CIRCVET

CIRCULAR ECONOMY PRACTICAL TRAINING MATERIALS
FOR PLASTIC MANUFACTURING INDUSTRIES

Deliverable 7.2 - Integration within other formats and trainings.

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1. Introduction

1.1 Higher Education in Europe

The higher education system implemented in Europe among the member countries is based on a common structure of degrees, which was initiated in 1999 with the signing of the Bologna Declaration initially by 29 countries, with the total number of member countries currently standing at 49 [1].

The structuring of higher education in Europe has evolved significantly in recent decades, seeking to homogenize and improve the quality of the education system throughout the continent that facilitates the comparability of education systems, promotes mobility between countries and increases the competitiveness and quality of European universities. The Bolognia process are structured in the followed items [1]:

- **ECTS (European Credits Transfer and Accumulation System)**: A credit system to facilitate the transfer of qualifications between institutions in different countries. An academic year usually corresponds to 60 ECTS credits, where 1 credit it is equivalent to 25 hours.
- **European Diploma Supplement**: Document attached to the degree detailing the level, content and status of the studies carried out, to facilitate international comparability. This achieves the recognition of degrees between countries, allowing students to continue their training in another country or find a job, without the need to validate their degree.
- **Quality guarantee:** The creation of national and international mechanisms to ensure the quality and transparency of higher education programs is encouraged. Likewise, these mechanisms should provide flexibility to respect the national particularities of each participant.
- **Three cycles education system**:
  The structure promoted by the Bologna process establishes three cycles, which include an undergraduate, postgraduate and doctoral program, as follows [2] :

  - Bachelor: 3-4 years (ISCED 6)
  - Master: 1-2 years (ISCED 7)
  - Ph. D programme: 3-5 years (ISCED 8)

Regarding the first of the cycles (Bachelor), the most widespread workload among the countries participating in the Bologna process is 180 ECTS credits, specifically according to the Bologna Process Implementation Report of 2024, in more than half of the members.

Countries such as Albania, France, Italy and Switzerland apply this workload in all first-cycle programs.

Approximately one third of the participating countries adopt a model for the first cycle of 240 ECTS credits, with more than 90% of the first cycle programs in countries such as Armenia, Azerbaijan, Greece or Spain [1].

A small number of countries incorporate a workload of 210 ECTS credits in some of their curricula, including Denmark, Germany and Poland.

As for the second cycle (Master's Degree), the one with the highest workload implemented among the member countries, is the one with a duration of 120 ECTS credits. In countries such as the Netherlands, North Macedonia and Spain, a second-cycle model of 60-75 ECTS credits predominates [1].

1.2. Vocational education training

Regarding vocational training, the European Union, through the Copenhagen process (2002), initiated voluntary cooperation between member states by establishing a structure that may vary from country to another, sharing some common elements in terms of training modalities, their levels or the duration of training [3].

Currently, the following types of vocational training are taught:

- Dual vocational training: This is a system where students combine theoretical learning in educational centres with practical experience in companies. It is very common in countries such as Germany, Austria and Switzerland. Apprentices spend part of the week at school and part of the workplace [4]
- School-based vocational training: In this model, apprenticeships are mainly carried out in schools or vocational training centres, with traineeships or internships in companies. This model is more common in countries such as Spain, Italy or France [5].

Both types of training are generally organized into different levels that correspond to the complexity and difficult level according to ISCED classification [2] [6]:

- Basic Vocational Education Certificates (ISCED 3): Generally, these are programs designed for students who have not completed secondary education, providing them with basic training that will allow them to enter the labour market or continue with more advanced studies.
- Intermediate Grade Professional (ISCED 4): Equivalent to the post-compulsory secondary level, these programs prepare students for direct entry into work or to continue higher education.

- Higher Level Vocational Education Diplomas (ISCED 5)**:** These programs offer more specialized training and usually have a significant component of practical training in companies.

Currently, and due to the problems arising from climate change, the loss of biological diversity and the interconnection of environmental challenges with the global economy and social lifestyles, has generated the need to integrate circular economy competencies at the different scales of education, both in Higher Education and for I-VET. as highlighted in the 2023 edition of the Compendium [7].
In this document, it is illustrated the adequate integration of the contents developed in WP 2 (content development) with the curricula of different trainings in Higher Education and I-VET.

2. Glossary of terms, abbreviations, and acronyms

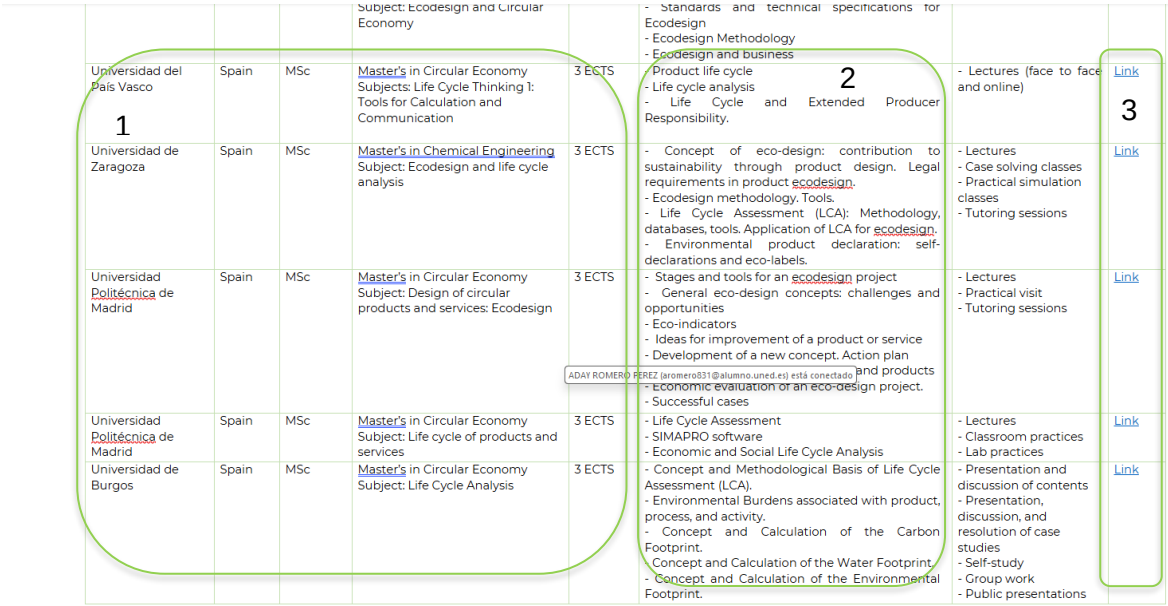
Partner shortname	
P1-AIJU	Partner 1 – ASOCIACIÓN DE INVESTIGACIÓN DE LA INDUSTRIA DEL JUGUETE CONEXAS Y AFINES (Spain)
P2-CENTIMFE	Partner 2 – CENTRO TECNOLÓGICO DA INDÚSTRIA DE MOLDES, FERRAMENTAS ESPECIAIS E PLÁSTICOS – CENTIMFE (Portugal)
P3-KIMW-Q	Partner 3 – Gemeinnützige KIMW-Quaòifizierungs GmbH (Germany)
P4-POLYMERIS	Partner 4 – POLYMERIS (France)
P5-PROPLAST	Partner 5 – Consorzio per la promozione della cultura plastica – PROPLAST (Italy)
P6-LINPRA	Partner 6 – LIETUVOS INZINERINES PRAMONES ASOCIACIJA LINPRA (Lithuania)
P7-ULPGC	Partner 7 – Universidad de las Palmas de Gran Canaria (Spain)
P8-IDL	Partner 8 – Infinitivity Design Lab (France)
P9-APRC	Partner 9 – ALYTAUS PROFESINIO RENGIMO CENTRAS (Lithuania)
P10-UNITR	Partner 10 – Università degli Studi di Trento (Italy)
P11-HIT	Partner 11 – HUB INNOVAZIONE TRENTINO – Fondazione (Italy)
P12-VPM	Partner 12 – VISAGINO TECHNOLOGIJOS IR VERSLO PROFESINIO MOKYMO CENTRAS (Lithuania)

3. Objective of the deliverable.

The objective of this deliverable is to check and contrast the adequacy of the contents developed in the project with the different higher education programs under the Bologna process, as well as their adequacy to the European I-VET training programs in order to facilitate their adoption by the I-VET and university curricula.

4. Methodology.

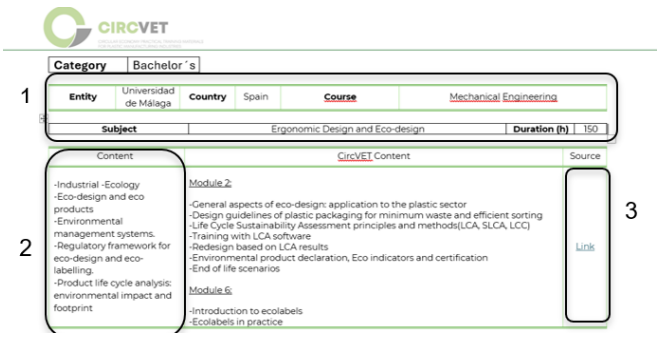
To carry out this task, the contents developed in WP 1 - Methodology and Study Plans have served as support, in which a compilation of higher education and vocational training programs was made, where their program is specified.



			Subject: Ecodesign and Circular Economy		- Standards and technical specifications for Ecodesign - Ecodesign Methodology - Ecodesign and business		
Universidad del País Vasco	Spain	MSc	Master's in Circular Economy Subjects: Life Cycle Thinking 1: Tools for Calculation and Communication	3 ECTS	- Product life cycle - Life cycle analysis - Life Cycle and Extended Producer Responsibility.	- Lectures (face to face and online)	Link
Universidad de Zaragoza	Spain	MSc	Master's in Chemical Engineering Subject: Ecodesign and life cycle analysis	3 ECTS	- Concept of eco-design: contribution to sustainability through product design. Legal requirements in product ecodesign. - Ecodesign methodology. Tools. - Life Cycle Assessment (LCA): Methodology, databases, tools. Application of LCA for ecodesign. - Environmental product declaration: self-declarations and eco-labels.	- Lectures - Case solving classes - Practical simulation classes - Tutoring sessions	Link
Universidad Politécnica de Madrid	Spain	MSc	Master's in Circular Economy Subject: Design of circular products and services: Ecodesign	3 ECTS	- Stages and tools for an ecodesign project - General eco-design concepts: challenges and opportunities - Eco-indicators - Ideas for improvement of a product or service - Development of a new concept. Action plan - Economic evaluation of an eco-design project. - Successful cases	- Lectures - Practical visit - Tutoring sessions	Link
Universidad Politécnica de Madrid	Spain	MSc	Master's in Circular Economy Subject: Life cycle of products and services	3 ECTS	- Life Cycle Assessment - SIMAPRO software - Economic and Social Life Cycle Analysis	- Lectures - Classroom practices - Lab practices	Link
Universidad de Burgos	Spain	MSc	Master's in Circular Economy Subject: Life Cycle Analysis	3 ECTS	- Concept and Methodological Basis of Life Cycle Assessment (LCA). - Environmental Burdens associated with product, process, and activity. - Concept and Calculation of the Carbon Footprint. - Concept and Calculation of the Water Footprint. - Concept and Calculation of the Environmental Footprint.	- Presentation and discussion of contents - Presentation, discussion, and resolution of case studies - Self-study - Group work - Public presentations	Link

With this information, a comparison was made between the content of the subject corresponding to each title and with the content developed in WP 2 - Content Development, pointing out those modules that are related to the contents of the title.

Only content referring to regulated education has been included and has been classified according to the corresponding level according to whether it is a VET, bachelor's, or master's degree.



The classified information is contained in annexes I, II and III of this deliverable.

5. Results

As a result of the systematic review of 41 total degrees of the three levels, Bachelor's, Master's and VET, as well as 63 subjects contained in the support material developed in WP-1 "Methodology and curricula" and their comparison with the content developed in WP-2 "Content development", the following results have been obtained:

Of the total of the 41 degrees reviewed, 32% correspond to bachelor level degrees, 54% correspond to master's level and 14% correspond to VET level.

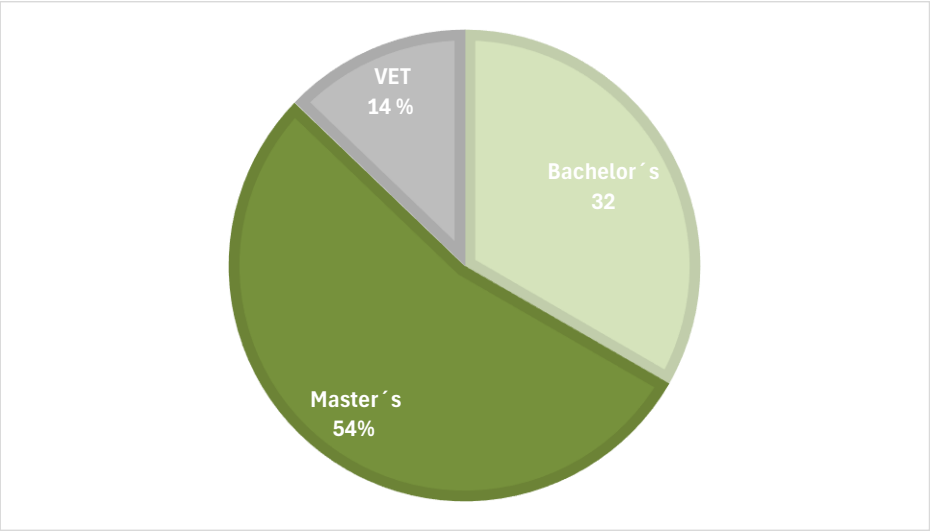


Figure 1: Distribution of related titles.

Regarding the subjects contained in the different degrees, a greater number of master's level subjects has been observed, accounting for 59% of the total number of subjects reviewed. In general, a greater number of subjects related to the circular economy can be observed at higher levels where there is greater specialization.

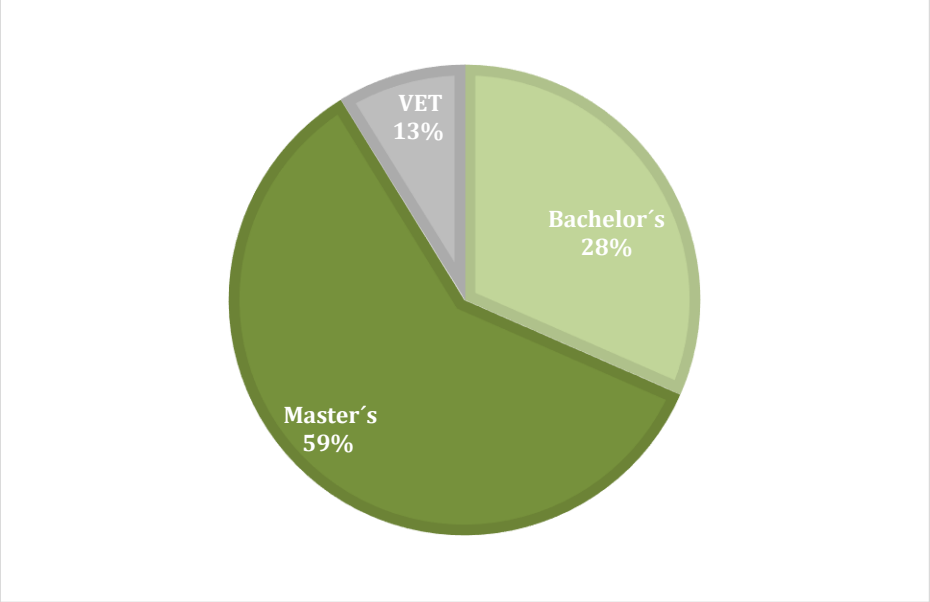


Figure 2. Distribution of related subjects

Likewise, according to the field to which the different degrees referred to in this document belong, the content developed in the areas of knowledge in the field of engineering and entrepreneurship has been listed. Likewise, a greater number of degrees related to engineering degrees is observed, due to the greater load of this in the contents of WP-2.

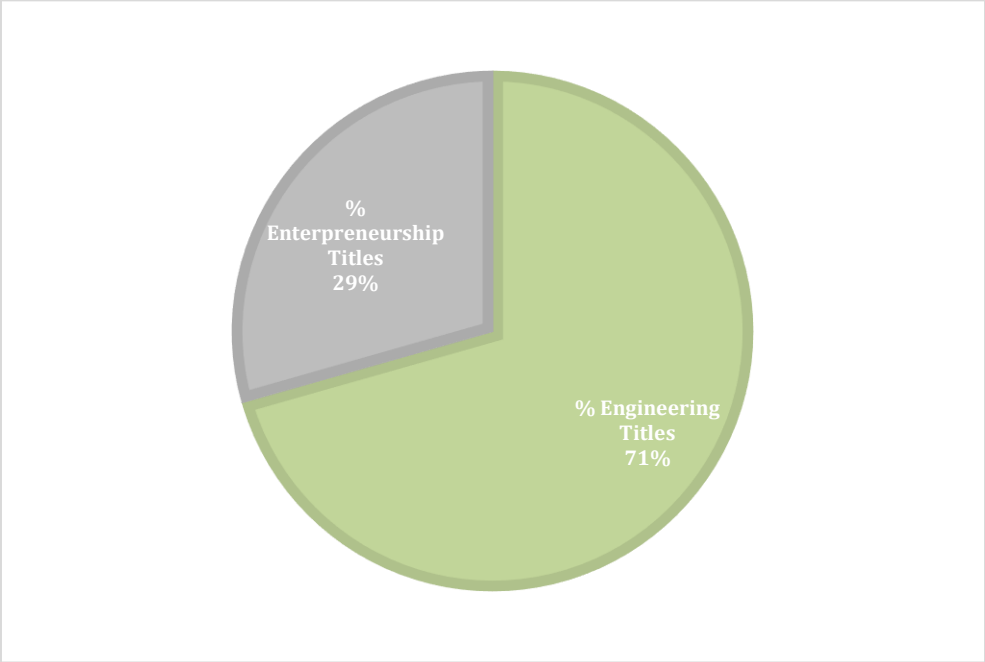


Figure 3. Knowledges area distribution

Finally, it is observed that the modules related to eco-design and LCA, as well as the module corresponding to Manufacturing processes, are those that have been most related to the degrees reviewed.

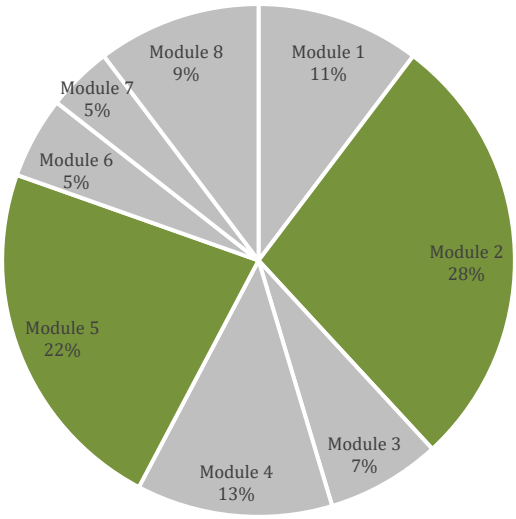


Figure 4. Module citation distribution

6. References

[1] "The European Higher Education Area in 2024: Bologna Process Implementation Report | Enhanced Reader."

[2] "The structure of the European education systems 2023/2024 - Publications Office of the EU." Accessed: Oct. 07, 2024. [Online]. Available: https://op.europa.eu/en/publication-detail/-/publication/3539fbd6-6685-11ee-9220-01aa75ed71a1/language-en

[3] I. Psifidou, "Evolución histórica de la formación profesional en Europa = Historical development of vocational training in Europe," 2014.

[4] "Formación profesional dual." Accessed: Oct. 07, 2024. [Online]. Available: https://www.make-it-in-germany.com/es/estudios-formacion/formacion-en-alemania/que-es/dual

[5] Cedefop, "Spotlight on VET – 2020 compilation: vocational education and training systems in Europe", doi: 10.2801/667443.

[6] "VET in Europe database | Vocational education and training in Europe | Spain | CEDEFOP." Accessed: Oct. 07, 2024. [Online]. Available: https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/spain-u2

[7] "GreenComp, El marco europeo de competencias sobre sostenibilidad - Publications Office of the EU." Accessed: Oct. 07, 2024. [Online]. Available: https://op.europa.eu/es/publication-detail/-/publication/bc83061d-74ec-11ec-9136-01aa75ed71a1/language-es

7. List of annexes

I- Bachelor´s annex
II- Master´s annex
III- Vocational Education Training

I-Bachelor´s annex

Entity	Universidad de Málaga	**Country**	Spain	**Title**	Mechanical Engineering

Subject	Ergonomic Design and Eco-design	**Duration (h)**	150

Content	CircVET Content	Source
-Industrial -Ecology -Eco-design and eco products -Environmental management systems. -Regulatory framework for eco-design and eco-labelling. -Product life cycle analysis: environmental impact and footprint	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Training with LCA software -Redesign based on LCA results -Environmental product declaration, Eco indicators and certification -End of life scenarios Module 6: -Introduction to ecolabels -Ecolabels in practice	Link

Subject	Packaging	**Duration (h)**	150

Content	CircVET Content	Source
-Packaging and packaging-Packaging and the environment. -Packaging life cycle Packaging materials and manufacturing processes-Labelling	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Training with LCA software -Redesign based on LCA results -Environmental product declaration, Eco indicators and certification -End of life scenarios Module 6: -Introduction to ecolabels -Ecolabels in practice	Link

Subject	Design methodology	**Duration (h)**	150

Content	CircVET Content	Source
-Introduction to Industrial Design Methodology -Concept and evolution of the Industrial Design Methodology -Introduction to the Design project -Techniques or methods of Problem Analysis	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging	Link

-Requirements and specifications of an industrial design project. -Integrated product design and development -Techniques or Methods of searching for Solutions and Ideas -Evaluation techniques or methods -Value Analysis	for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) -Training with LCA software -Redesign based on LCA results.	

Subject	Recycling and the environment	**Duration (h)**	150

Content	CircVET Content	Source
-Recycling and the environment -Product Life Cycle -Eco-design -Green Design Practicalities -Discussion of examples of interest	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) Module 4: -Current situation in Europe and waste management in different industrial sector -Recycling technologies Module 7: -Presentation and definition of concepts related to materials recovery and added values	Link

Entity	Arcada University of Applied Sciences	**Country**	Finland	**Title**	Mechanical and Sustainable Engineering

Subject	Life Cycle Assessment	**Duration (h)**	125

Content	CircVET Content	Source
-Introduction to LCA and Industrial ecology -Environmental impacts Material flow analysis (MFA) -Environmental product declarations (EPD) -Carbon assessment of buildings (OneClickLCA) -Sustainability tools in CAD (SolidWorks) -LCA software (GaBi)	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) -Training with LCA software -Redesign based on LCA results Module 6: -Introduction to ecolabels -Ecolabels in practice	Link

Entity	Universitá di Genova	**Country**	Italy	**Title**	Environmental Engineering

Subject	Life Cycle Assessment and Eco design	**Duration (h)**	125

Content	CircVET Content	Source
-Eco-design -Life Cycle Assessment (LCA) Life cycle modelling through supporting tools -Case studies -Group Project	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Training with LCA software -Redesign based on LCA results	Link

Entity	Kaunas University of Technology	**Country**	Lithuania	**Title**	Chemical Technology and Engineering

Subject	Sustainable Development	**Duration (h)**	150

Content	CircVET Content	Source
-Introduction to course. -Philosophy and Sustainable Development. -Welfare and Happiness. -Circular Economy.	Module 1: -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies	Link

-Climate Change. -The design for sustainable development. Cultural -Diversity and Digital Culture. -Final course. Perspectives of Sustainable Development and future tendencies.	-Regulatory Framework and Circular Economy business models Module 3: -Blockchain applied to the traceability of materials -Digital manufacturing (DM) Module 2 -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting	

Subject	Polymer Technology	**Duration (h)**	150

Content	CircVET Content	Source
- Basic definitions of polymer science and nomenclature - Chain polymerisation - Copolymerisation - Polycondensation - Reactions of macromolecules - Physical states of polymers - Technologies for production of polyethylene and polypropylene - Technologies for production of polymeric films and pipes - Polymers and copolymers of styrene - Polymers based on halogen containing unsaturated hydrocarbon - Polyvinyl acetate. Polyvinyl alcohol. Polyacetates. Polyamides	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Content	CircVET Content	Source
- Acrylates - Natural and synthetic rubbers - Technologies of rubber products		

Entity	**University of Management and Economics**	**Country**	**Lithuania**	**Title**	**Entrepreneurship and innovation**

Subject	Entrepreneurial Marketing	**Duration (h)**	75

Content	CircVET Content	Source
-Added value of marketing to organizations and its evolution -Micro and macro environmental analysis -Forecasting market opportunities -Main segmentation criteria -Adapting elements of the marketing mix to the target market -Calculation of marketing costs and revenues teamwork	Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Entity	Universidad de Santiago de Compostela	**Country**	Spain	**Title**	The DEIN- Circular Master´s Degree

Subject	Strategic Management of Innovation	**Duration (h)**	75

Content	CircVET Content	Source
-Strategy, innovation and competitiveness -Industry dynamics of innovation -Formulating innovation strategy -Business model innovation	Module 4: -Current situation in Europe and waste management in different industrial sector Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Entity	Universidad Politécnica de Cataluña	**Country**	Spain	**Title**	Materials Engineering

Subject	Recycling and raw materials	**Duration (h)**	150

Content	CircVET Content	Source
- Introduction to recycling - Life Cycle Assessment (LCA). Principles of eco-design - Consumption of plastics and waste - Plastics recycling - Eco-design - Alternatives to conventional plastics - Recycling of municipal solid waste. Technology and processes - Introduction to extractive metallurgy: pyrometallurgy - Steel extraction and recycling. Example of a pyrometallurgical process - Introduction to extractive metallurgy: hydrometallurgy. - Aluminium extraction and recycling - Extraction of other metals: titanium, magnesium, and copper - Recycling of ceramic materials and glass	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) Module 4: -Current situation in Europe and waste management in different industrial sector -Recycling technologies	Link

Entity	University of Perugia	Country	Italy	Title	Engineering of sustainable materials and processes

Subject	Materials Recycling	Duration (h)	225

Content	CircVET Content	Source
- Potential sources of recycled plastics. - Regulatory aspects. - Type of plastic waste, collection, storage, separation of plastics from other materials, grinding, separation by type of plastics, compaction, granulation - Classification of recycling technologies - Analysis of recycling possibilities of some types of plastics. - Examples of applications of recycle plastics - Biodegradation - Waste management and regulatory environment - Waste classification - Waste sorting - Classification of the different fractions - Treatments for the recovery and recycling of the various fractions	Module 4: -Current situation in Europe and waste management in different industrial sector -Recycling technologies Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	University of Padua	**Country**	Italy	**Title**	Sustainable chemistry and technologies for circular economy

Subject	New plastics economy: polymers, biopolymers and their recycling	**Duration (h)**	150

Content	CircVET Content	Source
Introduction to polymer science - Terminology and elucidation of the concepts of biobased, biopolymers, bioplastics, biodegradability, compostability, biocompatibility, bioinspired, etc. with reference to EU regulation context. - Examples of biobased/biodegradable polymers. - Examples of functionalised and chemically modified biobased/biodegradable polymers.. - General overview on methods for the characterisation of polymers and biopolymers - Methods for the functionalisation and the chemical modification of polymers and biopolymers - Identification and sorting of polymers. Italian and European regulation on recovery, recycling and waste management. Reference to SUP European regulation. - Recycling technologies	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Universidade do Minho	**Country**	Portugal	**Title**	Polymers Engineering

Subject	Polymers processing	**Duration (h)**	250

Content	CircVET Content	Source
- Extrusion: introduction, main types of extruders - Extrusion lines: analysis of the main types of lines, main mechanisms and phenomena, equipment and variables - Injection moulding: introduction, the process cycle, main mechanisms and process phenomena, equipment and variables - Thermoforming: introduction, the process cycle, main variables, technology variants and materials - Blow moulding: introduction, process cycle, main variables, technology variants and materials - Rotational moulding: introduction, the process cycle, main variables, technology variants and materials	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Universidade do Minho	**Country**	Portugal	**Title**	Materials Engineering

Subject	Polymers science	**Duration (h)**	125

Content	CircVET Content	Source
- Basic Settings. Classification of polymers. Mean molecular mass types and determination. - Polycondensation basics. Balanced and unbalanced polycondensation molecular mass distribution, kinetics. Examples of industrial application. - Polyaddition. Initiation, propagation, chain transfer, termination. Thermodynamics of polymerization. Radical polymerization kinetics. -Industrial applications of radical polymerization. - Radical copolymerization importance. General Copolymerization Equation – Mayo-Lewis. Copolymerization constants. Most important industrial copolymers. - Fundamentals of ionic polymerization. Cationic and anionic polymerization initiation, propagation, termination. Kinetics. Examples. - Coordinative polymerization. Ziegler-Natta process, metallocene polymerization. Other initiating systems. - Chemical reactions of polymers network formation, cross-linking, basic concepts of polymeric degradation.	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Subject	Polymers processing techniques	**Duration (h)**	125

Content	CircVET Content	Source
- Extrusion: introduction, main types of extruders - Extrusion lines: analysis of the main types of lines, main mechanisms and phenomena, equipment and variables - Injection moulding: introduction, the process cycle, main mechanisms and process phenomena, equipment and variables - Thermoforming: introduction, the process cycle, main variables, technology variants and materials - Blow moulding: introduction, process cycle, main variables, technology variants and materials - Rotational moulding: introduction, the process cycle, main variables, technology variants and materials	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes	Link

Entity	Universidade de Aveiro	**Country**	Portugal	**Title**	Materials Engineering

Subject	Polymer technology	**Duration (h)**	150

Content	CircVET Content	Source
- Introduction: historical evolution, classification and applications of polymers. - Additives - Processability of polymers - Processing of polymers in continuous regime - Processing of polymers in batch mode - Plastic recycling and waste recovery.	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Universidade do Porto	**Country**	Portugal	**Title**	Materials Engineering

Subject	Polymeric materials	**Duration (h)**	150

Content	CircVET Content	Source
- Introduction to the study of polymers History and importance of polymers. Definition of polymer and co-polymer. isomerism. Classification of polymers - Polymer synthesis	Module 4: -Current situation in Europe and waste management in different industrial sector	Link

- Structure and properties of polymers - General purpose thermoplastics and thermosets, properties and applications. - Polymer Additives - Properties and applications of hydrogels - Polymer characterization techniques - Adhesives - Special engineering polymers - Degradation of polymers - Polymer recycling - Introduction to the study of polymer matrix composites	-Recycling technologies <u>Module 5:</u> -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	

II- Master´s annex

Entity	Universidad Internacional de Valencia	**Country**	Spain	**Title**	Circular Economy and Suitable Development

Subject	Management of Circular Production to Achieve Sustainability	**Duration (h)**	150

Content	CircVET Content	Source
-Study of the considerations and reason for circular production -Waster at the core and circular production as a function of business models -Study of circular products versus circular services. -Boundary between the two Business opportunities derived from the recirculation of materials and waste -Importance of eco-design as an initial part of the circular and sustainable value chain and its value chain, and its influence on the life cycle. -The product life cycle and the tools for circular production. -Industry 4.0, Internet of things, energy and water efficiency and Lean manufacturing. -Biological cycle: waste management and recovery. -The circularity of industrial water and the opportunity of CO2 -Audits and environmental management systems in companies -Analysis and study of the influence of industrial services and utilities: primary sources, renewables, and circular production	Module 1: -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies -Regulatory Framework and Circular Economy business models Module 2: -General aspects of eco-design: application to the plastic sector -Design guideline of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) Module 3: -Digital manufacturing in circular economy -Simulation/motorization -Internet of Things	Link

Subject	Sustainable business model and green entrepreneurship	**Duration (h)**	150

Content	CircVET Content	Source
-New business strategy: innovation and eco-design as an opportunity and sources of ideas -Trends and value of ideas. Support of digital technologies in the circular economy and sustainability. -Strategic and operational models and plans. Implementation plan. -Measuring the impact of circular and sustainable companies. -Value proposition and life cycle analysis -Digital tools for validating circular and sustainable businesses -Digital tools for validating circular and sustainable businesses -Legal aspects, legal forms and intellectual and industrial protections applied to circular and sustainable models. -Specific programs for circular and sustainable entrepreneurship. -Optimization strategies in the sales and presentation of start-ups	Module 3: -The cloud -Big Data Analysis Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Entity	Universidad del País Vasco	**Country**	Spain	**Title**	Master's in project management

Subject	Eco-design and circular economy	**Duration (h)**	75

Content	CircVET Content	Source
-Introduction to the concept. -Basic principles and implications for the design of products and services -Introduction to Eco-design process. The Eco-design process	Module 2: -General aspects of eco-design: application to the plastic sector	Link

-Eco-design strategies throughout the product life cycle -Legislative environmental related to Eco-design. -European eco-design Directive and related regulations. -Search for solutions to eco-design problems of product, systems and installations. -Application of the principles of the international standard UNE-EN ISO 14006. -Implementation of new business models based on product-service system, as a strategy to promote the Circular Economy	-Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC)	

Entity	Universidad del País Vasco	**Country**	Spain	**Title**	Masters in Circular Economy

Subject	Life cycle Thinking1: Tools for Calculation and Communication	**Duration (h)**	75

Content	CircVET Content	Source
-Product life cycle -Life Cycle and Extended Producer Responsibility	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) -Environmental product declaration, Eco indicators and certification -End of life scenarios	Link

Entity	Universidad de Zaragoza	**Country**	Spain	**Title**	Master´s in Chemical Engineering

Subject	Eco-design and life cycle analysis	**Duration (h)**	75

Content	CircVET Content	Source
-Concept of eco-design: contribution to sustainability through product design. -Legal requirements in product eco-design Eco-design methodology. Tools -Life Cycle Assessment (LCA): Methodology, databases tools. -Application of LCA for eco-design -Environmental product declaration: self-declarations and ecolabels	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Training with LCA software -Redesign based on LCA results -Environmental products declaration, Eco indicators and certification -End of life scenarios	Link

Entity	Universidad Politécnica de Madrid	**Country**	Spain	**Title**	Master´s in Circular Economy

Subject	Design of circular products and services Eco-design	**Duration (h)**	75

Content	CircVET Content	Source
-Stages and tools for an Eco-design Project -General eco-design concepts: challenges and opportunities -Eco-indicators -Ideas for improvement of a product or service Development of a new concept. Action plan Innovation in materials, processes, and products -Economic evaluation of an eco-design project -Successful cases	Module 1: -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies -Regulatory Framework and Circular Economy business models Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC)	Link

Subject	Life cycle of products and services	**Duration (h)**	75

Content	CircVET Content	Source
-Life Cycle Assessment SIMAPRO software -Economic and Social Life Cycle Analysis	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Training with LCA software -Redesign based on LCA results -Environmental products declaration, Eco indicators and certification -End of life scenarios	Link

Entity	Universidad Burgos	**Country**	Spain	**Title**	Master´s in Circular Economy

Subject	Eco-design	**Duration (h)**	75

Content	CircVET Content	Source
-Strategies and new business models-Resources and capabilities as a source of transformation towards the circular economy -Circular entrepreneurship: Application of the business model canvas to the new business models of the circular economy	Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Subject	Life Cycle Analysis	**Duration (h)**	75

Content	CircVET Content	Source
-Concept and Methodological Basis of Life Cycle Assessment (LCA) -Environmental Burdens associated with product, process and activity. -Concept and Calculation of the Carbon Footprint	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Environmental products declaration, Eco indicators and certification -End of life scenarios	Link

Subject	Circular Economy: general aspects and regulatory framework	**Duration (h)**	75

Content	Circlet Content	Source
-The Challenge of Environmental Problems: Linear Economy and Circular Economy -Alternatives to the Way Current Economies Operate: The Theory of Decrease-Current State of the Circular Economy: National, European and International Regulatory Framework	Module 1: -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies -Regulatory Framework and Circular -Economy business models Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Subject	Strategy and new business models	**Duration (h)**	75

Content	Circlet Content	Source
-Strategies and new business models-Resources and capabilities as a source of transformation towards the circular economy-Circular entrepreneurship: Application of the business model canvas to the new business models of the circular economy	Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Entity	Trinity College of Dublin	**Country**	Ireland	**Title**	Circular Economy and Recycling Technologies

Subject	Plastics, Composites and Plastics Recycling	**Duration (h)**	150

Content	Circlet Content	Source
- Fundamentals of plastics - Plastic recycling techniques - Energy recovery - Combustible gases recovery from organic waste	Module 4: -Current situation in Europe and waste management in different industrial sector -Recycling technologies Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Universidad de Sevilla	**Country**	Spain	**Title**	Master´s in Design and Engineering of Industrial Products and Installations in PLM and BIM Environments

Subject	Eco-innovation and Product Eco-design	**Duration (h)**	75

Content	Circlet Content	Source
-Sustainability Paradigms for sustainability in PLM and BIM environments -LCA and PLM and BIM environments Industrial or social metabolism of products and environments PLM and BIM -Product energy metabolism Eco-innovation of products. -Eco-design of product and diversity -Local development and digitised environments of design and sustainability assessment.	Module 2: -General aspects of eco-design application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) Module 3: -Digital manufacturing (DM) -Simulation / motorization Module 4: -Current situation in Europe and waste management in different industrial sector	Link

Subject	Entrepreneurship: Creation and Development of Innovative Companies	**Duration (h)**	75

Content	CircVET Content	Source
-Business Creation-Quality Management-Technology -Based Companies (EBTs) -ISO Standard on Quality Management	Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Subject	Technologies and Applications in Automation Installations for Industry 4.0	**Duration (h)**	75

Content	CircVET Content	Source
-Data Infrastructure in Information Systems -Industrial-Supervision and Integration in Industry 4.0	Module 3: -Blockchain applied to the traceability of materials -Digital manufacturing (DM) -Simulation/ motorization -The cloud -Internet of things -Big Data analysis	Link

Entity	Universidad de Santiago de Compostela	**Country**	Spain	**Title**	Master´s in Environmental Engineering

Subject	. Ecological design of processes and products	**Duration (h)**	112.5

Content	CircVET Content	Source
-Data indicators, and environmental audits -Life Cycle Analysis -Economic and social analysis -Eco-design -Eco-labelling	<u>Module 1:</u> -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies -Regulatory Framework and Circular Economy business models <u>Module 2:</u> -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) -Environmental product declaration, eco-indicators and certification <u>Module 4:</u> -Current situation in Europe and waste management in different industrial sector <u>Module 6:</u> -Introduction to ecolabels -Ecolabels in practice -Consumer awareness	Link

Subject	Environmental processes and circular economy	**Duration (h)**	112.5

Content	CircVET Content	Source
-Life cycle philosophy. -Circular Economy. Fundamentals. Multi-R system. Business model-Material balances. -Energy balances-Mechanical energy balance	Module 1: -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies -Regulatory Framework and Circular Economy business models Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) Module 7: Presentation and definition of concepts related to materials recovery and added values	Link

Subject	Business creation and management	**Duration (h)**	75

Content	CircVET Content	Source
-General Concepts: Economic System and Companies -Sustainable development and circular economy	Module 1: -Presentation and definition of concepts related to the circular economy -Circular Economy implementation strategies	Link

-Entrepreneurship and entrepreneurial ecosystem -Process of creating a company -Business Management: Planning and organization in the company -Main managerial functions -The process of managing a sustainable company -Fundamentals of accounting and finance -Project feasibility analysis: The business plan -Commercial viability -Technical feasibility -Financial viability	-Regulatory Framework and Circular Economy business models <u>Module 8:</u> -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	

Entity	Norwegian University of Science and Technology	**Country**	Norway	**Title**	Master´s in Circular Economy

Subject	Life Cycle Assessment (LCA)	**Duration (h)**	185.5

Content	CircVET Content	Source
-Theoretical background for Life Cycle Assessment as a method -Skills to use the method -Knowledge about its application areas and limitations	<u>Module 2:</u> -Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) -Training with LCA software -Redesign based on LCA results	Link

Subject	LCA Practice & Reporting, Specialization module	**Duration (h)**	185.5

Content	CircVET Content	Source
-Method of Life Cycle Assessment -Basis and practical skills to perform an attributional life cycle assessment study	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods(LCA, SLCA, LCC) -Environmental products declaration, Eco indicators and certification -End of life scenarios	Link

Entity	Tecnische Universtät Berlin	**Country**	Germany	**Title**	Masters of Innovation Management, Entrepreneurship hip and sustainability

Subject	Eco-design	**Duration (h)**	150

Content	CircVET Content	Source
-Drivers and development -Legislation -Eco-design approaches -Tools for eco-design -Life Cycle Assessment	Module 1: -Regulatory Framework and Circular Economy business models Module 2: -General aspects of eco-design: application to the plastic	Link

	sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) Module 4: -Current situation in Europe and waste management in different industrial sector	

Entity	Katholieke Universiteit Leuven	**Country**	Belgium	**Title**	Masters of Materials Engineering

Subject	Eco-design and Life Cycle Engineering	**Duration (h)**	75

Content	CircVET Content	Source
-Introduction -Life cycle analysis LCA -DfE techniques -Retraction logistics -Industrial ecosystems -Legislation and norms -Software support: workshop	Module 1: -Regulatory Framework and Circular Economy business models Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment (LCA, SLCA, LCC)	Link

Content	CircVET Content	Source
	-Training with LCA software -Redesign based on LCA results <u>Module 7:</u> -Presentation and definition of concepts related to materials recovery and added values	

Entity	KTH Royal Institute of Technology	**Country**	Sweden	**Title**	Master's in engineering materials science

Subject	Eco Design	**Duration (h)**	150

Content	CircVET Content	Source
-Life Cycle Assessment -Recycling of materials and components -Design for disassembly -Design rules for materials choice surface treatment -Structural layout -Relevant EU directives and laws	<u>Module 2:</u> -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) <u>Module 4:</u> -Current situation in Europe and waste management in different industrial sector -Recycling technologies <u>Module 5:</u>	Link

Content	CircVET Content	Source
	-Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing process	

Entity	Universitá di Camerino	**Country**	Italy	**Title**	Master´s in Eco-design & eco innovation

Subject	Strategie E Strumenti Per L´Eco-DESIGN E LÉCO-Innovazione	**Duration (h)**	60

Content	CircVET Content	Source
-Regulations -Methodology -Life Cycle Assessment -Ecolabel	<u>Module 1:</u> Circular Economy implementation strategies Regulatory Framework and Circular Economy business models. <u>Module 2:</u> General aspects of eco-design: application to the plastic sector Desgin guidelines of plastic packaging for minimum waste and efficient sorting Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) <u>Module 6:</u> Introduction to ecolabels Ecolabels in practice General aspects related to understanding consumer needs with respect to sustainable products	Link

Subject	Design E Sviluppo Di Prodotti Eco-Sostenibili	**Duration (h)**	100

Content	CircVET Content	Source
-Design for recycling -Disassembling -Durability, upgrading materiali ecosostenibili redesign	<u>Module 2:</u> -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) <u>Module 4:</u> -Current situation in Europe and waste management in different industrial sector -Recycling technologies <u>Module 7:</u> -Presentation and definition of concepts related to materials recovery and added values	Link

Entity	University of Aveiro	**Country**	Portugal	**Title**	Master in product Design and Engineering

Subject	Eco design and ecoefficiency	**Duration (h)**	150

Content	CircVET Content	Source
-Product development and industrial trends -Eco-design and Eco-efficiency concepts and tools -Life Cycle Assessment ISO 14040 and 14044 standards -Industrial Environmental Management Systems ISO 14001:2015 standard -Energy management in manufacturing ISO 5001:2018 standard -Lean Manufacturing and other principles that can assist efficiency production -Product and Business Design for Circular Economy	<u>Module 2:</u> -General aspects of eco-design application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) <u>Module 3:</u> -Digital manufacturing (DM) -Simulation /motorization <u>Module 8:</u> -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Subject	Life Cycle Analysis and Sustainability	**Duration (h)**	150

Content	CircVET Content	Source
-Introduction: Objectives and content Process Life Cycle Assessment (LCA): Definition and Importance -LCA methodology/ LCA phases (objective and target definition, inventory analysis, impact assessment, interpretation)/ LCA tools (software) and standardization of procedures -Sustainable Manufacturing: Definition and Importance -Sustainability Characterization Methodology -Environmental Impacts of AM -AM sustainability characterization	Module 2: -General aspects of eco-design; application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting -Life Cycle Sustainability Assessment principles and methods (LCA,SLCA,LCC) -Training with LCA software -Redesign based on LCA results Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Kaunas University of Technology	**Country**	Lithuania	**Title**	Environmental Engineering

Subject	Technologies for Waste Management and Resources Recovering	**Duration (h)**	150

Content	CircVET Content	Source
-Material flows in the anthroposphere, principles of linear and circular economics -Traditional extraction of resources from the lithosphere and biosphere -The main engineering, economic and legal aspects for solid waste management - Waste generation , characterisation and properties -Waste prevention, collection and transportation -Mechanical waste treatment and material separation -Physico-chemical recovery of material from waste -Chemical stabilization of hazardous substances in waste and soil -Aerobic processes and technologies for waste treatment and resource recovery -Anaerobic processes and technologies for waste treatment and resources recovery -Thermal and thermos-oxidative treatment of waste and soil, recovery of materials an energy -Integrated specific waste management and resource recovery processes -Recycling and use of recovered materials -Waste landfilling and landfill operation	Module 4: -Current situation in Europe and waste management in different industrial sector -Recycling technologies	Link

Entity	Universida de de Lisboa	**Country**	Portugal	**Title**	Materials Engineering

Subject	Technology of Polymeric materials	**Duration (h)**	150

Content	CircVET Content	Source
- Introduction. Facts about the plastics industry and environmental sustainability. - Rheological behaviour of polymeric melts in isothermal and non-isothermal flow. - Melt flow rate. - Melting and solidification of thermoplastics. - Mixing processes (distributive and dispersive). Polymeric mixtures and alloys. Additions. - Continuous processing of polymers: extrusion and calendaring. - Batch processing of polymers (I): injection - Numerical simulation of the injection moulding process of polymeric components using Moldflow software. - Batch processing of polymers (II): blowing, thermoforming, compression, transfer and rotational moulding, and additive manufacturing. - Identification and analysis of different processing technologies taking into account the type of polymeric component to be manufactured.	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Universidade Nova de Lisboa	**Country**	Portugal	**Title**	Materials Engineering

Subject	Polymeric materials processing	**Duration (h)**	150

Content	CircVET Content	Source
- Introduction: Continuous and discontinuous processes; examples of techniques and final objects manufactured by these two types of processes. - Extrusion (of plates, sheets and films, fibers and monofilaments, extrusion-blow; extrusion-coating of electrical cables and extrusion-granulation), injection moulding, injection-blow moulding, calendaring and thermoforming. - Brief reference to other technologies: injection and reaction moulding (RIM), rotation moulding, thermoplastic castings, coatings, co-injection, pultrusion, SMC, manufacturing of polymeric foams, machining, additive manufacturing. - Valuation of Polymeric Residues. Life cycle of a polymeric material. Waste sources. Solid waste recovery techniques. Enhancement technologies. Sustainable development and life cycle analysis. - Mechanical recycling. -Additivation of recycled and recycled polymer processing techniques	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Universidad Politécnica de Madrid	**Country**	Spain	**Title**	Masters in composite materials

Subject	Constituents materials and characterization	**Duration (h)**	200

Content	CircVET Content	Source
- Polymer Matrix Composites. Types of resins and fibers. - Characterization of reinforcing fibers - Physico- Chemical Characterization of polymer matrix. - Interaction Fiber Matrix. Interfaces. - Physical properties of laminates, prepregs - Physical properties of sandwich structures, foams and honeycombs - Characterization lamina & laminates - Moisture absorption and Adhesives - Statistical Methods. Determination of allowable - NTD methods 1.11 Procurement of Composites - Laboratory: chemical tests (DSC, DMTA, FTIR) - Laboratory: mechanical testing (tensile, ILLS) - Laboratory: impact tests and micrographics - Laboratory: non-destructive inspection equipment	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Subject	Manufacturing processes for polymer matrix composite structure	**Duration (h)**	200

Content	CircVET Content	Source
- Process of hand moulding. - Autoclave based processes (prepreg) - Equipment for manufacturing - Techniques for consolidation and curing of thermosetting resins - Liquid Moulding RTM, RFI, SCRIMP - Out of autoclave Techniques - Principles of the processes with thermoplastic matrix - Tooling for Composites - Assembly - Cutting, Machining - Manufacturing costs. Economic model. Production Orders - Additive Manufacturing - Composite industrialization - Factories 4.0	Module 3: -Digital manufacturing (DM) -Simulation / motorization Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Kaunas University of Technology	**Country**	Lithuania	**Title**	Chemical Engineering

Subject	Engineering of Polymeric Materials	**Duration (h)**	150

Content	CircVET Content	Source
- Processing fundamentals of polymeric materials - Periodic mixing equipment - Continuous mixing equipment - Rubber compounding equipment - Extrusion technologies - Moulding technologies and equipment - Calendaring technologies and mechanisms	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Vytautas Magnus University	Country	Lithuania	Title	Business and entrepreneurship

Subject	Entrepreneurship and Innovation	Duration (h)	150

Content	CircVET Content	Source
-Entrepreneurship and innovation: diversity of concepts and contexts -Principles of entrepreneur's thinking and behaviour -Innovative approaches to established business -Value innovation concept and cases -Principles of reviewing market boundaries -Identification of non-user groups -Stages of practical implementation of value innovation -Business model design -Business model innovations -Patterns/patterns of innovative business models - Profit dynamics in modern industries and business models	Module 8: -Presentation and definition of concepts related to entrepreneurship and innovation -New business development -Technology transfer and intellectual property rights	Link

Entity	Università degli Studi di Salerno	**Country**	Italy	**Title**	MATESPACK – MAteriali e TEcnologie Sostenibili per il PACKaging

Subject	PLASTICS PROCESSING TECHNOLOGIES	**Duration (h)**	40

Content	CircVET Content	Source
Module 2 - Compounding, extrusion and coextrusion - Flat filming and blown filming. - Molding and related and thermoforming - Solvent film production technologies	Module 5: - Manufacturing processes in the context of circular economy	Link

Subject	PACKAGING ECODESIGN AND SUSTAINABILITY	**Duration (h)**	40

Content	CircVET Content	Source
Module 7 - Ecodesign of packaging - Recycling of polymeric and cellulosic materials for packaging - Biodegradation and composting - LCA (Life Cycle Assessment) of packaging materials.	Module 2: - General aspects of eco-design: application to the plastic sector - Design guidelines of plastic packaging for minimum waste and efficient sorting - Life Cycle Sustainability Assessment principles and methods (LCA, SLCA, LCC) - Training with LCA software - Redesign based on LCA results. Module 4: - Recycling technologies	Link

Subject	LOGISTICS, MANAGEMENT AND ENABLING TECHNOLOGIES 4.0 FOR PACKAGING	**Duration (h)**	40

Content	CircVET Content	Source
Module 8 - Principles of integrated logistics - Production process planning and management. - Digitization of business processes and enabling technologies Industry 4.0 - Traceability - Communication and marketing	Module 7: - Presentation and definition of concepts related to materials recovery and added values	Link

III-VET annex

Entity	Alytaus	**Country**	Lithuania	**Title**	A vocation training programme for plastic injection moulding machine setters

Subject	Modelling and manufacturing of plastic products using a 3D printer	**Duration (h)**	125

Content	CircVET Content	Source
-Model a product in 3D using a computer program. -Prepare the 3D printing device and materials. -Produce plastic products using a 3D printer.	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Catálogo nacional de qualificações	**Country**	Portugal	**Title**	Técnico/a de Transformação de Polímeros/Processos de Produção

Subject	Polymers and plastics	**Duration (h)**	50

Content	CircVET Content	Source
- Polymers: identification, concepts and definitions, chemical composition, structure, properties, processing temperature, additives and applications	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

- Plastics: generalities, types, composition and characteristics, properties and applications of thermoplastics, elastomers and thermosets		

Entity	Catálogo nacional de qualificações	**Country**	Portugal	**Title**	Técnico/a de Desenho de Mobiliário e Construções em Madeira

Subject	Polymers technology	**Duration (h)**	50

Content	CircVET Content	Source
- Basics about polymers. - Thermoplastics and elastomers. - Thermosetting (resins). - Thermoplastic processing. - Elastomer processing. - Processing thermosets - Production technologies - Main applications.	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Visaginas Technology and Business Vocational Education and Training Centre	**Country**	Lithuania	**Title**	Adjuster of the plastic molding machines modular

Subject	Adjuster of the plastic moulding machines modular	**Duration (h)**	90

Content	CircVET Content	Source
- Organize and prepare for the production process - Produce plastic products by injection moulding - Produce plastic products by extrusion - Produce plastic products by blowing	Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	IES La Foia	**Country**	Spain	**Title**	Technician in Metal and Polymer Moulding Forming

Subject	Manufacturing of Moulds and Models	**Duration (h)**	2000

Content	CircVET Content	Source
-Characterises the models and moulds manufacturing process, relating the processes to obtain pieces by moulding to the different types of moulds. – Obtains mixtures of sands, polymers and additives for moulding, analysing the sequence of incorporation of the products. – Manufactures moulds and models, relating the stages of the process to their characteristics. – Assembles models and moulds, relating them to the sequence of operations and the tools required. – Complies with the rules on labour risk prevention and environmental protection, identifying the associated risks and the measures and the equipment to prevent them.	Module 2: -General aspects of eco-design: application to the plastic sector -Design guidelines of plastic packaging for minimum waste and efficient sorting Module 4: -Current situation in Europe and waste management in different industrial sector Module 5: -Manufacturing processes in the context of circular economy -Recycled materials and composites to manufacturing processes -Bio-based and/or biodegradable materials to manufacturing processes	Link

Entity	Scuola di alta formazione per la transizione ecologica - SAFTE	**Country**	Italy	**Title**	Percorso SAFTE 2025

Subject	National and European guidelines on environmental aspects in ESG assessments	**Duration (h)**	19.5

Content	CircVET Content	Source
Week 1: • General introduction to the main application formulas of Circular Economy and Bioeconomy. • Strategies for consumption and waste prevention. • Optimization of material flows, extension of product life cycle. • "Product-to-service" transition, reuse and remanufacturing. Week 2: • General introduction on the principles of "supply chain" design: from product eco-design to end-of-life valorisation. • European policy for sustainable resource use. • EPR regime: the standard designs the industrial operating model. • Guidelines on the application of End of Waste. The system of controls. • Circular economy: definition and applicability on a corporate scale. • Industrial symbiosis strategies and experiences. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects.	Module 1: - Presentation and definition of concepts related to the circular economy. - Circular economy business model Module 2: - General aspects of eco-design: application to the plastic sector - Design guidelines of plastic packaging for minimum waste and efficient sorting	Link

Week 3: • Tools for monitoring production and organizational models, including for reporting, communication and qualification of the enterprise. • The monitoring of product/process environmental performance, environmental certifications. • The sustainability report and GRI standards. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects.		

Subject	Energy strategies in the ecological transition	**Duration (h)**	19.5

Content	CircVET Content	Source
Week 4: • Energy conversion and transition from fossil fuels to renewables: the goals, technologies, solutions, and system integration. • "Smart" and 'carbon neutral' cities. Technological innovation and digitalization in climate strategies. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects. Week 5: • Digital technologies for the circular economy. • The regeneration of cities. The role of the Circular Economy in energy innovation.	Module 3: - Digital manufacturing	Link

• Enterprise energy regeneration and redevelopment in the framework of the Circular Economy. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects. Week 6: • Integration of technology solutions for energy system optimization. • Collective consumers and energy communities. • Case studies of energy communities in operation. • Incentives for the implementation of renewable energy sources. Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects.		

Subject	Circular economy of materials	**Duration (h)**	19.5

Content	CircVET Content	Source
Week 7: • European strategies for the bioeconomy and the new role of players in the supply chain. • Bio refineries and biomaterials: the new trend of ecological transition. • Sustainability in the agrifood supply chain. • Organic waste in the European context. "Circularity in the water sector. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects. Week 8: • Integrated valorization of organic waste.	<u>Module 1:</u> - Circular Economy implementation strategies <u>Module 4:</u> - Current situation in Europe and waste management in different industrial sector - Recycling technologies <u>Module 5:</u> - Recycling materials and composites to manufacturing processes.	Link

• Chemical recovery and wastewater valorization. • The role of anaerobic digestion in the circular economy. Industrial integrations in biomaterials. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects. Week 9: • Recycling of polymeric and composite materials. • Valorization of other categories of end-of-life materials. • Sustainability in the Building & Construction sector. • Plastics and bioplastics. • Concrete business experiences for each of the formulas presented and analysis of economic and environmental effects.	- Bio-based and/or biodegradable materials to manufacturing processes	

CIRCVET

CIRCULAR ECONOMY PRACTICAL TRAINING MATERIALS FOR PLASTIC MANUFACTURING INDUSTRIES

PROJECT INFO

Grant Agreement	Project: 101055916 — CIRCVET — ERASMUS-EDU-2021-PI-ALL-INNO
Programme	Erasmus+
Key Action	EACEA.A – Erasmus+, EU Solidarity Corps A.2 – Skills and Innovation
Action Type	ERASMUS Lump Sum Grants
Project Title	CIRCVET – Circular Economy Practical Training Materials for Plastics Manufacturing Industries
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PROJECT CONSORTIUM

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