E-learning course: Course Curriculum
CIRCULAR ECONOMY OF FIBROUS COMPOSITES AND TECHNICAL TEXTILES

Module	Unit	Short abstract
0. Introduction into the e-learning course		Explain to students in general terms the contents of the course, the teaching methodology to be used, assessment systems, how the platform works.
1. Circular economy for technical textiles and fibrous composites	Introduction to the module. 1.1. Concept of circular economy for technical textiles and fibrous composites. 1.2. Goals of sustainable development. 1.3. Concept of eco-design for technical textiles and composites. 1.4. Sustainable nature of logistics.	1.1. "Basic elements regarding the circular economy concept will be presented, starting from the limitations of the current linear system. The module will present definitions, principles and strategies related to the circular economy. The concept and associated vocabulary will be introduced. The particularities related to the circular economy of technical textiles and composite materials will be presented". 1.2. "The objectives of sustainable development in general and of the textile industry in particular and the ways in which they can be achieved will be highlighted: - waste reduction - reducing noise pollution - reducing air pollution - reducing water and soil pollution - reducing the consumption of water and chemicals in the stages of chemical finishing - extending the life of textile products - the development of recycling technologies

		- development of collection, sorting and preparation for textile recycling 1.3. Introduction to Sustainable Design and Sustainability. Explain what the Product Life Cycle (LCA) is and the basics steps. How to develop green composites and technical eco-textile. To know the Advantages and disadvantages over traditional ones. Examples of sustainable technical textile and composites products. To present the available Products, Social and Environment certifications. 1.4 The reasons of why logistics companies should always take under serious consideration the sustainability will be discussed. All dimensions of sustainability such us, economy, ethics, environment, education and their contents will be illustrated. Details of initiative examples of all four dimensions of sustainability in a textile and fibrous composites supply chain process are going to be included in the module also.
2. Sustainable resourcing for technical textiles and fibrous composites	Introduction to the module 2.1. Sustainable fibres and yarns for technical textiles and fibrous composites. 2.2. Sustainable materials for technical textiles and fibrous composites. 2.3. Sustainable matrixes for fibrous composites:	Introduce knowledge about sustainable fibres yarns, materials and matrixes used for technica textiles and fibrous composites. 2.1. “In the module 2.1. the main types of fibers and threads used in the textile industry will be presented. The impact on the environment in the process of making the yarns will be presented. The types of fibers/threads that can be recycled will be presented and their properties will be analyzed.” 2.2. ” In the module 2.2. the main types of textile materials/structures used to make technical textiles and fibrous composites will be presented. The impact on the environment will be presented in the process of making fabrics, knitwear, clothing (?) Different types of technical textiles and composite materials will be presented, specifying for each field of use.” 2.3. “The interest in high-performance composites based on renewable resources is growing

		tremendously. The combination of natural fiber with bio-based polymeric matrixes is one of the bes ways to produce a sustainable composite materia or, so-called green composite. Bio-based polymer have been defined as man-made or man-processed organic macromolecules derived from biologica resources. In this study, different types of bio-based and biodegradable sustainable matrixes fo example, Polyhydroxyalkanoates (PHAs), Polylacti acid (PLA), Polyhydroxy butyrate (PHB), Polyacryli acid, thermoplastic starch, cellulose acetate etc derived from different bioresources will be discussed. Furthermore, the adhesion properties and compatibility of these matrices with natural and man-made fibers will be a part of the discussion."
3. Sustainable processes used in manufacturing of technical textiles and fibrous composites	Introduction to the module 3.1. Sustainable mechanical processes for manufacturing of technical textiles and fibrous composites. 3.2. Sustainable chemical processes for manufacturing of technical textiles and fibrous composites.	3.1. In this module the mechanical processes o manufacturing will be presented, based on specific examples and case studies. The manufacturing perspectives like, the brand power, the economy o scale, the variety and volume, the constraints and the leadtime, will be illustrated in details. A typica industrial process in the domain of textiles will be provided, which will include the job shop, the batch process, the line flow and the mass customization. 3.2 At the beginning of this module, the meaning o chemical treatment as by far the most diversified process in the value-added chain of textiles will be explained and the three sections of pre-treatment dyeing and finishing will be highlighted. The discussion will also include that a sustainable supply chain is one where the environmental and human impact of the products is taken into account throughout their production across the supply chain. This will be provided to participants with specific case studies of processes from sourcing o sustainable resources to production, storage, and logistics, which are all done in an eco-responsible manner and is environmentally friendly and sustainable.

4. Quality and waste management	Introduction to the module 4.1. Quality management. 4.2. Quality control (standardized testing). 4.3. Waste management	Introduce to quality control as well as quality and waste management methodology and testing. 4.1. An introduction to the quality management and an already established implementation of the basic conceptual elements of quality control will be provided. A brief discussion will take place, referring to the commitment and support in a top management level, the integrated operations within and between facilities as well as the focus in the final product process performance. 4.2. "A key factor for the development of a sustainable composite is the determination and control of their properties by different standardized tests. In this segment, all the physical, mechanical, morphological, and structural properties of the composites that are necessary to control the material will be described. The testing standard, process, equipment, and technology to determine each property of the materials will be discussed briefly. Finally, some general problems of the quality of the composites and their respective solutions to overcome these problems will also be analyzed in this section." 4.3. "Wastes are generated during the manufacturing of composites as well as at the end of their life. Therefore, the management of waste composites is an important part of ensuring the sustainable development and production of composite materials. This chapter will begin with the usual waste management systems of the composites, e.g., landfilling, incineration/combustion, recycling and reusing. A brief overview of the relevant topics including the hazards of composite wastes, thermal recycling technique for energy/fuel recovery, mechanical recycling process for producing the by-products, disadvantages of landfilling, and recent developments of composite waste management systems will be presented here."

5. Recycling of fibrous composites and technical textiles: possibilities and challenges	Introduction to the module 5.1. Recycling of fibrous composites and technical textiles with one raw composition. 5.2. Recycling of fibrous composites and technical textiles with mixture raw composition. 5.3. Recycling of fibrous composites and technical textiles with "critical" raw composition.	Introduce to recycling process of these textile products: Define concepts and types of recycling. Difficulties and challenges of recycling fibrous composites and technical textile. 5.1. Establish the composition of the material to be recycled and define its properties, and thus the recycling process and its variables and the possibility of obtaining new products and/or materials. 5.2. Establish the composition of the materials to be recycled, define the properties of each one of them, separation possibilities, define and establish the recycling process and its variables, and the possibility of obtaining new products and/or materials. 5.3. Establish the composition of the materials to be recycled, define the properties of each one of them define and establish the regulations to be used fo the recycling of this type of materials and thei recycling possibilities. Define the recycling proces and its variables taking into account their specia nature, and the possibility of obtaining new products and/or materials.