



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2017/2018
MASTER'S DEGREE (MSC)	MANAGEMENT ENGINEERING
SUBJECT	SUSTAINABLE PRODUCTION TECHNOLOGIES
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50368-Ingegneria gestionale
CODE	18816
SCIENTIFIC SECTOR(S)	ING-IND/16
HEAD PROFESSOR(S)	INGARAO GIUSEPPE Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	99
COURSE ACTIVITY (Hrs)	51
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	INGARAO GIUSEPPE Monday 12:00 16:00 Dipartimento di Ingegneria, Università degli Studi di Palermo - Viale delle Scienze - 90128 PALERMO (ITALY) Thursday 14:00 18:00 Dipartimento di Ingegneria, Università degli Studi di Palermo - Viale delle Scienze - 90128 PALERMO (ITALY)

PREREQUISITES	knowledge of manufacturing processes; specifically, expertise concerning metal shaping processes is highly recommended. Mechanical as well technological properties of engineering materials
LEARNING OUTCOMES	Knowledge and comprehension skills The course aims at providing skills concerning products environmental impact analysis. The whole product life cycle as well as the inventory techniques for each phase life will be analyzed. The student will be able to identify the dominant phase as well as to propose new strategies to minimize the environmental impact of a given product. The student will be an expert in energy and resource efficiency in product manufacturing and in Life Cycle engineering (LCE) techniques. The students will be able to developed life cycle comparative analysis under both economic and ecological design objectives. Ability to apply the acquired knowledge The students will apply the learned Life Cycle Engineering methodologies to several case studies. Specifically, during practical classes and project work development the students can apply the acquired knowledge to real case studies. Also during oral examination two extra questions will be asked to foster the student reasoning and to test his/her problem solving skills. Independent thinking skills The students, by the end of the course, will have learned Life cycle based methodologies aimed at analyzing the environmental impact of a product/process. The students, will be able to both identify the main issues and to propose innovative strategies to minimize the environmental impact of a given product/process. Communication skills The students will be able to properly communicate the acquired content, specifically they will be able to take part to technical discussions concerning Life Cycle Engineering. Communications skills will be developed by case studies analysis developed within the practical classes as well as by the project work presentation. Learning skills Students should be able to independently implement economic and ecological analyses of an assigned case study. Moreover they have to prove they can propose new design strategies to improve the ecological performance of a product/process.
ASSESSMENT METHODS	The evaluation procedure consists of two parts. The first part focuses on a project work to be developed throughout the course. The second part is a more conventional oral examination. As far as the project work is concerned, it will be organized in teams of 3/4 students. The students will be assigned an overall topic and they will have to independently analyze and properly address their research activities. The project delivery consists of a technical report (maximum 20 pages) and PowerPoint presentation (15 minutes for each student). After presentation a brief discussion will take place, the teacher will ask the student some questions to analyze the acquired skills by means of project work development. Such examination aims at evaluating the personal reinterpretation level as well as the ability to deepen an assigned topic. By PowerPoint presentation the teacher can also evaluate the students communication skills. After the project work discussion the teacher will assign an individual mark (on a scale of 30) to each student As far as the second step of the evaluation procedure is concerned, an oral examination will take place. During the exam the teacher will ask at least 4 questions to cover all the main topics dealt with within the course. Subsequently two more questions will be asked to evaluate both the level of personal reinterpretation of the learned contents as well as the ability to apply the acquired knowledge to real case studies. Such two extra questions will be properly structured and will be also less specific to foster the student reasoning and to test his/her problem solving skills. Students will receive a mark for the oral presentation. The student will be positively evaluated only if they prove to have at least an acceptable knowledge of the topics provided during the course. The mark will rise as the level of knowledge, the ability of personal reinterpretation of as well as the aptitude to apply acquired knowledge to real case studies improve. The final mark is obtained by carrying out the arithmetic mean between the project work and the oral examination marks
EDUCATIONAL OBJECTIVES	The course aims at providing the students with design tools to minimize the environmental impact of products/processes. Overall, the course aims to increase the awareness of young engineers concerning the main factors of influence concerning the environmental impact analysis of product/processes. In other words, the course fosters the life cycle thinking and ecodesign approaches. The course provides skills allowing the students to apply LCE techniques to develop economic and ecological analysis of products and processes.
TEACHING METHODS	Frontal as well as practical classes

SUGGESTED BIBLIOGRAPHY	Notes provided by the teacher. Scientific papers provided by the teacher Material and the Environment (Ecoinformed Material Choice) Micheal F. Ashby, Elsevier, second edition,2012.
-------------------------------	--

SYLLABUS

Hrs	Frontal teaching
2	Introduction to sustainable manufacturing, sustainable development definition, dependence on nonrenewable materials
2	The role of material production within the global environmental impact
2	Embodied energy concept, the material life cycle and life cycle based analyses techniques
4	Life cycle assessment based on ISO 14040 procedure
1	Streamlined LCA methods
3	eco-auditing and methods for accounting for recycling credits
2	End of life strategies
3	Recycling issues: the case of aluminum alloys
3	flexible sheet metal forming processes: incremental and hydroforming processes.
3	Additive Manufacturing processes
5	Life cycle inventory at unit process level and manufacturing approaches comparison
Hrs	Practice
9	Application of eco-audit tools to different case studies
12	practical classes aimed at the project work development