Course title

Advanced Technician for automation and mechatronic systems

Course profile

Advanced technicians for automation and mechatronic systems work to realize, integrate, control machines, plants and automatic systems using interface devices between the controlled machines and the programmable devices that control them; intervene for programming and functional testing, guaranteeing customization and production flexibility, due to simulation techniques and rapid prototyping of both the control system and the physical machine. Technicians collaborate with the technological structures responsible for the creation and production of the various mechatronic machine components and intervene to ensure the best functional integration, adaptive to the context of operational use, and ensuring safety conditions for the operators.

Organization (main teaching, training and verification methodologies)

The main learning activities include:

- General courses in linguistic, communicative, relational, scientific, technological, legal, economic, organizational and managerial fields;
- Teachings of a technical-professional nature both common to the reference area (Made in Italy Technologies - Mechanical System) and specialist/distinctive of the profile.

The course is carried out in 2 full-time annuities, which constitute a student workload total of 1,500 hours.

The workload includes all the training methods:

- In the classroom;
- In didactic laboratories in offices equipped with software, systems and tools for exercises and checks, also installed at member companies/partners;
- Project Work/Research Project;
- Internship;
- Individual study.

Most of the teaching hours are entrusted to member companies or partners, who provide experts and/or in the company setting with related technological equipment, laboratories, plants and technical documentation.

40% of the work takes place in the company through an internship and establishing a strong link in the production fields.

Guided visits are also provided to leading companies and to laboratories and research centres both in and outside the Region. Visits to events or fairs abroad may also be possible.

Methodologies and verification criteria

At the end of the course there will be a final exam for the release of the Advanced Technician diploma.

The assessment of learning outcomes is also carried out at the end of each training unit, with the following criterion:

- Practical exercises to verify and evaluate the learning outcomes of the training units which provide for the prevalence of active and laboratory teaching methodologies and/or learning focused on the technologies in use;
- Written exercises to verify and evaluate the learning outcomes in theoretical training units which involve the use of traditional teaching methods.

Disciplinary area of reference (ISCED - F)

0714 Electronics and automation

Job title (national classification/standard)

Advanced technician for automation and mechatronic systems

Level

QF - EHEA: short cycle qualification

EQF: level 5

Total ECTS credits

120

Learning outcomes of the study course

At the end of the training path the student will be able to:

- Manage communication and relational processes within and outside the organization both in Italian and in English;
- Master the linguistic tools and information and communication technologies to interact in the workplace;
- Arrange, negotiate and develop activities in working groups to tackle problems, propose solutions, help in production, order and evaluate collective results;
- Organize and use information, data and their aggregations;
- Use statistical tools and models in the description and simulation of the different scenarios of the reference area;
- Develop and implement design, prototyping and industrialization techniques;
- Intervene in all segments of the supply chain from production to marketing;
- Manage production flows in programming, control and cost-effectiveness, also in relation to the methods of industrialization and continuous improvement;
- Configure, calibrate, document and maintain automatic systems of different types;
- Know the layout and control components in modern automation systems;
- Programming industrial automation systems;
- Know and configure robotic systems and vision systems for product handling;
- Apply methods of prevention, analysis and diagnostics of malfunctions and failures;
- Develop technical solutions to design, build, dismantle and test a complete automation.

Year I

Area / Range	Competence objectives for national classification/ standard	Module	Main contents	Learning outcomes of the unit	Methods and criteria for verifying results	Learning methodologies contexts and related workload (hours)	ECTS credits
General linguistic, communicative and relational field	Use technical English (micro language), related to the technological area of reference, to communicate correctly and effectively in the contexts in which is required Manage the communication and relational processes inside and outside the organization both in Italian and English	Technical English I	Communication in English (written, oral) on technical-specialist subjects relating to the professional domain and workplace	Be able to communicate in English at both written and oral level using a specific language and terminology regarding the sector of reference	Method: Written test multiple choice and oral interview in a foreign language. Criteria: The student will have to correctly demonstrate technical terminology, grammatical and syntactic knowledge, as well as fluency in language conversation	Classroom / laboratory: 30 hours Individual study: 45 hours	3
	Master the linguistic tools and information and communication technologies to interact in daily activities and at work	Digital tools for collaborative work, presentation and communication	Fundamental assets of collaborative work tools: speed, accessibility, usability, sharing and security. E-mail as a contact and repository tool (risks and opportunities). Mobile and multi-channel work (access to content from PC, notebook, smartphone or tablet). Collaborative exchange applications (video collaboration platforms, Whatsapp, WeTransfer and Skype). Transparent and traceable	Know how to use online collaboration tools; Know how to use presentation and communication tools; Know how to intervene in digital communication	Method: PC practice test Criteria: The student must correctly demonstrate the use of online collaboration tools and/or presentation and communication	Classroom / laboratory: 16 hours Individual study: 12 hours	1

			management tools for company workflows: technological solutions for the convergence of office automation, document management and management systems (co-editing, self-service analytics, personal archiving). Platforms and web promotion tools (Facebook Ads, Google AdWords) and organic positioning and search engine optimization (SEO)	activities: digital marketing, positioning and optimization on search engines (SEO)			
	Arrange, negotiate and develop activities in working groups to face problems, propose solutions, help produce, order and evaluate results	Team Working, Soft skills	Life cycle of a team; Motivation, role of team leader; Team building; Team management; Management of critical issues and conflicts; Performance management	Identify leadership style and interpret the main motivational dynamics that favour active participation of the members in a working group	Method: Practice Test Criteria: Placed in a team working situation, the student will have to demonstrate collaboration skills, listening and proposing solutions	Classroom / laboratory: 33 hours Individual study: 24 hours	2,5
General Scientific and technological field	Use statistical tools and models in the description and simulation of the different phenomenologies of the reference area, in the application and development of appropriate technologies	Machinery directive	The new Machinery Directive 2006/42/EC and CE marking of electrical and electronic products, RED Directive (Radio Equipment Directive)	Apply the Machinery Directive and related standards	Method: Laboratory exercises, written test Criteria: The student must demonstrate knowledge of the Machinery Directive and CE marking of electrical and electronic product, RED Directive and related standards	Classroom / laboratory: 12 hours Individual study: 20 hours	1

	Use tools and methodologies specific to experimental research for the application of technologies in the reference area						
General organizational and management area	Organize and independently manage, the working environment, personnel and the reference technological system in order to achieve expected production results	Job security	Consolidated law on safety prevention and protection in the company: general and sector-specific risks ATECO C28 - high level of risk	Know and apply the legislation on mandatory safety in the workplace and in the reference technological-production system	Method: Written test Criteria: The student will have to demonstrate knowledge of the regulatory provisions on safety and health in the workplace	Classroom / laboratory: 16 hours Individual study: 24 hours	1,5
	Recognize, evaluate and resolve conflict situations and work problems of different nature: technical-operational, relational, organizational Know, analyse, apply and monitor, in specific contexts, management models of production processes of goods and services Manage relationships and collaborations within the organizational structure within the work contexts, evaluating their	Studying the organization of the company	Organizational planning, the corporate value chain, relationships and organizational elements. Organization: structure and coordination mechanisms. Organizational structures comparisons: hierarchical-functional; for processes; matrix, slender (flat). Organizational coordination procedures and logics: planning, system of objectives and management control. Organizational management systems: work and activity processes, roles and duties, managerial and professional skills.	Analysing company logics with a view to efficiency, innovation, optimization of the use of resources, creation of added value, alignment between strategic choices and operating methods	Method: Written test through open question test Criteria: The student must be able to identify and represent various organizational models and to describe a management system for the optimization of processes	Classroom / laboratory: 10 hours Individual study: 16 hours	1

	effectiveness						
	Manage external relationships and collaborations - interpersonal and institutional - evaluating their effectiveness						
Common professional technical skills - Made in Italy technologies - Mechanical system	Develop and implement design, manufacturing and prototyping techniques Research and apply the technical and safety regulations of the electrical, electronic and mechanical sector in the design and use of components	Electrical design techniques I	Bases of electrical engineering for circuit design (laws and electrical quantities, resistors, circuits and networks in direct current, in single-phase and three-phase alternating current). Electrical components inside the hardware used in automatic machines, tools and their interfaces: building blocks of an automation system, auxiliary command and signalling devices, main types of on-off sensors, relays; contactors, resistors, transducers and actuators, electrical panels and plant engineering on machines. Identification of functions, chain systems, hardware measuring elements and their selection from catalogues. Electromechanical logic circuits (wired logic) and machine electrical diagrams	Apply principles of electronics and electrotechnics to industrial plant control equipment	Method: Exercise Criteria: The student will have to be able to read and interpret typical industrial electrical schematics	Classroom / laboratory: 68 hours Individual study: 58 hours	5
		Mechanical drawing I	Basic elements of industrial technical drawing (sheets; lines; stairs; normal numbers) and related UNI and ISO standards (paper formats, definitions and principles concerning technical drawings, types of lines, units of measurement, dimensional scales; axonometries, orthogonal projections, sections, crosshatch, dimensioning,	Represent mechanical groups and make drawings using 2D and 3D CAD	Method: CAD practice test criteria: The student must be able to perform the 3D modelling of mechanical groups	Classroom / laboratory: 96 hours Individual study: 54 hours	6

			general manufacturing tolerances, surface, shape and position tolerances, couplings. Unified designations for the univocal identification of elements/objects: materials, unified mechanical components (screws, nuts, plugs, pins, profiles, etc.), electrical/electronic components (resistors, capacitors, transistors, etc.), elements and symbols graphics Technical drawing implemented on the computer: 2D and 3D AutoCAD: parts, drawings and assemblies. Creating a 2D drawing: lines, points, circles and arcs. The drawing of mechanical details. 2D views of how products are manufactured and assembled. Dimensioning methods, tolerance and annotations based on ANSI, ISO, GD&T standards. 3D modelling of solids and surfaces: basic primitives, construction by extrusion and revolution. Advanced constructions: sweep extrusion, loft construction, track revolution. Boolean operations; chamfers and fillets.		and to carry out 2D table setting		
		Mechanical design techniques I	Elasticity theory. Resistance criteria. Beam theory, dimensioning criteria for parts, fatigue stress for metallic materials, approaches to mechanical design Machine building bases. Elementary machines. Connections: welding, screw. Rolling couplings. Plain and rolling bearings. Shaft-hub coupling: shafts and systems assembled on the hub. Cogwheels, gears and gears, crank mechanisms, coil springs, bent beams, hyperstatic beams, joints, couplings, reducers	Design mechanical components; know calibration methods mechanical parts/ kinematic mechanisms and the main approaches to design	Method: Exercise Criteria: The student will have to identify the geometric, mechanical and functional specifications of parts and assemblies of mechanisms and machines	Classroom / laboratory: 46 hours Individual study: 36 hours	3

		Pneumatic design techniques I	Drawing of pneumatic and vacuum schemes. Pneumatic actuators and control valves. Single and double acting control. Start, stop and memory status. Topographic and functional schemes. Symbol library, import into the drawing, development of technical schemes, bill of materials. Hydraulic systems and components: actuator; servo valve (amplifier); regulator; power unit (pumps). Fixed displacement pumps (gear; screw; vane) and variable displacement (axial piston; vane). Hydraulic movements: linear and rotary actuators, position and speed controls, through analogue and digital position transducers. Dynamic study: flow rate, escape between cylinder and piston and return to the tank.	Read and represent pneumatic and hydraulic diagrams	Method: Exercise Criteria: The student must demonstrate an ability to carry out the study of a pneumatic circuit (describe the sequence, draw piston motion diagrams, define starting positions and carry out an analysis of the controls)	Classroom / laboratory: 16 hours Individual study: 15 hours	1
	Programming industrial automation systems (PLC, robots, CNC machines, communication networks, monitoring and diagnostics systems, etc ...) Configure, calibrate, document and maintain automatic systems of different types	Designs and configuration of industrial control systems I	Control architectures and components in automation systems, PLC architectures, sensors and real-time and non-real-time communication networks. Computer design and its operation. Machine language and assembly language. High level languages: interpreted or compiled. Algorithm concept. Languages for PLC and IEC 1131 standard. Overview of the 5 languages built for the program flow in structured text. Development environment. Development of simple applications	Configure inputs (sensors) and outputs (actuators) of a PLC application and develop control system software programs	Method: Exercise. Criteria: The student will have to able to carry out the configuration and software program of a PLC control system	Classroom / laboratory: 56 hours Individual study: 40 hours	4
		Industrial control software I	Numerical control, interpolation and control design of a CNC machine. Tool card and machine preparation; address programming, CAD-CAM,	Program the prototype and finished parts processing	Method: Exercise. Criteria:	Classroom / laboratory: 32 hours	2

			customization Programming a CNC cycle in ISO Standard language: N, M, T, G functions. Function syntax. Workpiece zero and workpiece diameter coordinate system for the X axis of the spindle and real in mm for the Z axis of diameters. Choice of cutting parameters (speed, feed). Standard ISO code tables (G-CODE). CNC simulators	machines	The student must be able to generate programming of a CNC machining cycle in ISO language	Individual study: 24 hours	
		HMI design with operator panel	HMI (Human Machine Interface) functions, ergonomics of the HMI, physical components: LCD touchscreen display, CPU, communication BUS with the PLC. Graphical interface: menus, virtual commands (buttons, selectors, knobs, sliders, etc.) and tools (graduated scales, text messages, lights, etc.) for displaying information for process control and supervision. Insertion of the HMI in a Tia Portal project: screen size, model and communication protocol (Profinet) with PLC and creation of the graphic interface (pages)	Manage the graphical interface between PLC and operator (HMI) to display information on an automated process	Method: Exercise. Criteria: Starting from the analysis of a case, the student must analyse and understand a HMI project in compliance with functional and ergonomic requirements	Classroom / laboratory: 20 hours Individual study: 16 hours	1,5
	Identify materials, the relative processes and the treatments suitable for the various uses Choose the processing technologies and the relative machines on the basis of the technical-economic characteristics required	Materials I	Mechanical, physical, chemical and technological characteristics of the main materials used in the automation field: Steel, Cast Iron, Bronze, Brass, Copper, Light alloys, Titanium, Aluminium. Metallurgy: solidification of metals and alloys, diffusion laws with application to heat treatments, strengthening methods. Steel classification (UNI EN): special construction steels, maraging steels, tool steels, stainless steels, steels for use at high and low temperatures,	Identify materials, their processes and treatments; Choose the most suitable material for the construction of the machine and/or plant	Method: Multiple choice test Criteria: The student will have to demonstrate an ability to recognize the characteristics and properties of different materials	Classroom / laboratory: 28 hours Individual study: 24 hours	2

			13% Mn steels, cast steels. Cast iron: white cast iron, grey cast iron, graphite shape and distribution, mechanical properties, pearlite cast iron, alloyed cast iron, spheroidal cast iron, tempered cast iron (adi). Aluminium and its alloys: designation, foundry alloys, machining alloys: heat treatment, work hardening. Magnesium and its alloys: designation, foundry and processing alloys. Titanium alloys. Main characterization tests				
		Mechanical processing I	Chip cutting and removal processes: lathes, cutters, grinders, EDM, drills, machining centres. Metal cutting mechanics, metal workability and chip formation and morphology mechanisms. Orthogonal and oblique cuts. Definition of cutting motions, of stalking feed. Shear force and repulsion forces. Cutting pressure. Unified representation of the tool: cutting edge angles, profile angles, entering angles, tip radius. Phenomenological and unified wear criteria of tools. Tool life Hole machining: reamers and drills. Horizontal, vertical and universal milling machines. Slotting, broaching and grinding. Plastic deformation processes. Magli and presses: general characteristics. Calculation of the force obtainable from an eccentric mechanical press. Mechanical friction press (screw). Hydraulic press. Monoaxial, biaxial and triaxial deformation. Crushing between parallel planes and the slab-analysis method. Flow-stress of materials in cold and hot deformations. Cold plastic deformation of sheets: a)	Carry out the manufacturing study of a mechanical part; choose the processing technologies.	Method: Exercise with case analysis. Criteria: The student must correctly select the processing technologies for the production of mechanical parts.	Classroom / laboratory: 42 hours Individual study: 36 hours	3

			Blanking: punches, dies, blanking force, fine blanking; b) Bending: elastic return, crimping, calendaring, roller profiling; c) Drawing: pressure of the blank holder, drawing reduction ratios, drawing force and calculation of the template disc.				
		Electrical processing	Wiring tools: phase finder screwdrivers, testers, timers and sensors, welders. Tin soldering techniques, wiring methods and flows in electrical systems, connection methods. Wiring: execution of the technical specifications of the electrical drawing relating to cable ducts, component positioning, terminals, switches, terminals. Earthing and protection of people and systems from electrical voltages. Functional testing of interconnected systems of a simple electromechanical system.	Know operating methods for assembly, wiring and testing of electronic circuits/ electromechanical systems.	Method: Exercise with case analysis. Criteria: The student must correctly select the assembly and wiring techniques of an electrical system.	Classroom / laboratory: 28 hours Individual study: 32 hours	2,5
	Apply fault prevention, analysis and diagnostics methodologies on systems and plants and propose possible solutions. Manage post-sales and maintenance needs.	Assembly of mechanical parts and testing of automation systems	Cyclic preventive maintenance: cycles of use and failures due to wear; classification of machines, logs and standards; maintenance on condition: potential failure and tolerable limit value; types of predictive monitoring; categories of predictive signals or emissions; vibration analysis, malfunctions of gearboxes and rolling bearings, inspections with thermal imaging camera, electrical measurements of AC/DC motors; ultrasound investigations; PHM approach and soft-computing prognostic techniques for the residual useful life.	Apply predictive maintenance techniques.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to correctly demonstrate an ability to apply predictive maintenance techniques.	Classroom / laboratory: 16 hours Individual study: 8 hours	1

Specific technical professional skills for the job		Elements of technological innovation in the mechanical and automation system	Analysis of innovative aspects of the advanced automation and smart/digital manufacturing sector (through fairs, seminars, workshops, specialist interventions on the latest automated production systems): manufacturing Big Data, additive manufacturing (3D printing), industrial Internet of Things, Cloud, advanced automation and advanced HMI (Human Machine Interface).	Know tools, enabling technologies and innovative approaches for production and management in automation companies.	Method: Debriefing and evaluation of significant learning by rubric. Criteria: The student must be able to recognize significant examples of advanced applications within a sector's technological trajectory.	Classroom / laboratory: 31 hours Individual study: 40 hours	3
INTERNSHIP I			Curricular objectives: characterization of materials, processes and treatments; technical drawing reading and assembly of mechanical components for the transmission of motorcycles; understanding electrical, pneumatic and wiring diagrams; component reliability verification methods and use of control and regulation equipment.	Develop a greater awareness of a personal study path, consolidating the knowledge acquired in the classroom phase.	Method: Observation and verification of the intern's performance by evaluating their effective exercise of knowledge and skills. Self-evaluation and reworking of the experience by the student. Criteria: The chosen evaluation will include an evaluation judgment of the company tutor and subsequent feedback with the student's self-evaluation by the agency's educational. The result of the combination of hetero and self-evaluation constitutes the summary report of the experience, which will be one of the objects of the final exam.	Internship in the company: 320 hours Individual study: 60 hours	16

Total hours in classroom/laboratory in year I: 596
Total internship hours in year I: 320
Total sum of hours in year I: 916

Year II

Area/ Range	Competence objectives for national classification/ standard	Module	Main contents	Learning outcomes of the unit	Methods and criteria for verifying results	Learning methodologies, contexts and related workload (hours)	ECTS credits
General linguistic, communicative and relational field	Use technical English (micro language), related to the technological area of reference to communicate correctly and effectively in the contexts in which is required. Manage the communication and relational processes inside and outside the organization both in Italian and English. Master the linguistic tools and information and communication technologies to interact in daily activities and work contexts.	Technical English II	Communication in English (written, oral) on technical-specialist subjects relating to the professional domain and the workplace.	Be able to communicate in English at both written and oral level using a specific language and terminology specific to the sector of reference.	Method: Written test multiple choice and oral interview in a foreign language. Criteria: The student will have to correctly demonstrate technical terminology, grammatical and syntactic knowledge, as well as fluency in language conversation.	Classroom / laboratory: 30 hours Individual study: 45 hours	3
	Prepare technical and regulatory documentation that can be managed through telematic networks.	Meta-competences and active job search	Labour market, self-marketing, regulations and contracts.	Manage external relations; produce a CV, face a job interview.	Method: Simulation. Criteria: The student will have to write a CV and implement an effective active job search strategy.	Classroom / laboratory: 16 hours Individual study: 24 hours	1,5

	Assess the implication of information flows with respect to the effectiveness and efficiency of the management of production or service processes, also identifying alternative solutions to ensure quality.	Analysis, use and protection of digital data	Introduction to complex predictive models (inferential statistics and nonlinear systems) based on nonlinear data sets, raw data and large amounts of data to reveal relationships and dependencies and make predictions of results and behaviours. Presentation of analysis and data mining tools with emerging technologies based on cloud computing and distributed computing: Hadoop, MapReduce and NoSQL databases. Data protection: General regulation for the protection of personal data n. 2016/679 and the data protection organizational structure. Corporate network and data protection plan: device configuration, backup and cybersecurity processes against the dangers of device theft and cryptolocker virus.	Analyse, manage, interpret big data and open data. Know and apply the right level of protection to the data (Reg. EU 679/2016 - GDPR). Know and adopt different copyright and license rules to apply to data, digital information and content. Apply different behavioural rules and know-how in the use of digital technologies and in the interaction with digital environments.	Method: Open-ended questionnaire. Criteria: The student must describe the application potential of complex predictive models based on large amounts of non-linear data and the use function of data protection systems in the company.	Classroom / laboratory: 16 hours Individual study: 12 hours	1
General legal and economic field	Find the sources and apply the regulations that regulate the life of the company and its external relations at national, European and international level. Know the constitutive factors of the company and the impact of the company in the reference territorial context.	Company and Project Management	Key business functions in the automation sector; international principles and Project Management standards; patenting and intellectual property protection.	Organize and manage work for projects within the company's processes; apply PM techniques; know the process of awarding an industrial patent.	Method: Exercise. Criteria: The student must demonstrate the working techniques for projects within the sector organizations and in accordance with the legislation on the protection of intellectual property.	Classroom / laboratory: 20 hours Individual study: 20 hours	1,5

	Use negotiation strategies and techniques with reference to the market contexts in which the companies in the reference sector also operate to strengthen the image and competitiveness.	Quality assurance and documentation	Application of the UNI EN ISO 9001: 2015 standard; quality policy and concept; Certification process; monitoring.	Understand the ISO EN 9001-2015 standard and the requirements for implementing a QMS.	Method: Written multiple choice test. Criteria: The student must demonstrate knowledge of the requirements of the ISO EN 9001-2015 standard.	Classroom / laboratory: 12 hours Individual study: 8 hours	1
General organizational and management area	Know and help to manage the quality of organizational models that encourage innovation of companies in the sector. Know, analyse, apply and monitor, in specific contexts, management models of production processes of goods and services. Analyse, monitor and control, for the part of competence, the production processes in order to formulate proposals/identify solutions and alternatives to improve the efficiency and performance of the technological and human resources used with a view to continuous improvement.	Environmental management and sustainability	ISO 14001 standard; EMS and environmental impact; waste management, LCA. Environmental focus: reduction of energy and raw materials consumption and of the environmental impacts of the production processes; recovery, reuse, recycling and disposal of parts and components at the end of their useful life; digital revamping of machines and systems	Know the environmental protection systems at industrial production level; apply techniques for the sustainable management of the life cycle of automatic machines.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student must demonstrate the life cycle approach to sustainable management of automatic machines and the circular economy approach to recovery, reuse, recycling and disposal of parts and components at the end of their useful life.	Classroom / laboratory: 12 hours Individual study: 10 hours	1

Common professional technical skills - Made in Italy technologies - Mechanical system	Develop and implement design, manufacturing and prototyping techniques. Research and apply the technical and safety regulations of the electrical, electronic and mechanical sector in the design and use of components.	Electrical design techniques II	Electric motors (continuous, asynchronous, step-by-step, brushless), static power converters, drives with electric motors and servomotors. Efficiency classes of electric motors and IEC 60034-30: 2008 standard D size and choice of electric cars. Testing the functionality of electrical machines.	Apply electrical principles to design techniques; develop and implement design techniques	Method: Exercise Criteria: The student must be able to carry out the configuration and calibration of an electric car	Classroom / laboratory: 72 hours Individual study: 32 hours	4
		Mechanical drawing II	Parametric solid modelling based on features of the machining applied on the solid model and construction schematics. File management, libraries; rendering; simulation, control and validation of projects. Pro/Engineer 3D, family tables, advanced functions for creating assemblies and drawing tables.	Represent mechanical groups and make component drawings	Method: CAD practice test Criteria: The student must be able to perform 3D modelling of mechanical groups and to carry out the design of components	Classroom / laboratory: 50 hours Individual study: 24 hours	3
		Mechanical design techniques II	Mechanical elements applied to machines, sizing criteria for commercial elements, fatigue stress for metallic materials. Transmission and control elements: transmission between skewed axes, worm gears, eccentric and cams, connecting rod-crank mechanism, flywheel masses. Three-dimensional technical design of machines and mechanisms with 3D CAD drawing systems and study of movement and transmissions. Table setting with graphic conventions.	Design mechanical components; identify solutions and choose components; develop and implement the techniques of design, prototyping and industrialization of the machines.	Method: Exercises in CAD. Criteria: The student will have to demonstrate an ability to design a mechanism/machine with the use of 3D CAD systems.	Classroom / laboratory: 52 hours Individual study: 24 hours	3
		Pneumatic design techniques II	Pneumatic components, calibration and choice of pressure and vacuum components. Pressure tanks and other pressure components (pipes, vessels and valves). Types of vacuum and vacuum pumps: wall-shifting, momentum transfer, trapped. Vacuum pump characteristics: speed, pressure	Use pneumatic design tools and vacuum technology	Method: Exercise. Criteria: The student will have to demonstrate an ability to select and calibrate the pressure and vacuum	Classroom / laboratory: 16 hours Individual study: 8 hours	1

			range and flow rate. Energy saving.		components of a pneumatic system.		
	Programming industrial automation systems (PLC, robots, CNC machines, communication networks, monitoring and diagnostics systems, etc.). Configure, size, document and maintain automatic systems of different types.	Architectures and configuration of industrial control systems II	Configuration of control systems and communication networks in automation, architectures for motion control systems. Structured text language. Finite state machines. The architecture of the control software of an automatic machine. Fieldbuses and remote I/O components. Operator interfaces. Interaction with robots.	Program systems for the control, cyclic synchronization of the axes and the management of complex movements of an automatic system.	Method: Exercise. Criteria: Starting from the analysis of a case study, the student must be able to configure and program a controlled handling system.	Classroom / laboratory: 64 hours Individual study: 30 hours	4
		Control and application of robots to industrial automation and vision systems	Industrial manipulators, mechanical characteristics and their applications. Environments and programming languages and configuration of industrial robots. Sensors for vision systems, integration with industrial robots.	Know, configure and program robotic systems and vision systems for product handling	Method: Exercise. Criteria: Starting from the analysis of a case, the student must be able to configure and program a robotic system integrated by a vision system.	Classroom / laboratory: 48 hours Individual study: 24 hours	3
		Plant supervision with SCADA	Characteristics of a basic SCADA, configuration of SCADA, network and alarm services. Driver installation. Database management. Graphic objects. Writing a basic application.	Know how to recognize the main characteristics of a SCADA and manage its basic applications.	Method: Exercise. Criteria: Starting from the analysis of a case, the student must be able to configure a supervision system (SCADA).	Classroom / laboratory: 24 hours Individual study: 12 hours	1,5
		Industrial control software II	CAD/CAM applications to program production processes of prototypes and finished manufacturing parts. The generation of toolpaths for CNC machining starting from CAD models and assemblies. Post-Processor SW for ISO coding of CAM packages. Virtual models applied directly on production systems (in loop design). Automatic	Program the production processes of prototypes and finished parts through CAD-CAM applications.	Method: Exercise. Criteria: The student must be able to generate the tool paths of a MUCN on a CAM station starting from the CAD model of the piece to be machined.	Classroom / laboratory: 40 hours Individual study: 16 hours	2

			management of machining tools (workpiece change mode). Advanced CAD/CAM solutions for manipulation and preparation of 5-axis mathematical machining models.				
	Identify the materials, the relative processes and the treatments suitable for various uses.	Materials II	Classification, standards and physical-mechanical characterization of polymeric materials. Main properties and selection criteria: rigidity, strength, manufacturability. Injection moulding process (process modelling, moulds, feeding and cooling, process variables). Joining methods, snap fit. Addition and condensation polymers. Sol gel method for the synthesis of colloids. Gel, xerogel and aerogel. Polymer matrix composite materials (classification, standards, physical-mechanical characterization methods, main properties). Production technologies: autoclave lamination and moulding, micromechanical approach. Cost of the different materials and metal replacement assessments.	Choose the most suitable material for construction of the machine/plant.	Method: Multiple choice test. Criteria: The student will have to demonstrate an ability to recognize the characteristics and properties of different materials.	Classroom / laboratory: 20 hours Individual study: 10 hours	1
	Choose the processing technologies and the relative machines on the basis of the technical-economic characteristics required.	Mechanical processing II	Forging and forging processes. Hot pressing: burr channel and its function. Calculation of the total moulding force. Burr plane, draft angles, fillet radii, oxidation, shrinkage. The massive forming of crankshafts, connecting rods and gears and components (blades, discs). Extrusion and drawing processes. Hot and cold extrusion. Direct, indirect, hydrostatic, impact extrusion. Matrices and extrusion ratio. Friction, extrusion speed and working pressure. Cladding. Drawing: dies, products, lubrication. Calculation of the lower opening angle of the die to minimize the drawing tension. Calculation of the theoretical maximum reduction value. Drawing of	Know the manufacturing technologies for industrialization and production of mechanical components; choose the processing technologies and related machines.	Method: Exercise with case analysis. Criteria: The student will have to correctly select the processing techniques for the production of metal components.	Classroom / laboratory: 36 hours Individual study: 16 hours	2

			pipes. Upsetting and electro-upsetting. Additive manufacturing. Additive manufacturing processes: a) conversion of photosensitive polymers (stereolithography); b) the deposition of molten thermoplastic materials; c) lamination of sheets; d) powder fusion (Selective Laser Sintering and Powder Spraying) Stereolithography for rapid prototyping through: generation of STL files from CAD model or with reverse engineering; slicing; layer by layer construction; after-treatment.				
	Intervene in all segments of the supply chain from production to marketing. Manage production flows in their programming, control and cost-effectiveness, also in relation to the logic of industrialization and continuous improvement.	Production planning and logistics	Production planning, internal orders, product logistics, component management, types of logistics costs, lean production.	Manage production flows in programming, control and efficiency.	Method: Exercise with case analysis. Criteria: The student will have to correctly set up a production schedule based on cost configurations.	Classroom / laboratory: 8 hours Individual study: 8 hours	0,5
	Apply fault prevention, analysis and diagnostics methodologies on systems and plants and propose possible solutions. Manage post-sales and maintenance needs.	Diagnostics of repair and maintenance interventions and after-sales management	Probability methodologies and parameters of reliability, availability, maintainability, safety (RAMS) of a component, availability in repairable systems and description of the life of the components; fault schematics, RCM approach: functional blocks and plate performance, predictive analysis (FMEA/FMECA) of the functional block failure conditions, tasks and maintenance policies.	Apply methods of prevention, analysis and diagnostics.	Method: Exercise with case analysis. Criteria: The student will have to correctly set up a preventive and predictive maintenance program.	Classroom / laboratory: 8 hours Individual study: 8 hours	0,5

Specific technical professional skills for the job		Teamwork cross module (design, assembly, disassembly and testing of a complete automation)	Electro-mechanical and pneumatic assembly of components and sub-groups and testing and testing procedures for complete machines; plant qualification and validation. Reconstruction of a production cycle, from design to final testing, Virtual commissioning and 3D printing.	Develop technical solutions to design, build, dismantle and test a complete automation.	Method: Evaluation of team work outputs. Criteria: The student must demonstrate the production cycle (from design to testing) of a complete automation.	Classroom / laboratory: 60 hours Individual study: 25 hours	3,5
INTERNSHIP II			Curriculum objectives in areas of: a) design and prototyping; b) production and industrialization; c) automatic systems and industrial automation. Individual or small group participation in the development of an existing company project or assignment of an ad hoc project on automation applied to automatic machines	Consolidate technical-specialist knowledge acquired in the course	Method: Observation and verification of the intern's performance by evaluating their effective exercise of knowledge and skills. Self-evaluation and reworking of the experience by the student. Criteria: The chosen evaluation will include an evaluation judgment of the company tutor and subsequent feedback with the student's self-evaluation by the agency's educational. The result of the combination of hetero and self-evaluation constitutes the summary report of the experience, which will be one of the objects of the final exam	Internship in the company: 480 hours Individual study: 60 hours	22

Total hours in classroom/laboratory in year II: 604
Total internship hours in year II: 480
Total sum hours in year II: 1,084

Progression rules (prerequisites)

Successful completion of the first year is necessary to access the second year of the course and only upon obtaining 60 credits.

At the end of the course in year II, the diploma of Advanced Technician is obtained after passing a final test. The diploma stipulates the technological field and the national classification/standard, which allows access to public competitions and universities with the recognition of university credits. The EUROPASS certificate is also issued in Italian and English.

Intnership abroad

Participants are given the opportunity to carry out part or the entire internship period in foreign companies. Credits are recognized without any further activity or learning verification being requested from the student.

Flexibility/customization

Preparatory modules of REALIGNMENT, specifically for the topics of Technical Drawing and Studying Mechanical Drawings (40h), Electrical Engineering/Electronics (40h). Realignment is mandatory for all participants who do not pass the initial technical assessment. These hours are to be considered in addition to the expected course hours. It may be possible to organize an extracurricular training course in English.

Credit calculation criteria

The calculation criterion applied is the following:

1 credit = sum of classroom hours / laboratory / enterprise / internship + individual study hours / 25 hours (except for rounding up).

Course location

ITS MAKER Foundation

Headquarters of Assoform Romagna

Piazza Cavour, 4 - 47921 Rimini (RN)