General information	
Academic subject	**Industrial Ecology**
Degree course	Business and Management Strategies
Academic Year	1
European Credit Transfer and Accumulation System (ECTS)	8
Language	Italian
Academic calendar (starting and ending date)	I semester (from 12/09/2022 to 23/12/2022)
Attendance	Optional

Professor/ Lecturer	
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Department and address	Ionian Department, Faculty of Economics, Lago Maggiore street corner with Ancona street
Virtual headquarters	Microsoft Teams (code: pfy0u1a)
Tutoring (time and day)	Wednesday and Friday from 11:00 to 13:00 (presence and online mode)

Syllabus	
Learning Objectives	- The aim of the course is to make students acquire the principles, concepts, tools and methodologies of Industrial Ecology. It constitutes a new paradigm of economic development which, increasingly at international and local level, is finding wide diffusion, allowing the creation of sustainable development paths, programs and policies. - During the course, active teaching methods will be privileged, with case studies and / or analysis of scientific works, multimedia teaching supports, demonstration of specialized software, group work and simulations, visits and study seminars.
Course prerequisites	No
Contents	Definition of Industrial Ecology (EI). Schematic of the main physical interactions between the economic system and the environmental system. Industrial metabolism and environmental metabolism Historical evolution of EI: the different approaches to cleaner production (end -of-pipe, cleaner production, industrial symbiosis). Concepts and principles of EI. Review of the main EI approaches and tools. Design for the Environment (DfE), Eco -design. Notes on integrated quality - environment design tools The life cycle of the product from an EI perspective: from the cradle to the grave. Life Cycle Assessment (LCA) as an environmental management tool in an extended life cycle perspective. Simplified approaches to LCA. Notes on other environmental management and evaluation tools (Substance Flow Analysis, Material Flow Analysis, Input -Output Analysis). Ecological labels (Ecolabel, EPD, PEF). Eco -industrial parks. The paradigmatic case of Kalundborg, the Closed Project, the Humber region, the Taranto case study. LCA Software Analysis.
Books and bibliography	• Notarnicola B. 2020: "Appunti dalle lezioni". • Notarnicola B., 2008. Strumenti tecnici a supporto delle certificazioni ambientali: l'Analisi del Ciclo di Vita (LCA), 2008. In Buonfrate A.: Codice dell'Ambiente, UTET pg. 787 -811. • Ehrenfeld J., Gertler N., 1997. Industrial Ecology in Practice The Evolution of Interdependence at Kalundborg, Journal of Industrial Ecology, 1(1) pp.67 - 79. • Mirata M., 2004. Experiences from early stages of a National industrial symbiosis

	programme in the UK. Determinants and coordination challenges, Journal of Cleaner production, 12 (8 -10), pp.967 -983. • Notarnicola B., Uricchio A.F., Tassielli G., Renzulli P.A., Selicato G., 2012. Elaborazione di un modello di applicazione dei principi e degli strumenti dell'ecologia industriale ad un'area vasta. Cacucci Editore, Bari (Un capitolo a scelta). **Recommended reading:** • Graedel TE, Allemby BR., 2002: Industrial Ecology, Upper Saddle River, NJ, Prentice -Hall • Notarnicola B., Tassielli G., Settanni E., 2005. Life Cycle Costing e ambiente: lineamenti metodologici e applicazione alla produzione di energia elettrica. Ambiente, Risorse, Salute, n. 101, 14 -19.
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
200	64		136
ECTS			
8	8		

Teaching strategy	
	Lectures, internal cycles of lessons, exercises, seminars, laboratory activities, study visits. Course present in the e-learning area of the Faculty website.
Expected learning outcomes	
Knowledge and understanding on:	○ The Industrial Ecology course aims to provide students with in-depth specialist knowledge relating to the interactions between production processes and the environment, the eco-efficient use of raw materials in the same and the tools applicable for the improvement of production in key sustainable. (such as Eco-design, Life Cycle Assessment, Material Flow Analysis, Input-Output Analysis).
Applying knowledge and understanding on:	○ Having acquired the basic concepts and terminology, the student will have in-depth knowledge of the approaches and tools of Industrial Ecology and the practical aspects of LCA assessments using Software.
Soft skills	• *Making informed judgments and choices* ○ The course aims at the student's understanding of the most current environmental dynamics related to industrial ecosystems, the ability to evaluate the realization of a sustainable production or production process and with a problem-solving approach. • *Communicating knowledge and understanding* ○ At the end of the course, the student will have acquired the technical language useful for facing and covering managerial positions (such as Environmental Managers or Sustainability Managers), as well as providing advice on real cases. • *Capacities to continue learning* ○ The goal is to give the student an analytical technical-managerial ability. Finally, through the study of environmental management and assessment tools, it offers students the knowledge acquired that can be used on the territory both for public administration and private

	companies.

Assessment and feedback	
Methods of assessment	• Oral interview.
Evaluation criteria	• *Knowledge and understanding* o The student will have a broad view of the current entrepreneurial possibilities related to industrial ecology and the circular economy. • *Applying knowledge and understanding* o The student, having acquired the basic concepts and terminology, will have in-depth knowledge of the approaches and tools of Industrial Ecology and the practical aspects of LCA assessments using the Software. • *Autonomy of judgment* o The student will be able to understand all the theoretical problems and propose solutions and options for improving the environmental profile. • *Communicating knowledge and understanding* o The student will acquire adequate managerial skills with the aim of providing business consultancy about industrial ecology and the circular economy. • *Communication skills* o The student will acquire the technical language of the various industrial ecology tools • *Capacities to continue learning* o The student will acquire adequate knowledge on environmental management tools with the aim of applying them concretely to real case studies.
Criteria for assessment and attribution of the final mark	The final grade is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18.
Additional information	