Professional Qualification: RESEARCH, DEVELOPMENT, INNOVATION AND DESIGN PROJECTS MANAGEMENT, 3D PRINTING AND SCANNING, IN PROFESSIONAL ENVIRONMENTS.

Associated Vocational Families: (Electricity-Electronics, computing, Mechanical manufacturing)
Leve 3
Code: ESDEI3D_4
Draft 1
Situation Final

General competence

Develop 3D components manufacturing projects, establishing their features, developing layouts, undertaking all needed tasks to its processing, follow up and update, planning control costs, materials, equipments and documents applied to the Project throughout all phases of the process, in compliance with the relevant Regulation, and the established specifications and procedures. Researching and innovating to ensure the intended quality, as well as the personal and environmental safety.

Unit of competence

UC0009_3: Research, develop, plan, Schedule, innovate, control timings, provide the production, supervise the start-up, as well as the maintenance of 3D scanning and printing systems. Considering the installation conditions and the manufacturer's recommendations, guaranteing precaution, safety, environmental and quality conditions.

Professional Field

Professional context

It develops its profesional activity in the engineering area or technical office, which provides the venture projects department dealing with the design and manufacture of 3D printing items. Researching and innovating to ensure the quality of those components; which roles are the management of the projects, the planning control, the costs or the related documents, as well as the development of other projects dealing with the assembly and maintenance of 3D scanning and printing equipments.

Productive Sector

This qualification is set in different productive sectors:

- Engineering companies engaged in 3D models design.
- 3D scanning and printing asembly of installations in insustrial and auxiliary processes linked to the production.
- Research and innovation, and companies specialized in the management of projects.

Main jobs and employments

- 3D scanning and printing designer.
- 3D model planner.
- Higher Technician in design and maintenance of 3D scanning and printing systems.
- 3D model designer.
- Researcher of 3D models mechanical topology.
- Technical office technician, planning, costs control and 3D documents control.

Associated training (... h)
Formative Modules

UNIT OF COMPETENCE 3: Develop, Plan, Programme, Control of times, Supply the production, Supervise the start up, as well as the maintenance of 3D scanning and printing system, considering the installation conditions and the manufacturer's recommendations, guaranteing precaution, safety, environmental and quality conditions.

Level 3
Code UC0009_3

Professional achievement and implementation criteria

RP1: Preliminary proposal of the 3D printing and/or scanning work, setting a Plan and achieving the initial basic calculations.

CR1.1 The startig point is analysed according to a model established in the processes (Process/Subprocess), finding out the needed information for its complete definition.
CR1.2 The efficiency data of the subprocesses (activities), are determined from databases or from estimates provided by the person in cahrge and/or superior.
CR1.3 The lenght calculations are done using the starting point data, the formula provided by the model itself or the one stated.
CR1.4 The calculations of the links among the parts of the plan are developed without errors or mistakes, complying with the logic of the process of design and/or the construction resised by the modelo or those stated.
CR1.5 The plan is generated through a specific computer application, incorporating the sections or subprocesses of the model and introducing the results of durations and relationships.
CR1.6 The resulting plan is presented together with the calculations justifying the responsible and / or superior, according to the established formats.
CR1.7 The Base Plan is generated by incorporating the modifications proposed and agreed by all the responsible agents involved in this phase, being filed with the established format and codification.

RP2: Prepare general assembly plans and an exploded list of elements and/or materials, based on the initial proposal, their specifications and established design criteria, to achieve the expected quality levels.

CR2.1 The description and characterization of the printing and/or 3D scanning systems, of their components, and the regulations that affect the facilities, are identified for their application in the drawing process.
CR2.2 The plans are made applying the appropriate drawing standards and, where appropriate, the internal rules of the company and the established instructions.
CR2.3 The layout is made taking into account the conditions of exploitation, assembly and maintenance of the facilities, the characteristics and use, buildings where it is located and other types of factors.
CR2.4 The location and disposition of the printing and/or scanning machines, as well as the control elements, are fixed following the principles of accessibility, for assembly, maintenance and repair.
CR2.5 The arrangement of supports, fixed points and/or their constructive forms is carried out guaranteeing stability, avoiding mechanical stresses and unwanted deformations in the 3D printing and/or scanning equipment.

RP3: Determine the characteristics of the equipment, elements, materials, elaborating diagrams for the processes of printing and/or 3D scanning based on the conditions and previous design criteria, and complying with the application regulations.

CR3.1 The conditions and characteristics of the systems comply with the related regulations. Contemplating the safety standards and environmental protection.
CR3.2 The calculations of the magnitudes are made using tables, computer programs and established procedures.
CR3.3 The characteristics of the 3D elements are determined according to the type of equipment and installation. and its features responding to the requirements of it.
CR3.4 The necessary information for the elaboration of the 3D elements is included in the plans, sketches and / or diagrams.
CR3.5 Make the specifications report collecting all the data necessary for the preparation of the project: the purpose, location, functional and technical characteristics, as well as the equipment and elements, among others to be taken into account in the manufacture of 3D elements.

RP4: Select the equipment, tools, materials and control systems for the production of 3D elements, based on the specifications report and complying with the application regulations.

CR4.1 Equipments, supplies, materials and systems of control are chosen according to the current regulations, to the approval standars of the sector internal of the company.

CR4.2 The models and characteristics of the machines, equipment, and tools fulfill the required function
CR4.3 The adjustment and control parameters correspond to the technical specifications and characteristics included in the specifications report.
CR4.4 The choice of materials is made by combining the guarantees of quality, compatibility, reliability, durability, supply and costs.
CR4.5 The 3D printing and/or scanning equipment is uniquely identified with all brand references, model, among others, as well as with the approval standards to which it responds.
CR4.6 The general list of elements of the installation and safety measures with all the technical references, approval standards, identification of manufacturers and unit prices, among others, is included in the corresponding report and allows the preparation of budgets and the basic safety study.

RP5: Develop measurement and/or control programs in the 3D elements production processes, using the appropriate techniques, from the technical documentation and with the required quality.

CR5.1 It uses the necessary technical documentation (project, technical specifications, technical manuals and product manuals) to program the measurement and / or verification controls.
CR5.2 The needs to program the control systems are determined by identifying the equipment, elements, operation and accuracy of these.
CR5.3 The tools and control tools are selected according to the equipment, elements and precision of these.
CR5.4 The control program is prepared in response to the needs of the project.
CR5.5 The functional tests of the control program are carried out following the established procedure and verifying the correct execution.

RP6: Prepare the execution plan to carry out the manufacturing process, based on the data collected in the project (sketches, plans, diagrams and selected materials, with the required quality).

CR6.1 The plans and diagrams of the elements and control systems are represented taking into account, among others:

- The symbology and standardized conventions of application and, where appropriate, the internal rules of the company.
- The identification of the different systems and their components.
- The scale and the representation system most suited to the contents.

CR6.2 The graphic layout of the representation of the elements, their groupings and the systems of reference and coding in the different planes, is elaborated taking into account, among others:

- The established relations among them.
- The sequential follow-up of the production process and the facilities.
- The specifications of the equipment and the constituent elements of the installation.

CR6.3 The location of the equipment, its dimensions, elements and technical specifications are represented in the general plans and comply with the regulations and application standards.
CR6.4 The detail plans include the assembly of the elements to the printers and / or 3D scanners taking into account, among others:

- The construction forms and the dimensions of supports and / or anchors, pipes, equipment and environmental conditions.
- The transport, the passage through the accesses and the manipulation with the available means and in the required conditions of security.
- The security elements necessary for production, as well as their specifications and requirements

CR6.5 The current regulations regarding the safety of people, equipment and facilities are met in the defined implementation, achieving the established quality levels.
CR6.6 The general list of equipment, elements of the installation and security means is updated in the case of variations.

RP7: Determine costs in the processes of printing and/or 3D scanning, defining the manufacturing units and the quantities of each of them, applying established unit prices, based on the technical documentation of the project, and with the required quality

CR7.1 The established manufacturing units are decomposed, to obtain their cost, applying established procedures taking into account, among others:

- The elements that compose them.
- The quantities of each of them.
- Measurements and tolerances dimensional and/or geometric established, with their units.
- The operations to be performed.
- The conditions of assembly.
- The labor involved.
- The estimated time for execution.
- The quality conditions required and others that may arise.
- The total cost of each manufacturing unit.

CR7.2 The manufacturing units comply with the technical specifications of the project and those of the specifications.
CR7.3 The total set of units to be manufactured is calculated considering the work to be done and includes all the materials and elements used.
CR7.4 The measurements obtained are specified in the corresponding document with the required precision and are collected with the precise and standardized unit of measurement.
CR7.5 The information obtained is reflected in the corresponding document and allows the preparation of the budget.

RP8: Define the technical conditions of testing and implementation, providing proposals for innovative improvements or research in the field of competence, in technical documentation of the project of printing systems, 3D scanning, measuring and / or control elements, taking into account Count the required quality.

CR8.1 The technical specifications for the supply of materials, products and equipment, is prepared taking into account the characteristics, standards, regulations and approvals of manufacturing, quality and safety conditions.
CR8.2 The required reception tests are defined to ensure the established quality level.
CR8.3 The conditions of storage and handling of materials and / or equipment are extracted from the manufacturer's information.
CR8.4 The reception conditions and the test protocol of the facilities are clearly specified in the corresponding documentation.
CR8.5 The moments and results obtained are specified in the corresponding documentation.
CR8.6 The necessary technical documentation (project and technical specifications) is collected to prepare the work plan.

RP9: Prepare the manual of service and maintenance of the printing and / or 3D scanning systems, of the measuring and/or control elements, taking into account the technical documentation of the project, and the required quality.

CR9.1 The service instruction manual is prepared specifying the conditions of use, operation, safety and manual operations of operation.
CR9.2 The actions that must be followed in case of breakdown or emergency are specified in the service instruction manual.
CR9.3 The maintenance manual is prepared taking into account, among others:
- Inspection points for maintenance.
- The parameters to control.
- The operations to be performed.
- The means employed.
- The periodicity of the actions.

RP10: Prepare the basic study of safety, health and environmental protection for the execution of the project with the required quality.

CR10.1 The risk factors associated with the operations (transport of materials, assembly of elements and equipment, among others) are identified with precision.
CR10.2 Risks associated with risk factors are identified and preventive measures are indicated as well as the protections to be used, both individual, collective and environmental.
CR10.3 The basic study of safety, health and environmental protection is prepared taking into account the instructions for handling equipment and materials supplied by the manufacturer, as well as the experience obtained in productive processes of similar characteristics.

Professional Context

Means of production

Specific computer equipment and applications for computer-aided 3D design, CAD and measurement and control system programming for 3D element production processes.
Printers Scanner. Reproducing drawings. Drawing instruments. Calculator. Applications and specific environments for measurements and budgets. Office automation applications. software calculation and simulation. Tables and graphics.

Products and results

Initial proposal of the work. Proposal of the Plans. Design proposals for design. Innovative and / or research proposals applied to the designs of the models. Projects for the manufacture of 3D models. List of equipment and materials to be used. Process diagrams Detail plans. Plans of the facilities. Lists of materials. Control guidelines. Reports of feasibility studies of the manufacture of the product. Programs of measurement, verification and control of production. Manufacturing units. Costs of production, budgets. Technical specifications for testing and testing facilities. Tokens and records. Instruction manual for service and maintenance of equipment, tools and control elements. Basic study of safety, health and environmental protection.

Used or generated information

Project specifications. Reports. Diagrams of operation of machines and processes of printing and / or 3D scanning. Plans and schemes of equipment and systems. Regulations and regulations in force. Manufacturers catalogs List of instruments. Technical specifications. Design manual Technical documentation of standardized elements. Commercial catalogs and specific materials. AMFE of the product and design. Homologation requirements. Safety rules and protection of people, equipment and environmental. UNE, EN, IEC standards. Rules of symbology and representation of facilities (ISA, ASA, ISO, among others).

FORMATIVE MODEL 9: Research and Project Management of 3D printing and scanning systems.

Level 3
Code: MF0009_3
Associated to UC: Investigate, develop, plan, program, innovate, control times, provision production, supervise the start-up, as well as the maintenance of systems scanning and 3D printing, taking into account the installation conditions, and the manufacturer's recommendations, ensuring the conditions of prevention and safety, environmental and quality
Lenght: Hours

Capacities and evaluation criteria

C1: Analyze planning processes, valuing their usefulness, comparing the different methods used, and performing calculations without using specific computer applications.

CE1.1 Explain the difference between the notion of a project as a technical document and as a planned and directed action, specifying the relationship between both concepts.
CE1.2 Explain why planning in projects is useful and necessary, formulating a definition of the concept of planning adjusted to the development of projects.
CE1.3 Explain the elements common to all planning methods, defining the following concepts: process model, subprocesses, phases, subphases, activities and relationships.
CE1.4 Classify and compare the different types of planning methods, diagrams, critical path methods, differentiating their objectives, scope and calculation procedures.
CE1.5 Explain the different types of relationships between activities, inferring what the critical path consists of.
CE1.6 In a practical assumption of a basic 3D printing process, perform the calculations and make their equivalent representation in a basic diagram, solving all the parameters without using specific computer applications.
CE1.7 Explain the needs for monitoring, updating and reviewing the planning, describing the changes that the project undergoes during its development.
CE1.8 Describe the usual defects in the application of the planning of a project, associating its causes and effects.
CE1.9 Describe the factors of research and technological and organizational innovation in the work of project planning, assessing its impact.

C2: Analyze the processes associated with the development of projects, defining the phases that compose them and determining the necessary activities to include in their base program.

CE2.1 Relate the phases involved for the achievement of a project (initial definition, design, contracting, execution), determining the purpose of each phase, the result achieved (base program, design program, contracting program and execution program) respectively) and the temporal relationships that bind them.
CE2.2 Explain the level of detail that is reached in the previous definition of an action, and its corresponding base program, identifying the intervening and/or consulted agents during its elaboration and the roles that they perform.
CE2.3 In a practical case of a given project, determine the activities necessary to generate the base program, which includes all the phases that make up that same project.
CE2.4 Identify the stages (plan, study, preliminary project, project) that may be involved in the development of a project to manufacture 3D elements and the documents that comprise it, specifying the degree of definition reached by the design in each of these stages.
CE2.5 Describe the process of procurement or contracting, ordering the stages involved.
CE2.6 Describe the usual deviations in the temporal development of 3D element manufacturing projects, associating the measures to reduce them.

C3: Analyze the graphic technical information of the 3D models, prepare plans in the established support and obtain all the data that characterize them.

CE3.1 Relate the symbols of the elements with the function they perform.
CE3.2 Identify and represent with the applicable standard symbology: machines and equipment, automation and

control systems, materials, etc...

CE3.3 Select the most suitable supports and formats for the realization of the plans.

CE3.4 Choose the most appropriate graphic representation system.

CE3.5 Select the scale to be used, determine the elevations, floors, sections and details that are necessary for the best definition of the drawing.

CE3.6 Represent, according to the regulations, the elevations, floors, sections and details that are part of the graphic information contained in the plans.

CE3.7 Dimension the drawings according to their functionality and the assembly process.

C4: Identify the components of the 3D equipment, drawing up diagrams, analyzing their operation, and describing the operating parameters of the same and the facilities.

CE4.1 Given the 3D production equipment and characterized by its drawings and technical documentation:

- Interpret these plans of these equipment and the intended use to which they will be allocated.
- Identify its parts and elements, relating them to the symbols that appear on the plans.
- Identify the parts of said equipment and relate the dimensions that appear in the planes with reality.
- Describe the general operation of the equipment.
- Establish the operating relationships between the different systems and elements of said equipment.
- Describe the structure of the system and the elements that comprise it:
- Control elements.
  - Working parts.
  - Wiring and driving systems.

CE4.2 Classify the different control systems according to their technology and application.

CE4.3 Describe the elements of control, the elements of work and wiring, indicating their function, technical characteristics and relationship between them.

CE4.4 Describe the technical characteristics of the 3D equipment used and each of the parts of which the system is composed.

CE4.5 From the technical documentation of 3D equipment characterized by its drawings and technical memory:

- Check the main characteristics of the differentparts of those equipments.
- Check whether the regulations are applied.
- Prepare hypotheses about the effects that would produce on the operation of such equipment, the modification of the characteristics of the same or the malfunction of one or more parties.

C5: Develop measurement and/or control programs in the production processes of 3D elements, based on the specifications or conditions given and applying the regulations.

CE5.1 Based on specifications or given indications of a measurement and/or control system for 3D element production processes:

- Identify for its application the regulations that affect the layout.
- Draw and complete the general schemes, the situation of the elements of the same and the verification schemes.
- Complete and calculate the basic parameters so that they meet the conditions indicated in the specifications.

CE5.2 Finish and perform the calculation of the mechanical and dimensional magnitudes.

CE5.3 Select the equipment and elements of the installation from specific catalogs, responding to the characterization of the same.

CE5.4 Prepare a list of equipment, elements and dimensioned materials, using the nomenclature of the sector and indicating quantities and location of the verification elements.

C6: Design and develop measurement systems and/or control of production processes of 3D elements.

CE6.1 Compile the necessary technical documentation (project, technical specifications, technical manuals and product manuals) for use in the programming of the measurement and / or control system.

CE6.2 Determine the needs to program the measurement and/or control systems, identifying the necessary equipment, elements and tools.

CE6.3 Select the development tools and equipment according to the equipment and elements of the system.

CE6.4 In a practical case of elaboration of a measurement and/or control system using the documentation, tools and necessary equipments:

- Elaborate the measurement and/or control scheme.
- Prepare the execution diagram.
- Verify the functionality of the established procedure.

C7: Draw up plans and diagrams of the entire process of manufacturing 3D elements, using computer applications and starting from the sketches, diagrams and technical documentation collected in the project or in the general list of equipment and elements of the facilities.

CE7.1 Draw the plans and diagrams of the 3D models taking into account sketches, diagrams and technical documentation collected in the project or in general equipment and elements of the facilities.
CE7.2 Draw the plans and diagrams of the 3D models in the corresponding format and with the standardized graphic specifications of the sector.
CE7.3 Draw the plans using the most appropriate symbology and representation system and complying with current regulations.
CE7.4 Graphically dispose the elements in the plans in a way that allows knowing the relationships established between them, and the presence of other facilities involved in the process.
CE7.5 Draw the plans and detail schemes, taking into account their specific construction, dimensions and connections.

C8: Determine the manufacturing units and the cost in the processes of printing and/or 3D scanning, from the project documentation and taking into account standard scales, or unit prices extracted from catalogs.

CE8.1 Identify the manufacturing units indicating the elements or characteristics that compose them, the quantities of each of them, the operations to be carried out in each one of them, assembly conditions, manpower involved and the time necessary for the execution.
CE8.2 Elaborate the costs of the manufacturing units taking into account the standard scales used in the sector or the unit prices extracted from catalogs.
CE8.3 Prepare the total cost of the process taking into account the total number of manufacturing units.
CE8.4 In a practical case of calculation of costs of a 3D model manufacturing project, using the necessary documentation and tools:

- Identify the measurements with their units.
- Identify the manufacturing units, and the quantities of each of them.
- Identify the materials and resources used.
- Calculate the estimated time for execution.
- Calculate the cost of the facilities.
- Prepare the budget in the established format or software.

C9: Determine the technical conditions of testing and commissioning by providing proposals for innovative improvements or research, applied to 3D printing and scanning systems, and/or measurement and/or control elements, taking into account the technical documentation and quality required

CE9.1 Identifies the technical specifications required to select the supply of materials, products and equipment, taking into account the characteristics, standards, regulations and homologations of manufacturing, quality and safety conditions.
CE9.2 Perform the reception tests required to ensure the level of quality established.
CE9.3 Apply the conditions of storage and handling of the materials and / or equipment, extracting the information from the technical documentation provided by the manufacturer.
CE9.4 Apply the reception conditions and verification protocols of the facilities according to the specifications of the corresponding documentation.
CE9.5 Collect all data and specific results in the corresponding documentation.
CE9.6 Consult the necessary technical documentation (project and technical specifications) compiled in the preparation of the work plan.

C10: Write the manual of service instructions, and maintenance of the printing and/or 3D scanning systems, of the measuring and/or control elements, taking into account the technical documentation of the project, and the required quality.

CE10.1 Organize and collect the information for the preparation of the manual of service and maintenance instructions.
CE10.2 Prepare the user's instruction manual for the user specifying the basic operating and safety conditions.
CE10.3 Prepare the start-up protocol following the instructions of the equipment manufacturers and taking into account safety regulations.
CE10.4 Prepare the maintenance manual specifying the inspection points, parameters to be monitored, periodicity of the actions and the general rules in case of breakdown or emergency.
CE10.5 Prepare instructions for environmental management.

C11: Write basic safety, health and environmental protection studies for the execution of the printing and/or 3D scanning project with the required quality.

CE11.1 Identify the risk factors associated with the operations to be performed.
CE11.2 Identify the risks associated with each of the risk factors, indicating the preventive measures and the protections to be used both individually, collectively and environmentally.
CE11.3 Prepare the basic safety, health and environmental protection study taking into account the risk factors, associated risks, protection measures, handling conditions given by the manufacturer and other safety studies of similar characteristic

Capacities whose acquisition must be completed in a real working environment

C2 (C2.3), C4 (C4.1), C6 (C6.4), and C8 (C8.4)

Other Capacities:

Assume responsibility for the work that is carried out and the fulfillment of the objectives.

Show creativity in the development of the work you make.

Propose alternatives in order to improve the results.

Finish the work according to criteria of suitability, speed, economy and efficiency.

Demonstrate a certain degree of autonomy in the resolution of contingencies related to their activity.

Learn new concepts or procedures and take advantage of training effectively using the knowledge acquired.

Contents:

1.- Planning/programming of 3D production projects.

1.1.- Meanings of the term project.
1.2.- Function of the planning / programming**.**
1.3.- Usual deviations in the project deadline**s.**
1.4.- Defects of application of planning / programming.
1.5.- Factors of technological and organizational innovation:
- Recently implemented organizational systems, recently implemented procedures and techniques, applications and recently implemented computer equipment.

2.- Methods of representation and calculation in planning.

2.1.- Concepts: tasks, hammocks, milestones, activities, path and critical path, process model, subprocesses, phases and subphases, structure of project breakdown.
2.2.- Temporal relationships between activities (start-start, start-end, end-end, end-start), total and free float.
2.3.- Gantt chart: representation, calculation, advantages and disadvantages.
2.4.- Critical way methods(CPM):
- Types, precedence network, arrows method or PERT; representation; calculation; advantages and disadvantages.
2.5.- Reference calendars.

3.- Development of 3D production projects.

3.1.- Initial phase: objectives, intervening agents; relationship with the design, contracting and execution phases; base program.
3.2.- Design phase: objectives, intervening agents; Previous, simultaneous and subsequent steps to the design phase. Stages in the elaboration of projects: building (preliminary study, preliminary project, basic project, execution project) degree of definition; delivery strategy of the design lots; relationship with the contracting and execution phases; design program; usual deviations in terms

(causes and effects).

3.3.- Contracting phase: objectives, intervening agents; supply systems for products and services under construction; strategy and lots of contracting; stages of the sourcing and contracting process; relationship with the design and execution phases; Hiring program; usual deviations in terms (causes and effects).

3.4.- Execution phase: objectives, intervening agents; relationship with the design and execution phases; Execution program.

3.5.- Deactivation phase.

4.- Basis of graphic representation.

4.1.- Representation systems. Dimension. Tolerances.

4.2.- Technical drawing of manufacturing processes:

- Elevations, floors and sections of 3D elements.
- Interpretation of the technical documentation of projects of 3D elements (plans, memory, specifications and budgets).

4.3.- Rules of graphic representation of standardized elements:

- Normalization of profiles, tubes, plates, strapping. Fixed and demountable unions.
- Superficial signs. Surfaces Rugosity. Machining signs
- Treatments of materials.
- Written indications.
- Symbology of facilities and schemes

4.4.- Overall plans:

- Schematics of facilities, equipment and flow diagrams.
- Electrical and regulation schemes.
- Pneumatic and hydraulic diagrams.
- Symbology, standardization and representation conventions.

4.5- Geometry and 3D adjustments:

- Geometric and dimensional regulations; Adjustments and tolerances.

4.6.- Dimensional accuracy in 3D printing:

- Resolution of the 3D printer. (Layer thickness) (ppp).
- Printing tolerance.

4.7.- STL reparation.

- Introduction to Mesh Repair.
- Neffabb basic.
- MeshMixer.

4.8.- 3D design models advices.

5.- 3D Model Design Software.

5.1.- CAD: Current Design Software.

- Openscad. Design of parts, through programming.
- Parameterizable designs. Source files.*.scad
- Freecad.
- Tinkercad.
- Google Sketchup.
- Autodesk applications:
  - 123D Design, 123D Make, y ThingMaker (TinkerPlay).
- Others: IntelliCAD, LibreCAD, DraftSight, Blender, 3Dtin, etc

5.2.- Other 3D design applications.

5.3.- 3D graphic file standards:

- *.SCAD, *.STL : Standard Triangle Language and *.AMF: Additive Manufacturing Format.

5.4.- Printer Firmware.

- Marlin:

- Load the firmware in Arduino. - Firmware files: (File configuration.h, and other files). - Marlin Firmware Configuration. - Calibration of the Printer. - Calibrated thermistors: (PID Control, Proportional, Integral Derivative). - Sprinter. Etc...

6.- 3D parts scanning.

6.1.- Introduction to photometric software.

6.2.- Applications for PC:

- Cyclop scanner of bq.
- Microsoft Kinect.
- Scan XYZprinting.
- Structure Sensor.
- Cubify Sense. Etc...

6.3.- Mobile applications.

- 123 Catch from AutodesK.

6.4.- Three-dimensional reconstruction of medical images.

- Creation of STL models, from tomography DICOM images:
- InVesalius; 3D Slicer; Osirix (Pixmeo); MITK (German Cancer research centre).

7.- Introduction of CNC equipment. Numerical Control Machines.

7.1.- Introduction to CNC (Numerical Control by Computer).

7.2.- History. Numerical Control (CN).

7.3.- Components and Architecture

7.4.- Classification.

7.5.- Operating principle:

- Coordinate system.

7.6.- Applications:

- Machine tools. Lathes Milling machines Boring, Automatic welding of SMD components, Etc.
- Metal modeling. Joinery, Carpentry. Sculpture. Ceramic, etc...

7.7.- CAD / CAM Systems (Design and Computer-Assisted Manufacturing).

7.8.- CNC programming:

- Programming in the Numerical Control.
- Manual programming, automatic programming.
- Foundations and methodology to prepare a program.
- Standardization of programming codes. DIN 66024 and 66025.
- CNC programming languages:
- Characters used in CNC programming; Codes G and M. Examples; * .STL and * .Gcode files. Examples.

8.- 3D printers:

8.1.- Types of printers.

- SLA: 3D printers by Stereolithography.
- SLS: 3D printers of selective laser sintering.

- 3D printers by injection.
- FDM: Printing by deposition of molten material:
    - 3D Cartesian printers; 3D Polar Printers; Delta 3D printers; 3D Printers by Robotic Arm.

8.2.- 3D Printing Technologies: (Addition printing).

8.3.- Evolution and type of 3D printers.

8.4.- 3D Printer Applications: Fields of Application:

8.5.- Process and Stages of 3D printing. Obtaining the STL:

- 3D design.
- 3D design programmed. SCAD.
- 3D scanning.
- From STL to G-Code. Laminators.
- G-Code 3D printing.

8.6.- 3D printers parts:

- Mechanics: structures (Methacrylate, Aluminum, Steel, XXL); smooth and threaded rods; Bearings; Bearings; Screws; Pulleys Gears; Transmission belts; Printed pieces; Parts Repositories.
- Electrónica: Arduino, SAV MK1, Sanguinololu, u Otras Placas; RAMPS. (Conectores. Shields. Pantallas LCD). Motores: (Motores paso a paso, Servomotores y Drivers o Controladores "Pololus"). Resistencias (Resistencias Calefactoras, Termistores); Finales de carrera; Hotends; Cama Caliente; Ventiladores.

9.- 3D Printing materials:

9.1.- Thermoplastic materials; Polymers; Metals; Alloys; Powder; Edible Materials; Finishes; Additives; Other materials.

10.- Verification and Quality of 3D products:

10.1.- Considerations to take into account:

- Cost of the Printer; Cost of printing materials. Price per Kg .; Print speed; Cost of the printed prototype; Color printing
- Post-printing work. (Removal of support material, Hardening of material with waxes and thermoplastic polymers, in ABS, use of acetone, Sanding, polishing by abrasion, varnish, etc ...).
- Other Physical-Chemical Characteristics: Hardness, Flexibility, Resistance, Opacity, Transparency, Rigidity, High Temperature, Colors. etc...
- Dimensional accuracy: (Resolution of the 3D printer. (Layer thickness), (ppp); Printing tolerance).

11.- Manuals of service instructions, and maintenance of printing systems and/or 3D scanning.

11.1.- Technical specifications of printing systems and/or 3D scanning.

11.2.- Conditions for commissioning the facilities: test protocol:

- Application regulations.
- Manufacturers documentation.

11.3.- Inspection points for maintenance and parameters to control.

11.4.- Preparation of data sheets and records.

11.5.- Preparation of safety and environmental recommendations.

11.6.- Preparation of service and maintenance manuals.

12.- Security in the elaboration and execution of projects of printing and/or 3D scanning. Regulations of safety and hygiene and environmental protection.

12.1.- Projects, type of security. Security plans in the execution of printing and/or 3D scanning projects.

12.2.- Identification of risk factors and associated risks.

12.3.- Preparation of basic safety and environmental protection studies.

12.4.- Collective and individual protection equipment.

Context parameters of the training

Spaces and facilities

The spaces and facilities will respond, in the form of a multipurpose classroom of a minimum of 2 m^2 per student, and a classroom of 80 m^2 or singular space, to the training needs, according to the Professional Context established in the Unit of Associated Competition, taking into account the applicable regulations of the productive sector, risk prevention, occupational health, universal accessibility and environmental protection.

Professional profile of the trainer:

1.- Mastery of knowledge and techniques related to the design of printed products in 3D, which will be accredited by one of the following two ways:

- Level 3 academic training, Technical Engineering, higher design studies, or other higher education, related to the professional field.
- Professional experience of at least 3 years in the field of competences related to this training module.

2.- Pedagogical competence accredited in accordance with what the competent Administrations establish.