Course title

Advanced Technician in the integrated management of industrial processes

Course profile

Advanced Technicians for control and optimization of industrial processes manage the production process by applying digital technologies of Industry 4.0 and the principles of continuous improvement (lean production). They deal with the analysis of the technical-design specifications relating to the processing of the product and verify its feasibility/production on the production lines. Using digital control, supervision and acquisition systems, technicians collect and manage the data generated by sensors and are able to analyze industrial costs and the efficiency of the production process, program maintenance policies and verify the need for technological updating of the installations.

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)

0715 Mechanics and metal trades

Job title (national classification/standard)

Advanced technician for the innovation of processes and mechanical products

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;
- Apply the principles of continuous improvement and Lean Production;
- Configure and manage supervisory control systems and data acquisition of Industry 4.0;
- Know, configure and manage cloud computing and cloud-based manufacturing systems;
- Collect and manage the data generated by sensors;
- Analyse the industrial costs and the efficiency of the production process;
- Plan maintenance policies and check the need for technological updating of the plants.

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	Master linguistic tools and information and communication technologies to interact in daily activities and work contexts.	Advanced Excel	Formulas, graphs and macros for recording, viewing and analysing quantitative data and obtaining significant information relating to work processes. Dynamic acquisition of data from external sources, analysis, validation, use as a database, subtotals, pivot tables, slicers, filters, reports, advanced formulas, graphs.	View and analyse quantitative data and obtain significant information relating to work processes with Microsoft Excel application	Method: PC practice test. Criteria: The student will have to correctly demonstrate advanced functions of Microsoft Excel.	Classroom / laboratory: 16 hours Individual study: 10 hours	1
		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 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).	Know how to use online collaboration tools. Know how to use presentation and communication tools. Know how to intervene in digital communication activities: digital marketing, positioning and optimization on search engines (SEO).	Method: PC practice test. Criteria: The student must correctly demonstrate use of online collaboration tools and/or presentation and communication.	Classroom / laboratory: 16 hours Individual study: 10 hours	1

	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 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
	Arrange, negotiate and develop activities in working groups to face problems, propose solutions, help produce, order and evaluate results.	Team Working	Life cycle of a team; motivation, role of team leader; team building; team management; management of critical issues and conflicts; performance management (outdoor methodology at IAL Campus in Cervia - Cooking in the kitchen and in the dining room; Orienteering in the city).	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 collaborative skills, listening and proposing solutions.	Classroom / laboratory: 16 hours Individual study: 10 hours	1
General Scientific and technological field	Use statistical tools and models in the description and simulation of different phenomenologies of the sector, in the application and development of the appropriate technologies.	Descriptive statistics and quantitative analysis techniques	Elements of descriptive statistics: graphical representations and study of phenomena by frequency, distribution, average, variability and concentration indices. Introduction and data collection: basic concepts; types of data. Data visualization: tables and graphs for categorical and numerical data. Summary statistics and numerical measurements: Central Trend Measures; Position Measurements (Non-Central); Box-and-whiskers Plot; Variability measures; Form of Distribution; Identification and Treatment of Outliers. Statistical reporting.	Use statistical tools and models.	Method: PC practice test with business case analysis. Criteria: Starting from a given business case, the student will have to demonstrate how to use descriptive statistics and quantitative analysis techniques.	Classroom / laboratory: 24 hours Individual study: 36 hours	2,5

			Random variables and normal probability distribution: linear combinations of random variables and standardization; normal probability and distribution.				
	Use tools and methodologies specific to experimental research for the applications of the technologies of the sector.	Relational databases	Data models and representation of reality. Physical (of applications from the organization) and logical (of data) independence. Levels of data description: logical scheme, internal and external. Addressing of data through indexes: data files and index files. Coding of physical reality (conceptual design) and representation using a relational model (logical design). Entities, attributes, associations, relationships. Table or scheme: tuples, domains and keys. Queries, forms and reports. Management creation in Access.	Use experimental research tools and methodologies.	Method: PC practice test. Criteria: The student will have to demonstrate an ability to query a relational database.	Classroom / laboratory: 30 hours Individual study: 32 hours	2,5
General legal and economic field	Find sources and apply laws relevant to the company and its external relations at national, European and international level.	Machine safety	Risk analysis and assessment: definition of machine limits, identification of hazards, risk assessment and reduction strategies. Security by design: the design of security functions and protective devices. Monitoring of safety signals: control systems (modules, configurators and safety PLCs). Functional Safety and Electrical Safety Related Control System (SRECS).	Be able to identify (notice) situations of potential danger in the operation of machines and plants and report them to the competent office.	Method: Multiple choice test. Criteria: The student must demonstrate knowledge on current directives for the safety of machines and systems.	Classroom / laboratory: 24 hours Individual study: 36 hours	2,5

General organizational and management area	Manage relationships and collaboration within the organizational structure within a work context, evaluating their effectiveness. Manage external relationships and collaborations - interpersonal and institutional - evaluating their effectiveness. Recognize, evaluate and resolve conflict situations and work problems of different natures: technical, operational, relational and organizational.	Communicate and relate to work	Negotiation situations and negotiation techniques; conflict situations and conflict management techniques; personnel relationships: the relationship between technical and emotional skills in determining company results.	Apply negotiation and conflict management techniques.	Method: Oral exam through simulations and role playing. Criteria: The student must demonstrate the use of effective communication techniques and/or negotiation and management of potentially conflicting situations.	Classroom / laboratory: 16 hours Project Work: 16 hours Individual study: 44 hours	3
	Organize and independently manage, the working environment, personnel and the reference technological system in order to achieve expected production results.	Corporate organization principles: processes, roles and functions	The organization: structure and coordination mechanisms. Organizational structures compared: 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. Represent the organization: organization charts, flowcharts and process schemes. Define process standards and performance indicators: times, quality, costs. Managing the organization: organizational analysis, organizational development and change management.	Identify the characteristics of the company organization, in terms of the configuration of work processes and related management logics functional to their optimization.	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: 16 hours Individual study: 24 hours	1,5

			Organizational learning and human resource management. Non-formal organization and organizational cultures.				
		The HSE model of workplace management	The company's HSE (Health Safety Environment) structure to safeguard workers; health and safety and environmental protection. Integrated risk management; integrated management of plant safety and protection of the working environment. Technical and managerial governance of business continuity. Risk assessment for the user of machines and ISO/TR 14121-2 Safety of machinery.	Apply company regulations and procedures for the prevention of accidents and safeguarding of health and safety conditions in the workplace, effectively managing general and specific risks.	Method: Multiple choice test. Criteria: The student must demonstrate knowledge of the HSE model of integrated risk management.	Classroom / laboratory: 16 hours Individual study: 24 hours	1,5
	Know and help to manage quality organizational models that encourage innovation in companies in the sector.	Integrated quality management systems	Phases of construction of a Quality Management System Planning and development of the program. Quality policy. Preparation of flows and processes. Preparation of the documentation. Staff training. Certification process. The integration of environmental and safety management systems with quality management systems. Comparison of the requirements of ISO 9001, ISO 14001, BS OHSAS 18001 systems. The BS PAS 99: 2006 Guideline for system integration	Manage organizational quality models.	Method: Open-ended questionnaire. Criteria: The student will have to demonstrate knowledge of the Integrated Management Systems (Implementation, certification and maintenance).	Classroom / laboratory: 24 hours Project Work: 8 hours Individual study: 44 hours	3

Common professional technical skills - Made in Italy Technologies Area - Mechanical system	Identify materials, the relative processes and treatments suitable for various uses.	Processing technologies and systems I	Fusion (models and core boxes for transitional forms. Permanent and characteristic casting of the shells). Plastic deformation (hammers and presses, cold plastic deformation of the sheets). Lamination (plates, sheets or plates). Direct, indirect, hydrostatic, impact extrusion. Drawing: dies, products, lubrication. Stamping and forging. Cutting and removal processes (metal cutting mechanics, metal workability and chip formation and morphology mechanisms). Welding and joining (types of joints, welding techniques).	Identify materials, processes and treatments and choose the processing technologies.	Method: Open-ended questionnaire. Criteria: The student will have to demonstrate knowledge of the main processes of materials in metal.	Classroom / laboratory: 30 hours Individual study: 16 hours	2
	Choose the processing technologies and relative machines on the basis of the technical-economic characteristics required.						
	Manage production flows in their programming, control and cost-effectiveness, also in relation to the logic of industrialization and continuous improvement.	Configuration models of production technologies	Work-shop model (workshop with departments): criterion of technological order (by process). Transfer production line model: sorting criterion by work cycle (by product). Group Technology, production cells and Flexible Manufacturing System. Comparative advantages and disadvantages in terms of productivity, flexibility, planning, circulating material, balance, reliability.	Configure production technologies.	Method: Exercise. Criteria: Starting from a case study, the student must be able to compare the advantages and disadvantages of the different production technology configuration models.	Classroom / laboratory: 24 hours Individual study: 12 hours	1,5
		Production planning, execution and control	Production management as an integrated logistics component. Aggregate production planning. Requirements planning: MRP and JiT. Types of production; pull and push systems; main and operational production plan; scheduling; order management; budgeting, analysis and determination of intermediate cost configurations, full cost and sale price.	Manage and control production.	Method: Exercise. Criteria: Starting from a case study, the student must be able to analyse and describe the configuration of a production plan.	Classroom / laboratory: 24 hours Individual study: 12 hours	1,5
	Develop and implement design, manufacturing and prototyping techniques.	Reading and interpretation technical drawings	UNI and ISO standards; paper formats, definitions and principles regarding technical drawings, types of lines, units of measurement, dimensional scales; axonometries, orthogonal projections,	Be able to interpret mechanical technical drawings	Method: Practice Test. Criteria: The student must	Classroom / laboratory: 32 hours Individual	2

			sections, crosshatching, dimensioning, tolerances. Regulatory and unifying bodies: ISO, CEN, UNI, ANSI, DIN, etc. Cogency level. Basic technical drawing standards (EN ISO 128). Graphical representation techniques (methods and standards. Orthogonal projections - technical sections). Graphic conventions in the table setting. Cartouches and annotations. Dimensions and standardized dimensioning systems. ISO system of dimensional and geometric tolerances. Surface state and roughness. Designation regulations for metallic materials (UNI, ANSI, CEN). Introduction to machine design (shaft-hub, threads, joints, gears, etc.). Critical reading, coding and interpretation of production company technical drawings.		demonstrate an ability to identify the unified designations of elements and technical drawing objects of mechanical components.	study: 18 hours	
		Product industrialization	BOM structure and manufacturing cycles. The planning of the process: study of the working cycles, definition of the cycle, phase, sub-phase, elementary operations of working and assembly of parts and components. Process selection: product-process matrix, identification of manufacturing technologies/assembly equipment and scheme of production layout strategies. Decoupling point between sales order and production for the determination of lead times and investment in stocks. Eco-design solutions, to encourage the reduction of the use of raw materials and energy, reuse and recyclability of waste or by-products of the processes during the production phase.	Manage the industrialization of the product from the definition of the processing line to the selection of technologies.	Method: Exercise. Criteria: The student must be able to configure a production cycle starting from the request for materials of the product.	Classroom / laboratory: 28 hours Individual study: 10 hours	1,5

	Configure, calibrate, document and maintain automatic systems of different types.	Computer networks	Differences between packet switching and circuit switching. Transmission of signals on: copper, fibre, laser, radio waves, WiMAX and WiFi. Choice of the most suitable transmission medium. WiFi and related security issues. Study of the different network topologies. IP addresses and classes. Features of: Hubs, Repeaters, Switches and Routers. Client/Server architecture and main services: FTP, HTTP, SMTP, IMAP with secure and SSH versions. How DHCP and DNS work. Features of the Firewall operation and tables. NAT and PAT. Operation, use and types of VPN. Reading the scheme of a network. Examples and design. Cyber security: security problems in networks and in the collection, management and storage of data and information. IS0/IEC 27001 Information Security and Privacy. ISO/IEC 20000 Management of IT Services. Data Warehouse Architecture and Modelling (DWH).	Identify the type of hardware and software of servers in relation to the needs of the system (applications in use, database, etc.).	Method: Exercise. Criteria: Starting from a case study, the student must be able to identify the design of computer networks for data transmission and communication protocols.	Classroom / laboratory: 32 hours Individual study: 18 hours	2
	Programming industrial automation systems (PLC, robots, CNC machines, communication networks, monitoring and diagnostics systems, etc.).	Object-oriented programming	Introduction to computational thinking. Read and produce sequence and flowcharts. Write and read pseudocode. Paradigm of imperative programming and specifically object-oriented programming. UML modelling language Programming in Java (Basic Constructs, Arrays, Text Files, Classes) Solve recurring problems with programming.	Translate technical specifications into compliant modules through the use of development tools and object-oriented programming languages.	Method: Exercise. Criteria: The student must be able to develop modules in Java language that comply with technical specifications.	Classroom / laboratory: 44 hours Individual study: 20 hours	2,5
	Research and apply the technical and safety regulations of the electrical, electronic and mechanical sector in the	Electromechanic al systems and components.	DC circuits and networks, single-phase and three-phase alternating current; electrical machines, industrial electrical systems, legislation and regulations in the electrical sector, risks of electrical	Know how to recognize electromechanical systems and components.	Method: Exercise. Criteria: Starting from a case study,	Classroom / laboratory: 26 hours	1,5

	design and use of components.		current on the human body and for electrical systems; building blocks of an automation system, auxiliary command and signalling devices, main types of on-off sensors, relays; contactors, electromechanical logic circuits (wired logic), actuators, PLCs, typical industrial electrical diagrams. Electrical panels and plant engineering on the machine.		the student must be able to identify the building blocks of an automation system and describe its functionality.	Individual study: 11 hours	
		Hydraulic systems and components	Components of a hydraulic system: actuator; servo valve (amplifier); regulator; power unit (pumps). Power supply: pump, electric motor, coupling, level switch, temperature alarm sensor, vent plug, filter, tank. Hydraulic movements: linear and rotary actuators, position and speed controls, through analogue and digital position transducers (potentiometric, inductive, magnetosonic, linear encoders). Pressure transducers for closed loop force or pressure controls. Fixed displacement pumps (gear; screw; vane) and variable displacement (axial piston; vane). Types of servo valves based on the relationship between the axial length of the piston and the width of the ports (with positive, negative and zero coverage). Dynamic study: flow rate, escape between cylinder and piston and return to the tank.	Know how to recognize hydraulic systems and components.	Method: Exercise. Criteria: Starting from a case study, the student must be able to identify the building blocks of a hydraulic system and to describe its functionality.	Classroom / laboratory: 16 hours Individual study: 8 hours	1
		Propulsion and drive systems	Combustion technologies of internal combustion engine (efficiency of the electronically controlled diesel injection, combustion and emissions) and of the power transmission from vehicle to road/off road. Features, evolution and areas of use of electric motors (continuous, asynchronous,	Know how to recognize propulsion and drive systems.	Method: Exercise. Criteria: Starting from a case study, the student must be able to identify the constituent elements of a propulsion and	Classroom / laboratory: 18 hours Individual study: 8 hours	1

			step-by-step, brushless), static power converters and drives with electric motors and servomotors. Electrification-hybridization of powertrain systems (for off road motor propulsion) and for actuators of automation systems. Coupling mode between internal combustion engines and electric machines. Environmental focus: electrification of power train systems and reduction of emissions.		drive system and to describe its functionality.		
		Metrology, measuring instruments and test systems	General information on measurements: sensitivity, precision, repeatability, reproducibility. Surface roughness 'Ra': analytical and geometric definition. Sampling lengths. Unified symbolism. Workshop measuring instruments: the Caliper and the Vernier principle, small gauge, micrometre, clock comparators, bore gauges, Johansson blocks Reference standards and ISO guides covering testing, certification and accreditation activities (UNI CEI EN 45000 series). Type tests and production surveillance. Verification on samples taken from the factory or from the open market. Acceptance tests of the production quality control system. Monitoring and verification of control. Evaluation and acceptance of the factory control system. Batch tests. 100% tests.	Correctly use measuring and testing instruments and methods.	Method: Practice Test. Criteria: The student must be able to correctly use the workshop measuring instruments in application of the test protocols and quality verification in production lines.	Classroom / laboratory: 30 hours Individual study: 10 hours	1,5

Specific technical professional skills for the job	Apply integrated continuous improvement techniques (Lean, WCM, TPM).	Lean manufacturing and continuous improvement	The principles of lean manufacturing: mapping the value (VSM); identify and eliminate waste (7 Muda); make flow (produce one piece flow, visual management and Kanban for replenishment of stocks); cadence (calculation of takt time) and levelling of volume and production mix (Heijunka). The principles of lean manufacturing: poka yoke and zero defect objective; the 5S (Separation, Order, Cleanliness, Standardization, Discipline) to improve the work areas; SMED technique to reduce set up times; productive maintenance (TPM) and total efficiency of a plant (OEE). Cost deployment: analysis of losses, costs and causes of losses, impacts on the income statement, quantification of economic benefits and investment priorities. People development: gap analysis, organizational development systems and personalized training.	Recognize the organizational, production and management principles of Lean Manufacturing and continuous improvement techniques.	Method: Written test with business case analysis. Criteria: Starting from a given business case, the student will have to demonstrate an ability to classify the production system and propose alternatives to it in the perspective of Lean Production.	Classroom / laboratory: 48 hours Project Work: 8 hours Individual study: 30 hours	3,5
INTERNSHIP I			Alternatively, the following areas can be considered eligible for inclusion: processing and production technologies and systems; b) quality control, metrology, measuring instruments and test systems c) computerized management of data generated by company processes	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	Internship in the company: 400 hours Individual study: //	16

			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.		

Total hours in classroom/laboratory/PW in year I: 612
Total internship hours in year I: 400
Total sum of hours in year I: 1,012

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.	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 foreign languages. Criteria: The student will have to correctly demonstrate technical terminology and grammatical and syntactic use, as well as fluency in language conversation.	Classroom / laboratory: 30 hours Individual study: 45 hours	3
General linguistic, communicative and relational field	Manage the communication and relational processes inside and outside the organization both in Italian and English.						
General linguistic, communicative and relational field	Prepare technical and regulatory documentation that can be managed through telematic networks.	Documentation and technical manuals	Perspectives and drawings for use and maintenance manuals. Use and maintenance booklets; technical assistance manuals; process manuals; spare parts catalogues; instruction and training manuals. Technical files from Machinery Directive 2006/42/CE.	Recognize documentation and technical manuals.	Method: Open-ended questionnaire. Criteria: The student must understand the functions of technical documentation.	Classroom / laboratory: 16 hours Individual study: 24 hours	1,5
General linguistic, communicative and relational field	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.	Problem solving techniques for continuous improvement	Continuous improvement and great innovations. Problem inventory, selection of priorities, project-based approach, creation of the project team and problem solving sequence. Pareto diagram and choice of the problem. Flow chart and polar chart for the problem setting. Cause-effect diagram, correlation diagram and stratification for the research and analysis of causes	Apply problem setting and problem solving techniques in the management of production processes.	Method: Exercise. Criteria: Starting from a business case, the student must demonstrate the correct application of statistical tools for process controls.	Classroom / laboratory: 22 hours Individual study: 28 hours	2

			(diagnosis). Affinity diagram, schematic diagrams and multi-criteria matrix for the choice of solutions (solving). Statistical and managerial tools for process control: control cards for attributes and variables, control cards for R and for the average.				
		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: 14 hours	1
General legal and economic field	Know the relevant rules governing the company and the impact for the company in a territorial context. Use negotiation strategies and techniques with reference to the market in which companies in the sector also operate to strengthen their image and competitiveness.	Industrial organization and market structure	Types of industrial organization and market structure depending on the B2B or B2C outlet market and the type of product Organization of supply chains, concentration and market competition. Evolution of demand. Development of high value-added services for manufacturing companies.	Understand the main market dynamics and the forms of productive organization of the mechanical engineering goods.	Method: Open-ended questionnaire. Criteria: The student will have to demonstrate knowledge of the main forms of organization in the field of instrumental mechanics and industrial plant engineering.	Classroom / laboratory: 16 hours Individual study: 24 hours	1,5

General organizational and management area	Know, analyse, apply and monitor, in specific contexts, management models of production processes of goods and services.	Project management techniques and order management	Definition of the objectives of an order and drafting of specifications (start up, definition of the objectives, identification of the decision makers, drafting of specifications and the launch document). Work Breakdown Structure for the analytical breakdown of the macro-activities of production of the deliverables and description of the micro-activities (scheduling). Establishment of the order team (OBS): relationships between services, team members and project manager; allocation of resources and attribution of responsibilities. Definition of the project budget: analysis of contract costs (procurement, industrial costs and commitments of direct and indirect human resources), economic and financial budget, monitoring techniques. Project planning (PERT, GANTT): analysis of the constraints and identification of the critical path and the margins of variability, milestones of progress. Risk analysis: identification, measurement and management and insurance techniques. Computerized project management with MS Project: Project views; creation of a project file; activity list; resource list; working hours and calendar; project control; verification and printing of the programming; printing and creating reports.	Apply methodology and tools of Project Management in planning and managing work.	Method: Written test with business case analysis. Criteria: Starting from a given business case, the student must demonstrate an ability to correctly use tools of project management.	Classroom / laboratory: 36 hours Individual study: 34 hours	3

	Analyse, monitor and control 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.	Total quality management techniques	Evolution of quality management: from final testing of the finished product (artisan production), to production control (mass production), quality assurance of the production system, total quality and TQM. Deming cycle and PDCA approach to process management. The Japanese CWQC: total quality and lean production. Basic criteria of the TQM for World Class quality: leadership, strategic planning, human factor management, staff satisfaction, management of resources and processes (Quality System), customer satisfaction, business results, impact on the company . The management system based on the UNI EN ISO 9000: 2015 standard.	Know and apply the procedures envisaged for the management of company processes.	Method: Written test with business case analysis Criteria: Starting from a given business case, the student must demonstrate an ability to develop an improvement program by formulating performance indicators.	Classroom / laboratory: 28 hours Individual study: 42 hours	3
Common professional technical skills - Made in Italy Technologies Area - Mechanical system	Identify materials, relative processes and treatments suitable for various uses. Choose processing technologies and relative machines on the basis of the technical-economic characteristics required.	Processing technologies and systems II	Additive manufacturing: a) stereolithography; b) deposition of molten thermoplastic materials; c) lamination of sheets; d) powder fusion (Selective Laser Sintering and Powder Spraying). Rapid prototyping and additive manufacturing: generation of STL files from a CAD model or with reverse engineering; slicing; layer by layer; post-treatment. Energy beam processing: a) water jet (Water Jet and Abrasive Water Jet); b) sinker EDM (EDM) and wire EDM (WEDM); c) laser beam processing (LBM) for ablation, vaporization and erosion.	Recognize characteristics of the various mechanical technologies.	Method: Open-ended questionnaire. Criteria: The student will have to demonstrate knowledge of the main additive and energy beam production processes.	Classroom / laboratory: 24 hours Individual study: 16 hours	1,5

	Develop and implement design, manufacturing and prototyping techniques.	Advanced metrology	The uncertainty evaluation: Gauss curve and Student's T-distribution, regression line. Compliance: area of safe compliance, safe non-compliance and ambiguity. Relationship between measurement uncertainty and tolerance in production processes. Verification of conformity of measuring devices. Instrumentation management and metrological confirmation Characteristics and conformity of measuring instruments and definition of requirements. Choice of measuring instruments. Definition of calibration intervals or metrological confirmation. Calibration, analysis and data recording procedures. Storage, use and maintenance of measuring instruments. Control of environmental conditions.	Define operating methods (methods, tools and procedures) of quality control of the processes (assessments of process and/or product/service non-compliance and corrective or preventive actions of the work methods).	Method: Practical test in the laboratory. Criteria: The student must correctly apply the calibration, instrument management and data recording procedures for the qualitative measurement of the process and/or product/service appropriate to the various processes.	Classroom / laboratory: 26 hours Individual study: 20 hours	2
		3D CAD modelling	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. 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. 3D prototyping.	Realize 3D parametric solid modelling.	Method: CAD practice test. Criteria: The student must be able to perform 3D modelling of solids and surfaces.	Classroom / laboratory: 40 hours Individual study: 14 hours	2

	Manage production flows in their programming, control and cost-effectiveness, also in relation to the logic of industrialization and continuous improvement.	Analysis and management of industrial systems	Operational structure of the system: product schematics, manufacturing cycle, layout. Management structure: internal information system and functional organization chart. Interactions between the production system and the market context: analysis of demand and order scheduling procedures. Methods and procedures for managing industrial production in volatile environments (short product life cycle, uncertain product types and fluctuating production): Constant Work In Process and Seru-Seisan (product production cells). Similarities and differences with Group Technology based cell manufacturing. Industrial IT for flexible reconfiguration and vertical and horizontal integration of the logistics-production chain. The RAMI 4.0 model.	Manage production flows.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to define order scheduling procedures within product production networks.	Classroom / laboratory: 24 hours Project Work: 12 hours Individual study: 19 hours	2
		Analysis and accounting of industrial costs	Analytical accounting within the corporate administrative system. Cost classifications. Cost analysis methods: single and multiple base full costing, full costing for cost centres, activity based costing, direct costing. Cost and result configurations. Budgetary control and variance analysis. Cost of the main production factors: labour costs, cost of materials, costs of using technical fixed assets.	Analyse and monitor industrial costs.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to apply the methods of analysis of industrial costs.	Classroom / laboratory: 30 hours Individual study: 20 hours	2
	Programming industrial automation systems (PLC, robots, CNC machines, communication networks, monitoring and diagnostics systems, etc.).	Web Service programming	Server side programming through the Python language. Apache web server development on Raspberry Pi 3 architecture. Machine to Machine interaction and interoperability between web applications through an interface that can be processed by the machine in combination with open standards HTTP	Program interoperability between machines (Machine To Machine) and their control with remote access to data sources.	Method: Practice Test Criteria: The student will have to configure a web server with Apache on Raspberry Pi 3.	Classroom / laboratory: 28 hours Individual study: 20 hours	2

			Service Oriented Computing (SOC) based on independent software components. Protocol stack, reference standard and web service technology stack.				
		Dashboard design for operational intelligence	Operational intelligence for viewing processes, events and business operations in (near) real-time (unstructured or semi-structured data, coming from machines, sensors, logs and social media) on: a) state of applications, services or infrastructures, b organizational notices; c) performance problems. Executive/operational dashboard: graphical presentation of the current status (instantaneous) and historical trends of the key performance indicators (KPI).	Design interfaces for remote supervision of data collected in real time from industrial plants and from the operational structure.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to develop a dashboard project for operational intelligence.	Classroom / laboratory: 24 hours Individual study: 11 hours	1,5
	Configure, calibrate, document and maintain automatic systems of different types.	Sensors	Metrological definition of sensor: transformation of the input quantity into a signal. Classification: direct reading sensor, sensor connected to indicator instrument, sensor connected to recording instrument. Main types of sensors and respective applications: infrared, sound, acceleration, temperature, heat, electricity (resistan-ce, current, voltage, power), pressure, movement, force, proximity/distance, biometric, chemical. Weight meters. Bidirectional sensors (receiver/ transmitter), outline of the I/O Link protocol. Artificial vision systems. Advanced sensors with microelectronic technology (MEMS). Calibration and calibration. RFID principles - RFID reader and RFID tag (transponder) system: microchip, universal unique number and antenna for RFID radio transreceiver frequency transmission.	Know the main types of sensors and their applications.	Method: Practice Test. Criteria: The student must perform the selection, calibration and calibration of sensors based on an application.	Classroom / laboratory: 32 hours Individual study: 16 hours	2

		IoT connection	Short-range connection networks of embedded devices (SE networked and distributed networked): models, architectures and communication protocols. IoT protocols: Open Interconnect Consortium (OIC), AllJoyn framework, Thread protocol. The sub-GHz networks for IoT; extended range WiFi connections with IEEE 802.11ah WiFi. ZigBee and Z-Wave. Acquisition of analogue data through sensors controlled by Arduino and management through a database.	Configure and maintain integrated sensor systems and network transmission of detected data.	Method: Practice Test. Criteria: The student will have to configure an integrated sensor system by applying the short range network data transmission protocols.	Classroom / laboratory: 28 hours Individual study: 20 hours	2
	Intervene in all segments of the supply chain from production to marketing.	Make or buy analysis	In “make or buy” scenarios and vertical and horizontal integration levels of the company. Differential analysis of make or buy alternatives based on the expected quantity of production and sale of the asset. Methods for calculating quantitative variations with respect to internal production. Ceasing costs: raw materials, ancillary materials, energy, direct labour, general department expenses. Inactivity and reuse of internal production capacity: depreciation and emerging MDC. Source cost of supplying the product to the supplier and total purchase cost (including depreciation of plants, general expenses, labour). Total cost logic in calculating the differential contribution to corporate profitability. Qualitative assessments of supplies. Ex ante and ex post transaction costs of the buy alternative	Know the scope of make or buy choices and levels of vertical and horizontal integration of the company.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to make evaluations between make or buy alternatives by selecting the most convenient option.	Classroom / laboratory: 30 hours Individual study: 16 hours	2

		Integrated logistics systems	Supply chain characteristics and configurations: components, processes and roles (customers and suppliers), relationships and coordination (drivers and key decisions in SC Management). Pull and push strategies and decoupling point in the supply chain. Postponement strategies and strategic fit. Collaboration and coordination dynamics in the supply chain: whip effect of demand variability (Forrester) and Vendor Managed Inventory (VMI). Demand management: sales & operation planning and coordination contracts. Supply chain design: location of facilities, pooling of stocks, configuration of the logistics network, transport systems. Optimization of stocks in conditions of uncertainty: newsvendor problem. Multi-site management, localization of stocks and determination of safety stocks.	Manage relations with the supply chain also from an integrated perspective.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to develop supply chain configuration solutions (location of facilities, pooling of stocks, configuration of the logistics network, transport systems).	Classroom / laboratory: 30 hours Individual study: 20 hours	2
	Apply fault prevention, analysis and diagnostics methodologies on systems and plants and propose possible solutions.	FMEA methodology	Probabilistic 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 tree, RCM approach: functional blocks and plate performance, predictive analysis (FMEA/FMECA) of the functional block failure conditions, tasks and maintenance policies.	Apply the FMEA methodology for predictive failure analysis.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to apply methods of predictive analysis of the ways, effects and critical aspects of failures.	Classroom / laboratory: 16 hours Individual study: 11 hours	1
	Manage post-sales and maintenance needs.	Maintenance techniques	Cyclic preventive maintenance: cycles of use and failures due to wear; classification of machines, the log and standards; maintenance on condition: potential failure and tolerable limit value; types of predictive monitoring; categories of predictive signals or emissions; vibration analysis,	Apply different maintenance techniques.	Method: Exercise. Criteria: Starting from the analysis of a business case, the student will have to evaluate alternatives between	Classroom / laboratory: 28 hours Individual study: 12 hours	1,5

			malfunctions of gearboxes and rolling bearings, inspections with thermal imaging camera, electrical measurements of AC/DC motors; ultrasound investigations; PHM approach and soft-computing techniques for prognostics of the residual useful life.		preventive and predictive maintenance programs (on condition), selecting the most convenient option.		
Specific technical professional skills for the job	Configure and manage supervisory control systems and data acquisition.	Supervision and control systems	Electronic monitoring of physical systems through the distributed IT system. Components of SCADA systems (Supervisory Control and Data Acquisition): a) sensors for measuring physical quantities; b) controllers (PLC or microcomputer) for measurements and local storage of data continuously or at intervals of time; c) telecommunication system between microcontrollers and supervisor; d) supervisor computer for data processing. System functionality: 1) data acquisition on process status; 2) supervision through data visualization and observation of the evolution of the states of a controlled process; 3) control through variation of characteristic parameters of the process after data processing. Real time control capability. HMI to facilitate operator/system interactions. Sizing in relation to the area to be checked. Advanced HMI: augmented and virtual reality systems. Main solutions to supervise and control the production departments and production: TIA PORTAL - SIEMENS, MES-MOM.	Manage supervisory control systems and data acquisition.	Method: Test with open-ended questions. Criteria: Starting from the analysis of a business case, the student must describe the constituent elements and functionality of a supervisory and control system.	Classroom / laboratory: 28 hours Individual study: 20 hours	2
	Configure and manage cloud computing and cloud-based manufacturing systems.	Cloud systems	Cloud Computing features: scalability, pay-per-use (on-demand) model, access network, resource pool, rapid elasticity, virtualization, multi-tenancy	Know, configure and manage cloud computing and cloud-based manufacturing	Method: Test with open-ended questions.	Classroom / laboratory: 24 hours	1,5

			and monitoring services. Enabling technologies of Cloud Computing: 1) Virtualization of HW resources; 2) Types and technologies of virtualization. Service models (SaaS, PaaS, IaaS), architectures (frontend, backend and network) and deployment models (public, private, hybrid). Development of multi-tenant SaaS applications (Business and BPM): platforms (SaleForce.com, Windows Azure, EC2) and metadata-driven architectures. Security and privacy for the Cloud. Cloud-based manufacturing: network access to a configurable pool of manufacturing resources.	systems.	Criteria: Starting from the analysis of a business case, the student will have to describe the constituent elements and functionality of a cloud system.	Individual study: 16 hours	
INTERNSHIP II			Development of a personalized project concerning the digitalization of processes and/or the vision of an integrated production system/supply chain. Alternatively to joining a team appointed to follow the entire development cycle of a specific job order, the intern can be introduced to the various functional activities according to the sequential and process logic as required by the execution of a job: design , design, production/assembly and testing	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: 400 hours Individual study: 50 hours	18

Total hours in classroom/laboratory/PW year II: 588
Total internship hours in year II: 400
Total sum of hours in year II: 988

Progression rules (prerequisites)

Successful training 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.

Internship 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

For all admitted students, the alignment modules of English (30h), Mathematics (30h), Physics applied to Mechanics - kinematics, dynamics, static - (30h), Electrical Engineering and Electronics (30h), Office package - (40h). Construction is planned between the first and second year with collaboration in a realignment laboratory (120h) to enhance IT skills related to the digitalization processes. For needs of RECOVERY and preparation for summative checks and the final exam, a total of 200 hours is foreseen, and may be used as personalized support. These hours (ALIGNMENT, REALIGNMENT, RECOVERY) are to be considered in addition to the expected curricular path.

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

Reggio Emilia headquarters