared workspaces, structured communication, speech act theory, workflow modelling, video conferencing and media spaces, synchronous applications and consistency, blockchain concepts, architectures, consensus methods, smart contracts, applications, Decentralized identities and verifiable credentials	English	4	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339887/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/339887/254?Sc tx=design=ca;lang=en</a>
R-30	RWTH Aachen, CS Department	1211902 - Process Management	Other	Process management requirements and concepts, New ways of working and business collaboration, Distributed Ledger Technology as enabler for flexible businesses, Modelling languages and patterns, Process execution, Smart contracts for process automation, Maturity models	English	4	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295125/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295125/254?Sc tx=design=ca;lang=en</a>
R-31	RWTH Aachen, CS Department	1212331 - Complexity Theory	Other	deterministic, nondeterministic, probabilistic, and parallel computation models; space complexity; alternation; hierarchy theorems; randomized computation; interactive proofs; probabilistically checkable proofs; fine-grained complexity	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336042/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336042/254?Sc tx=design=ca;lang=en</a>
R-32	RWTH Aachen, CS Department	1212336 - Infinite Computations and Games	Other	Büchi automata, parity games, parity tree automata, linear time temporal logic (LTL), monadic second-order logic, automata-theoretic decision procedures for logic	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/10163/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/10163/254?Sc tx=design=ca;lang=en</a>
R-33	RWTH Aachen, CS Department	1215696 - Geometry Processing	Other	polygon meshes, discrete differential geometry, mesh generation, geometric optimization (smoothing, decimation, refinement), surface mapping / surface parametrization, interactive 3D modeling	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295048/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295048/254?Sc tx=design=ca;lang=en</a>
R-34	RWTH Aachen, CS Department	1215751 - Learning Technologies	Other	Learning theories and their implications to elearning content and system design: Instructional design theories, theories about motivation, principles for multimedia learning. New learning theories for informal learning processes: emerging technologies for implementing systems and components for open and networked learning such as personal learning environments.	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295131/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/295131/254?Sc tx=design=ca;lang=en</a>
R-35	RWTH Aachen, CS Department	1211909 - Introduction to Virtual Reality (VR I)	Other	3D User Interfaces, Motion Tracking, 3D Depth Cues, VR Displays, Stereo Technology, VR Graphics, Collision Detection	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340333/254?Sc tx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340333/254?Sc tx=design=ca;lang=en</a>

R-36	RWTH Aachen, CS Department	1212688 - Selected Topics of Virtual Reality (VR II)	Other	Navigation, Haptic Interfaces, Acoustic VR, Experimental Design, Virtual Humans, Cybersickness, Immersive Visualization	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340488/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340488/254?ScTx=design=ca;lang=en</a>
R-37	RWTH Aachen, CS Department	1215862 - Physically-Based Animation	Other	basics of physically-based animation (particle systems, rigid bodies, numerical integration), simulation of deformable solids using discrete and continuous models (hair simulation, elastic rods, cloth simulation, soft bodies), fluid simulation, collision detection and collision response, physics engines	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336217/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/336217/254?ScTx=design=ca;lang=en</a>
R-38	RWTH Aachen, CS Department	1212692 - Advanced Techniques in Physically-Based Animation	Other	mathematical foundations, basics of rigid body simulations, multibody simulations (simulation of joints and motors, collision and contact handling, friction), simulation of deformable solids (basics, continuous material models, finite element method), fluid simulation (basics, incompressible fluids, viscosity, boundary handling)	English	6	<a href="https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340482/254?ScTx=design=ca;lang=en">https://online.rwth-aachen.de/RWTHonline/ee/ui/ca2/app/desktop/#/slc.cm.reg/student/modules/detail/340482/254?ScTx=design=ca;lang=en</a>
R-39	RWTH Aachen, EE Department	6017061 - Advanced Compiler Engineering	Software Engineering			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=223492&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=223492&amp;pOrgNr=14549</a>
R-40	RWTH Aachen, EE Department	6010452 - DSP Design Methodologies and Tools	Software Engineering			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1716&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1716&amp;pOrgNr=14549</a>
R-41	RWTH Aachen, EE Department	6010394 - Special-Purpose Operating Systems	Software Engineering			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1540&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1540&amp;pOrgNr=14549</a>
R-42	RWTH Aachen, EE Department	6017113 - Robotics and Man-Machine-Interaction 1	Artificial Intelligence/Robotics			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=227972&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=227972&amp;pOrgNr=14549</a>
R-43	RWTH Aachen, EE Department	6010429 - Estimation, Information Fusion and Machine Learning	Artificial Intelligence/Robotics			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1645&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1645&amp;pOrgNr=14549</a>
R-44	RWTH Aachen, EE Department	6010405 - Fundamentals of Big Data Analytics	Artificial Intelligence/Robotics			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1573&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1573&amp;pOrgNr=14549</a>
R-45	RWTH Aachen, EE Department	6020140 - Machine Learning for Speech and Audio Processing	Artificial Intelligence/Robotics			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=631416&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=631416&amp;pOrgNr=14549</a>
R-46	RWTH Aachen, EE Department	6010448 - Robotics and Man-Machine-Interaction 2	Artificial Intelligence/Robotics			4	<a href="https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1704&amp;pOrgNr=14549">https://online.rwth-aachen.de/RWTHonline/pl/ui/Sctx/WBMODHB.wbSHowMHBReadOnly?pKnotenNr=1704&amp;pOrgNr=14549</a>
U-1	UPV	33424 Automation and Robotics	ROBOTICS	Humanoid robots, Mobile robotics, Robot operating System, Automation with Robotics		6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33424&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33424&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-2	UPV	33419 Cybersecurity	SECURITY	Secure software development; Encryption and physical data protection; Contingency plans		6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33419&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33419&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>

U-3	UPV	33420 Data Science	DATASCIENCE	Introduction to Data Science; Data integration and manipulation; Data analysis; Knowledge exploitation; Introduction to R; Introduction to Python	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33420&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33420&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-4	UPV	33423 e-Administration	INFORMATION SYSTEMS	Legal and Political-Organizational Framework; Strategies and Tools for the Development of e-Administration; Electronic Administration Solutions and Strategic Projects	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33423&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33423&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-5	UPV	33421 E-learning and social networks	OTHER	Fundamentals; Educational resources; E-Learning Platforms; Evaluation of E-Learning projects; Social learning environments	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33421&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33421&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-6	UPV	33427 Enterprise resource planning	INFORMATION SYSTEMS	Business Management Systems; Business processes supported by ERPs; Selection process, change management and the ERP implementation project; ERP market and new trends	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33427&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33427&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-7	UPV	33422 Entertainment and Video Games	SOFTWARE ENGINEERING	Video game design; Programming of interactive multimedia applications; New interaction paradigms	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33422&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33422&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-8	UPV	33426 Environmental Intelligence	ARTIFICIAL INTELLIGENCE	Introduction: Environmental Intelligence; Smart Things and Smart Buildings; Smart Cities and Smart World	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33426&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33426&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-9	UPV	33428 Industrial Automation Computer Systems	ROBOTICS	Introduction to Industrial Control Systems; Industrial Communication Networks; Commercial and Research Systems	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33428&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2019">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33428&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2019</a>
U-10	UPV	33425 Logistics and Services	INFORMATION SYSTEMS	Logistics, planning and optimization; Computer Techniques applied in Logistics; Inventory and warehouse optimization; Location problems; Optimization of distribution and routing problems; Coating, partitioning and packaging problems	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33425&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2018">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33425&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2018</a>
U-11	UPV	33417 Medical Informatics	SOFTWARE ENGINEERING	Standardization of the Clinical Data in the field of medical Informatics. Medical terminologies and ontologies, protocols and standard formats; Information systems in medical imaging: PACS and RIS; Medical imaging: modalities, process and analysis techniques.	6	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33417&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=33417&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=2233&amp;P_CACA=2020</a>
U-12	UPV	11640 - 3D modeling and design	ROBOTICS	Introduction to Design and 3D Modeling; Geometric Modeling; Solid Modeling	4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=11640&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=11640&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>
U-13	UPV	11650 Algorithm for Problem Solving	SOFTWARE ENGINEERING	Programming competitions; Arithmetic and algebra; Number Theory; Comprehensive Tracking; Graphs; Dynamic Programming; Grids and geometry	4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=11650&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=11650&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>
U-14	UPV	11652 Scientific computing	SOFTWARE ENGINEERING	Data Structures and Basic Operations; Stationary Processes; Processes that Evolve Over Time	4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=11652&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=11652&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>
U-15	UPV	14094 Quantum computing	SOFTWARE ENGINEERING	Quantum computer; Bits and qubits; computation process; Breaking RSA encryption; Searching with a quantum computer; Quantum error correction	4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14094&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14094&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>
U-16	UPV	14097 - 3D Print	ROBOTICS	Cartesian robots; Practical aspects of FDM 3D printing; The slicing process; FDM 3D Printer Driver; Operating a 3D Printer; 3D Software; On-line printing services	4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14097&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14097&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>



U-17	UPV	14102 Animation and design of videogames	SOFTWARE ENGINEERING	Principles of animation and videogames; Sprite animations and UIs; Noncharacter animation ; Character animation; Camera animation; Advanced animation using Unity Timeline		4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14102&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14102&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>
U-18	UPV	14104 Design and management of genomic information systems	SOFTWARE ENGINEERING	Genomic Fundamentals; Design of Conceptual Schemes with genomic information; Access to relational and non-relational databases (in SQL and non-SQL environments); Search and identification of genomic variations with clinical relevance; Use of software platforms for genomic information management		4,5	<a href="https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14104&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020">https://www.upv.es/pls/oalu/sic_gdoc.get_content?p_ASI=14104&amp;P_IDIOMA=i&amp;P_VISTA=MSE&amp;P_TIT=156&amp;P_CACA=2020</a>
TU-1	TU Berlin	0433 L 707 - Digital Communities	Distributed Systems and Networks	online social networks; decentralized identity management; ethereum distributed ledger; decentralized identifiers; peer-to-peer; network analysis	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40407&amp;version=4&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40407&amp;version=4&amp;sprache=2</a>
TU-2	TU Berlin	3433 L 5701 - Mobile Services	Distributed Systems and Networks	mobile cellular networks; mobile internet; IMS/SIP services; location-based services; positioning; mobility management	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40576&amp;version=6&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40576&amp;version=6&amp;sprache=2</a>
TU-3	TU Berlin	0433 L 709 - Internet of Services Lab	Distributed Systems and Networks	internet of services; restful APIs; Android; web frameworks; cloud computing; container technologies	English	9	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40514&amp;version=9&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40514&amp;version=9&amp;sprache=2</a>
TU-4	TU Berlin	3435 L 501 - Brain Computer Interfacing	Communication Systems / Distributed Systems and Networks	event-related potentials; spatial filters; multivariate analysis of brain signals; single-trial classification of spatio-temporal features; signal decomposition methods; interpretation of spatial patterns and filters	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40515&amp;version=9&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40515&amp;version=9&amp;sprache=2</a>
TU-5	TU Berlin	3435 L 502 - Current Topics in Brain-Computer Interfacing	Communication Systems / Distributed Systems and Networks	event-related potentials; spatial filters; multivariate analysis of brain signals; single-trial classification of spatio-temporal features; signal decomposition methods; interpretation of spatial patterns and filters	English	3	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40362&amp;version=7&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40362&amp;version=7&amp;sprache=2</a>
TU-6	TU Berlin	3435 L 504 - Project: Brain-Computer Interfacing	Communication Systems / Distributed Systems and Networks	event-related potentials; spatial filters; multivariate analysis of brain signals; single-trial classification of spatio-temporal features; signal decomposition methods; interpretation of spatial patterns and filters	English	9	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40007&amp;version=4&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40007&amp;version=4&amp;sprache=2</a>
TU-7	TU Berlin	3435 L 505 - Brain-Computer Interfacing - From Neurons to Data	Communication Systems / Distributed Systems and Networks	event-related potentials; spatial filters; multivariate analysis of brain signals; single-trial classification of spatio-temporal features; signal decomposition methods; interpretation of spatial patterns and filters	English	3	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40853&amp;version=3&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40853&amp;version=3&amp;sprache=2</a>
TU-8	TU Berlin	0434 L 237 - Advanced Algorithmics	Foundations of Computing/ Data and Software Engineering	approximation, online, randomized, and parameterized algorithms; computational geometry; computational social choice; graph and string algorithms	English	9	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40025&amp;version=5&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40025&amp;version=5&amp;sprache=2</a>
TU-9	TU Berlin	0434 L 233 - Computational Complexity	Foundations of Computing	complexity classes, P vs NP problem, reductions, space and time complexity, circuit complexity, interactive protocols	English	9	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40379&amp;version=6&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40379&amp;version=6&amp;sprache=2</a>
TU-10	TU Berlin	0434 L 220 - Parameterized Algorithmics	Foundations of Computing/ Data and Software Engineering	multivariate algorithms, worst case analysis, algorithm design, fine-grained complexity analysis, dealing with NP-hard problems	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40627&amp;version=5&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?number=40627&amp;version=5&amp;sprache=2</a>

TU-11	TU Berlin	0432 L 135 - Cloud Computing	Distributed Systems and Networks	Virtualisation; Data-intensive processing; Platform as a Service; Containers; Resource Management	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40368&amp;version=14&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40368&amp;version=14&amp;sprache=2</a>
TU-12	TU Berlin	3436 L 10602/3/4/5 - Advanced Distributed Systems Prototyping: Cloud, Fog, Blockchain	Distributed Systems and Networks	blockchain prototyping; cloud prototyping; fog prototyping; information systems prototyping	English	12	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40984&amp;version=4&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40984&amp;version=4&amp;sprache=2</a>
TU-13	TU Berlin	0435 L 336 - Cloud Native Architecture and Engineering	Distributed Systems and Networks	cloud native architectures; continuous software integration; elasticity; resilience; management of cloud native systems	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40103&amp;version=9&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40103&amp;version=9&amp;sprache=2</a>
TU-14	TU Berlin	Privacy Engineering	Distributed Systems and Networks	foundation of privacy; privacy law; privacy by design; cryptographic foundations; k-anonymity; sticky policies; P3P; XACML	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40880&amp;version=3&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40880&amp;version=3&amp;sprache=2</a>
TU-15	TU Berlin	3436 L 10596 - Process Mining	Data and Software Engineering / Information Systems	business processes; data analysis; event logs; process discovery conformance checking	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40990&amp;version=1&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40990&amp;version=1&amp;sprache=2</a>
TU-16	TU Berlin	3436 L 10396 - Software Architecture for Blockchain Applications	Data and Software Engineering / Information Systems	Bitcoin; Ethereum; Hyperledger Fabric; blockchain-based applications and architectures;	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40971&amp;version=3&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40971&amp;version=3&amp;sprache=2</a>
TU-17	TU Berlin	3436 L 10634 - Foundations of Cryptographic Protocols	Distributed Systems and Networks	one-time pad; advanced encryption standards; RSA and prime number algorithms; one-way and hash functions; proof systems; zero-knowledge proofs; model-checking; formal specification and verification of cryptographic protocols	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=41003&amp;version=1&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=41003&amp;version=1&amp;sprache=2</a>
TU-18	TU Berlin	3436 L 1104 - DevOps: Engineering for Deployment and Operations	Data and Software Engineering	virtualization; containers; cloud; continuous deployment pipelines; microservice architectures; post production	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40991&amp;version=2&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40991&amp;version=2&amp;sprache=2</a>
TU-19	TU Berlin	Communication Acoustics	Digital Media und Human-Computer Interaction	auditory and speech acoustics; electroacoustics; audio technology; simulation of acoustic environments; signal processing;	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40526&amp;version=5&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40526&amp;version=5&amp;sprache=2</a>
TU-20	TU Berlin	Multimodal Interaction	Cognitive Systems / Digital Media und Human-Computer Interaction	auditory signals; visual signals; tactile signals; perception of signals; multimodal interaction between humans and machines	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40586&amp;version=7&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40586&amp;version=7&amp;sprache=2</a>
TU-21	TU Berlin	Natural Language Processing	Digital Media und Human-Computer Interaction	text pre-processing; text vectorization; language models; text classification; keyphrase extraction; named entity recognition; machine translation; evaluation metrics	English	6	<a href="https://tubcloud.tu-berlin.de/s/2CkWGF59ZNz5WN">https://tubcloud.tu-berlin.de/s/2CkWGF59ZNz5WN</a>
TU-22	TU Berlin	Algebraic Process Calculi	Distributed Systems and Networks	finite automata; handshake communication; parallelism; distribution; Pi calculus; structural operational semantics; bisimulation technique; congruences	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40319&amp;version=5&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40319&amp;version=5&amp;sprache=2</a>
TU-23	TU Berlin	3435 L 9099 - Lambda-Calculus and Type Systems	Distributed Systems and Networks	lambda calculus; simply-typed and polymorphic lambda-calculus; lambda cube; Curry-Howard correspondence	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40826&amp;version=4&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bolognamodule/beschreibung/anzeigen.html?nummer=40826&amp;version=4&amp;sprache=2</a>



TU-24	TU Berlin	Models and Theory of Distributed Algorithms	Foundations of Computing / Distributed Systems and Networks	synchronous and asynchronous communication; process modes; error models; leader election; reliable broadcast; consensus	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40578&amp;version=6&amp;sprache=1">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40578&amp;version=6&amp;sprache=1</a>
TU-25	TU Berlin	0434 L 362 - Introduction into Interactive Theorem Proving	Data and Software Engineering / Foundations of Computing	higher-order logic; Isabelle syntax; proof strategies; induction and co-induction; representation of theories in Isabelle/HOL; deep versus shallow embeddings	English	3	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40416&amp;version=4&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40416&amp;version=4&amp;sprache=2</a>
TU-26	TU Berlin	Database Technology	Data and Software Engineering	relational database systems; DBMS; file and buffer management; query processing; indexing; metadata management; query optimization; locking; recovery; transaction management; <b>parallel data processing; MapReduce</b>	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40405&amp;version=9&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40405&amp;version=9&amp;sprache=2</a>
TU-27	TU Berlin	Database Technology Labs	Data and Software Engineering	relational database systems; DBMS; file and buffer management; query processing; indexing; metadata management; query optimization; locking; recovery; transaction management; <b>parallel data processing; MapReduce</b>	English	6	<a href="https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40037&amp;version=5&amp;sprache=2">https://moseskonto.tu-berlin.de/moses/modultransfersystem/bologname/beschreibung/anzeigen.html?nummer=40037&amp;version=5&amp;sprache=2</a>

**Urban Planning - List of Courses and Related Learning Outcomes or Keywords**

OFFERED BY (UNIVERSITY)	COURSE NAME	THEMATIC CLUSTER	MACRO-AREA	LANGUAGE	ECTS	KEY-WORDS	(EXPECTED) LEARNING OUTCOMES			LINK TO COURSE PAGE
POLITECNICO DI MILANO	054495 IC URBANISM	Urban Design for a liveable built environment	URBAN PLANNING AND POLICY DESIGN	English	10		Knowledge and understanding	Applying knowledge and understanding	Social and lifelong skills (making judgments, communication, and lifelong learning skills)	<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054495&amp;lang=IT&amp;semestre=1&amp;anno_corso=1&amp;iditemOfferta=157815&amp;idRiga=274225">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054495&amp;lang=IT&amp;semestre=1&amp;anno_corso=1&amp;iditemOfferta=157815&amp;idRiga=274225</a>
POLITECNICO DI MILANO	054498 PLANNING THEORY AND PRACTICE	Policy Design, Pluralism, Conflict and Decision Making in the City	URBAN PLANNING AND POLICY DESIGN	English	12					<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054498&amp;lang=IT&amp;semestre=1&amp;anno_corso=1&amp;iditemOfferta=157816&amp;idRiga=274226">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054498&amp;lang=IT&amp;semestre=1&amp;anno_corso=1&amp;iditemOfferta=157816&amp;idRiga=274226</a>
POLITECNICO DI MILANO	054530 CONFLICT MANAGEMENT AND RESOLUTION	Policy Design, Pluralism, Conflict and Decision Making in the City	URBAN PLANNING AND POLICY DESIGN	English	6					<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054530&amp;lang=IT&amp;semestre=1&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274248">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054530&amp;lang=IT&amp;semestre=1&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274248</a>
POLITECNICO DI MILANO	054568 IC URBAN ETHNOGRAPHY	Policy Design, Pluralism, Conflict and Decision Making in the City	URBAN PLANNING AND POLICY DESIGN	English	8					<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054568&amp;lang=IT&amp;semestre=1&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274250">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054568&amp;lang=IT&amp;semestre=1&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274250</a>
POLITECNICO DI MILANO	054571 IC SMART CITIES AND URBAN INNOVATION	Sustainable Cities and Regions	URBAN PLANNING AND POLICY DESIGN	English	8					<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054571&amp;lang=IT&amp;semestre=2&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274251">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054571&amp;lang=IT&amp;semestre=2&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274251</a>
POLITECNICO DI MILANO	054685 LAND USE ETHICS AND THE LAW	Policy Design, Pluralism, Conflict and Decision Making in the City	URBAN PLANNING AND POLICY DESIGN	English	6					<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054685&amp;lang=IT&amp;semestre=2&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274249">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=054685&amp;lang=IT&amp;semestre=2&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=274249</a>
POLITECNICO DI MILANO	57174 EU POLICIES FOR SUSTAINABILITY AND THE CITY	Policy Design, Pluralism, Conflict and Decision Making in the City	URBAN PLANNING AND POLICY DESIGN	English	6					<a href="https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=057174&amp;lang=IT&amp;semestre=2&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=275423">https://www4.ceda.polimi.it/manifesti/manifesti/controller/ManifestoPublic.do?EVN_DET TAGLIO_RIGA_MANIFESTO=evento&amp;aa=2021&amp;k_cf=222&amp;k_corso_la=1098&amp;k_indir=***&amp;codDescr=057174&amp;lang=IT&amp;semestre=2&amp;anno_corso=2&amp;iditemOfferta=157825&amp;idRiga=275423</a>
UPV	32348 SUSTAINABILITY IN ARCHITECTURE AND URBAN MODELS	Sustainable Cities and Regions	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN (CORE COURSES)	Spanish	6					For years, terms such as sustainability or climate change have been constantly repeated. The effects caused by the human species on the habitat around us are undeniable. Faced with facts that endanger us all, as a collective, as a species, we try to understand what is happening - and why it is happening - in the environmental, social and technological spheres. In this context, this subject is conceived as a reflection on several general questions, applicable to any of the lines of specialisation: What do we talk about when we talk about sustainability? Who has talked about sustainability? Who is affected by whether or not sustainability issues are taken into account? How can we mitigate the effects of climate change? What does technology contribute and how can its impact be evaluated? The collective and collaborative reflection of all students and teachers will help everyone to establish their own critical position on these questions. The course also focuses on the experiences and approaches of a large group of collaborating professionals who will be invited to participate in the course.  <a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32348&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32348&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	32349 PROJECT AND CONSTRUCTION MANAGEMENT	Policy design: pluralism, conflict and decision making in the city	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN (CORE COURSES)	Spanish	6					It deals with Project Management, applying Integrated Project Management, i.e. Project Management. We will follow the criteria established by the Project Management Institute (PMI). The viability analysis of the Project and the Financial Strategy is approached, with the Project Finance as objective, to provide the Project Manager with the economic-financial knowledge necessary for the proper performance of its functions. In order to lead all this, we will provide the student with the tools that will allow him/her to carry out the Leadership.  <a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32349&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32349&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	34302 INTEGRAL GRAPHIC PROJECT MANAGEMENT		MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN (COMPLEMENTARY COURSES)	Spanish	3					The aim of the course is to train students in advanced computer representation techniques through the use of virtual reality. This will improve the capacity for ideation, representation and communication of the designed object or space. State-of-the-art virtual reality digital tools will be used for this training. An emblematic building from the history of architecture or a project on which the student is currently working will be used for learning. The student will model the project throughout the course in the same way as they would do in their professional life in order to present it to a competition or client. The theoretical part of the course will include the use of the virtual reality rendering engine Unreal Engine, as well as other necessary tools.  <a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=34302&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=34302&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>

UPV	34303 URBAN REHABILITATION AND REGENERATION	Urbanisation in the Global South: spatial and social challenges	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN  (COMPLEMENTARY COURSES)	Spanish	3		1. THE EXISTING CITY AND THE UPRISING CITY. Inequality, Vulnerability and Urban Segregation Urban Regeneration in Vulnerable Neighborhoods Interventions in the Coastal City. Mature Tourist Destinations	<a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=34303&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=34303&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	32351 LAND PLANNING AND MOBILITY	Sustainable Cities and Regions	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN  (SPECIALIZATION COURSES)	Spanish	3		1. TERRITORIAL MOBILITY STRATEGIES Sustainable Use of Land. Spatial Planning. Transit Oriented Development. Transport networks and infrastructures. Sprawl-repair Strategies.	<a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32351&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32351&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	32353 CITY AND TERRITORY: INTERVENTION INSTRUMENTS	Urbanisation in the Global South: spatial and social challenges  Urban Design for a liveable built environment at different scales	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN  (SPECIALIZATION COURSES)	Spanish	5		1. URBAN PLANNING INSTRUMENTS Territorial Strategic Planning and Environmental Assessment Structural and Detailed Urban Planning. Landscape Planning Instruments. Intervention in Cultural Heritage. Urban Management Operational Techniques.	<a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32353&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32353&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	32352 CITY AND PUBLIC SPACES	Urban Design for a liveable built environment at different scales  Policy design: pluralism, conflict and decision making in the city	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN  (SPECIALIZATION COURSES)	Spanish	3		1. URBAN MORPHOLOGY Urban Design: the Morphological Dimension. Urban Tissues Analysis. Elements and Patterns. Space Syntax.  2. PUBLIC PLACES AS URBAN SPACES Urban Design: the Perceptual Dimension. Public Places: Visual- aesthetic Spatial Assessment.	<a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32352&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32352&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	32350 LANDSCAPE AND ENVIRONMENT	Sustainable Cities and Regions  Urban Design for a liveable built environment at different scales	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN  (SPECIALIZATION COURSES)	Spanish	3		1. LANDSCAPE & ARCHITECTURE Landscape Design and Visual Arts. Landscape as Architecture: Form and Space.  2. LANDSCAPE AND URBAN PLANNING From Urban Parks to Urban Open Spaces Systems. Landscape Urbanism. Urban and Territorial Green/ Blue Infrastructure.	<a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32350&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32350&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
UPV	32354 WORKSHOP ON URBAN AND LANDSCAPE PLANNING	Urban Design for a liveable built environment at different scales	MASTER'S DEGREE IN ADVANCED ARCHITECTURE, LANDSCAPE, URBANISM AND DESIGN  (SPECIALIZATION COURSES)	Spanish	16		1. URBAN PLANNING WORKSHOP 1st Semester Design Studio (6 ECTS) GIS Seminar (2 ECTS)  2. LANDSCAPE & URBAN DESIGN WORKSHOP 2nd Semester Design Studio (6 ECTS) Spring Seminar by Invited Professor (2 ECTS)	<a href="http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32354&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158">http://www.upv.es/pls/balu/sic_asi.Busca_Asi?p_cod=32354&amp;p_caca=2021&amp;P_IDIOMA=i&amp;p_vist_a=MSE&amp;n_tit=2158</a>
RWTH Aachen University	202114801 Urban transformation (I & II)	Urban Design for a liveable built environment at different scales		English	6		The objective of the module is to explore and understand dynamics of the processes that can be observed in urban areas with a particular focus on those located in Europe. The students shall be able to apply this knowledge in their projects on real world case studies.	
RWTH Aachen University	2021057 European urban policies & territorial governing structures	Policy design: pluralism, conflict and decision making in the city		English	3		The objective of the module is to ensure deeper insight into European policies towards cities and regions and the way they respond to change and how they fit into the global urban agenda. The students shall understand the political aspect of design and planning and recognise and evaluate the territorial governing models and their relation to urban and regional transformation.	
RWTH Aachen University	2021100 Integrated project III: Networked urban systems in Europe	Sustainable Cities and Regions: The cluster revolves around the need to plan and design more sustainable urban environments, able to take into account different dimensions and through different tools	Master Transforming City Regions	English	15		The goal of the module is to equip students with design and solution-oriented skills which will focus on the continental scale of urban transformation and will be dealing with the problems like transboundary urban structures, interpretation of European territorial mega-structures, or urban networks of different kinds. Students shall prove they can conceptualise the problem, analyse real case studies, apply appropriate methodologies and design techniques, develop scenarios for the future transformation and prepare design which can help with the implementation of this scenario. The additional objective is to prepare students to team working while taking the individual responsibility for the specific task. Also important skill is to be prepared to the discussion with the representatives of different disciplines while having clear spatial perspective. Finally, as a result of the module the students shall be able to deliver a convincing public presentation of their project and debate their solution with the audience.	<a href="https://www.staedtebau.rwth-aachen.de/global/show_document.asp?id=aaaaaaaadddhvb">https://www.staedtebau.rwth-aachen.de/global/show_document.asp?id=aaaaaaaadddhvb</a>
TU Berlin	UD P2 Interdisciplinary Theory and Practice	Sustainable Cities and Regions: energy, environment, community	URBAN PLANNING AND URBAN DESIGN	English	3	Methods, Planning Approaches, Planning History, Interdisciplinary Concepts	In this lecture series the chairs of Urbanism and Habitat and Landscape Architecture and Open Space Planning introduce and juxtapose different theoretical planning approaches and the resulting practice. By reviewing planning processes and projects from the recent past almost forensically new insights will be gained and discussed on certain planning methods and practices. This debate will enrich today's concepts for urban design	<a href="https://fg-staedtebau.de/interdisciplinary-theory-and-practice/">https://fg-staedtebau.de/interdisciplinary-theory-and-practice/</a>
TU Berlin	Urban Design Theory and Baukultur	Urban Design for a liveable built environment at different scales	URBAN PLANNING AND URBAN DESIGN	German	5	Built Environmental Education, Architectural Heritage and Value, Sustainability	The subject of the core seminar on urban design theory and Baukultur is the connection between the spatial formulation of the city and space as well as the urban production processes that shape them. Baukultur is seen as a built environment in the service of society, which is subject to a permanent process of transformation	<a href="https://fg-staedtebau.de/semseminar-staedtebau-und-baukultur/">https://fg-staedtebau.de/semseminar-staedtebau-und-baukultur/</a>
TU Berlin	Critical Urban Policy Studies: Theoretical Issues and Empirical Explorations	Policy design: pluralism, conflict and decision making in the city	Planning Theory and Urban-Regional Policy Analysis	English	6	urban policy, transdisciplinarity, transition governance, social innovation, co-production and planning.	The Module 'Critical Urban Policy Studies: Theoretical Issues and Empirical Explorations' deals with theories, approaches and methods of critical urban studies. It focusses in particular on developing critical analyses of contemporary trends and emerging issues in urban policy and planning.	<a href="http://www.redaktion.tu-berlin.de/fileadmin/fg273/Beschreibung_Lehrveranstaltungen/M4-M9.2_SE_CUPS_SuSe_2020_Syllabus.pdf">http://www.redaktion.tu-berlin.de/fileadmin/fg273/Beschreibung_Lehrveranstaltungen/M4-M9.2_SE_CUPS_SuSe_2020_Syllabus.pdf</a>
TU Berlin	Planning as Political Process 2	Policy design: pluralism, conflict and decision making in the city	Planning Theory and Urban-Regional Policy Analysis	English	3	theorizing and research, meaning and role of conflict in democratic politics and society, specific nature of conflicts in urban development and planning, dynamics of contentious politics and social mobilization.	The module consists of contributions to a critical and reflective understanding of planning from a primarily socio-political perspective. It pursues an interdisciplinary approach which is meant to promote an exchange between urban and regional planning and urban and regional research, and in particular between planning theory and critical approaches to urban-regional and socio-spatial research, such as urban sociology, economic and political geography, political economy, as well as policy and governance research. The topics of the seminars are regularly updated with regard to current debates in planning theory and in urban and regional research. They deal with politico-economic and institutional conditions, with socio-political (power) relations and with spatial contexts of planning, with emphasis on the role of planning practises and discourses in the strategical-relational construction of socio-spatial settings.	<a href="http://www.redaktion.tu-berlin.de/fileadmin/fg273/Beschreibung_Lehrveranstaltungen/M4_SE_PP2_SuSe_2020_Syllabus_rev_20.04.pdf">http://www.redaktion.tu-berlin.de/fileadmin/fg273/Beschreibung_Lehrveranstaltungen/M4_SE_PP2_SuSe_2020_Syllabus_rev_20.04.pdf</a>

TU Berlin	Planning as Political Process 1	Policy design: pluralism, conflict and decision making in the city	Planning Theory and Urban-Regional Policy Analysis	English	3	theorizing and research, meaning and role of conflict in democratic politics and society, specific nature of conflicts in urban development and planning, dynamics of contentious politics and social mobilization.	The module consists of contributions to a critical and reflective understanding of planning from a primarily socio-political perspective. It pursues an interdisciplinary approach which is meant to promote an exchange between urban and regional planning and urban and regional research, and in particular between planning theory and critical approaches to urban-regional and socio-spatial research, such as urban sociology, economic and political geography, political economy, as well as policy and governance research. The topics of the seminars are regularly updated with regard to current debates in planning theory and in urban and regional research. They deal with politico-economic and institutional conditions, with socio-political (power) relations and with spatial contexts of planning, with emphasis on the role of planning practises and discourses in the strategic-relational construction of socio-spatial settings.	<a href="http://www.redaktion.tu-berlin.de/fileadmin/user_upload/Beschreibung_Lehrveranstaltungen/M4_SE_PP2_SuSe_2020_Syllabus_rev_20.04.pdf">http://www.redaktion.tu-berlin.de/fileadmin/user_upload/Beschreibung_Lehrveranstaltungen/M4_SE_PP2_SuSe_2020_Syllabus_rev_20.04.pdf</a>
TU Berlin	Urban and Regional Research	All thematic clusters	Planning Theory and Urban-Regional Policy Analysis	English	6	types and approaches to urban and regional research, research design	The focus of the Core Module Urban and Regional Research is on introducing to the different dimensions of this area of activity and to different understandings and paradigms of urban and regional research.  The contents of the Core Module Urban and Regional Research are articulated in four sections:  - features of the field of urban and regional research,  - types and approaches to urban and regional research,  - paradigm and traditions of urban and regional research,  - reflection and discussions by the students.  The following topic will be furthermore dealt with in the module:  - generating and developing research questions  - research design,  - research methodology,  - formulating a research proposal  - organising the research process,	<a href="https://www.planningtheory.tu-berlin.de/fileadmin/user_upload/UR-Research_2020-21_Syllabus.pdf">https://www.planningtheory.tu-berlin.de/fileadmin/user_upload/UR-Research_2020-21_Syllabus.pdf</a>
Chalmers	ARK142 Social Ecological Urbanism	Sustainable cities and regions & Urban Design for liveable built environment		English	Currently 22,5 (will be 15 start Autumn 2023)	Urban planning, Urban design, Social process, ecological processes,		<a href="https://student.portal.chalmers.se/en/chalmersstudies/programme-information/Pages/SearchProgram.aspx?course_id=31123&amp;parsergrp=2">https://student.portal.chalmers.se/en/chalmersstudies/programme-information/Pages/SearchProgram.aspx?course_id=31123&amp;parsergrp=2</a>
Chalmers	ARK174 Planning and design for Sustainable development in a Local Context	Sustainable cities and regions & Urban Design for liveable built environment		English	Currently 22,5 (will be 15 start Autumn 2023)	Urban planning, Urban design, Regional development, Critical perspective		<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/pages/searchcourse.aspx?course_id=27166&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/pages/searchcourse.aspx?course_id=27166&amp;parsergrp=3</a>
Chalmers	ARK128 Architecture and Urban Space Design	Sustainable cities and regions & Urban Design for liveable built environment		English	Currently 22,5 (will be 15 start Autumn 2023)	Urban planning, Urban design, Infrastructure and transport		<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/pages/searchcourse.aspx?course_id=27125&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/pages/searchcourse.aspx?course_id=27125&amp;parsergrp=3</a>
Chalmers	ARK496 Reality Studio	Urbanization Global South		English	Currently 22,5 (will be 25 start Autumn 2023)	Urban planning, Urban design, Urban processes, Global south		<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32332&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32332&amp;parsergrp=3</a>
Chalmers	ARK324 Design and Planning for Social Inclusion	Policy Design		English	Currently 22,5 (will be 15 start Autumn 2023)	Urban planning, Urban design, Urban processes, Agents, Bottom-up approaches		<a href="https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32416&amp;parsergrp=3">https://student.portal.chalmers.se/en/chalmersstudies/courseinformation/Pages/SearchCourse.aspx?course_id=32416&amp;parsergrp=3</a>
WUT	Design Studio II (Optimization)	Urban Design for a liveable built environment		English	10			<a href="http://asknow.eu/subject/show/design-studio-ii-optimization/">http://asknow.eu/subject/show/design-studio-ii-optimization/</a>
WUT	Information Process in Urban Planning	all the clusters		English	6		students will have learned how to research and apply urban design and planning revitalization strategies. Students learn how to tie urban design and information flow between government, stakeholders and local citizens. The proposed redevelopment takes into account the principles of sustainable urban design and needs of the changing climate. Through their analyses, students learn how to assess design solutions effects on the development process and inter-city, metropolitan and regional levels. Students learn how to implement public participation involvement in their projects.	<a href="http://asknow.eu/subject/show/information-process-in-urban-planning-electv/">http://asknow.eu/subject/show/information-process-in-urban-planning-electv/</a>
WUT	Experimental Design II	Urban design for a liveable built environment at different scales		English	6			<a href="http://asknow.eu/subject/show/experimental-design-ii-optimizing-detail/">http://asknow.eu/subject/show/experimental-design-ii-optimizing-detail/</a>
WUT	Sociology of Cities and Housing	Policy design: pluralism, conflict and decision making in the city		English	1			<a href="http://asknow.eu/subject/show/7366-2/">http://asknow.eu/subject/show/7366-2/</a>