UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Architettura		
ACADEMIC YEAR	2017/2018		
BACHELOR'S DEGREE (BSC)	INDUSTRIAL DESIGN		
INTEGRATED COURSE	SCIENCE AND TECHNOLOGY OF MATERIALS AND MATERIALS FOR DESIGN - INTEGRATED COURSE		
CODE	15333		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	ING-IND/22, ICAR/13		
HEAD PROFESSOR(S)	SCAFFARO ROBERTO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	SCAFFARO ROBERTO CATANIA CARMELINA ANNA	Professore Ordinario Professore Associato	Univ. di PALERMO Univ. di PALERMO
CREDITS	13		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**CATANIA CARMELINA ANNA** Wednesday 11:30 13:30 Dipartimento di Architettura Ed.14 I stanza 133 previo appuntamento **SCAFFARO ROBERTO** Monday 10:00 12:00 Viale delle ScienzeEdificio 6DICAM (ex Dip. Ingegneria Chimica)III piano, stanza 323 Tuesday 10:00 12:00 Viale delle ScienzeEdificio 6DICAM (ex Dip. Ingegneria Chimica)III piano, stanza 323 Wednesday 10:00 12:00 Viale delle ScienzeEdificio 6DICAM (ex Dip. Ingegneria Chimica)III piano, stanza 323 Thursday 10:00 12:00 Viale delle ScienzeEdificio 6DICAM (ex Dip. Ingegneria Chimica)III piano, stanza 323 Friday 10:00 12:00 Viale delle ScienzeEdificio 6DICAM (ex Dip. Ingegneria Chimica)III piano, stanza 323		

DOCENTE: Prof. ROBERTO SCAFFARO

PREREQUISITES	In order to understand the topics and to easily achieve the learning goals of the teaching course, the student must be confident with the subjects in the area of mathematics (SSD MAT/05).
LEARNING OUTCOMES	Knowledge and understanding ability The student, at the end of the teaching class, will possess knowledge of the main questions regarding characteristics, properties, application fields of the most common materials (even recycled) used for design purposes. An insight will be given to the processing technologies and to the preparation. Particular attention will be paid to typical engineering questions (design and verification) connected with the described processes and the consequent characterization tests. Ability to apply knowledge and understanding The student will be able to describe and use the different materials studied in the course to evaluate which is the best to realize a certain object-device. The student will also be able to identify the possible interactions and synergy among different materials to optimize the performance of an object-device. Judging autonomy The student will be able to interpret known data on materials in order to evaluate the range of their applicability. The student will be also able to recognize and acquire all the properties of a material necessary for the implementation/solution of design-verification problems. Communication ability The student will acquire the capability to communicate and express problems inherent the course topics. The student will be able to highlight questions related to the preparation and processing of different materials, to their lifetime behavior and to their recycling, by proposing solutions to solve possible shortcomings and critically assessing their effectiveness. Learning ability At the end of the course, the student will have learnt how to choose the most suitable material for a certain application, by evaluating properties, function of the object, environmental impact. This will allow continuing the studies with improved autonomy, dynamism and with the awareness to be able to make supported choices when realizing potential projects.
ASSESSMENT METHODS	The evaluation will be based on three tasks: a preliminary written composition followed by an interview and a practical design project. The written composition consist in a test containing five questions (four related to Materials Science and Technology and one related to Materials Design) to be answered openly in a maximum time of 120 minutes. This first task aims to evaluate some basic competences and problem solving capability of the student. The stimuli, well defined, clear and univocally interpretable allow formulating the answer in full autonomy. Moreover, they are structured in order to allow the comparability. The interview consists in questions about the written task. It aims to assess the competences and the knowledge learnt during the course. The questions will verify: acquired knowledge; elaboration capability; talking capability; ability to build autonomous connections not bound to the referring textbooks; capability to produce autonomous evaluations inherent the course topics; capability to understand the applications connected with the discipline areas; capability to connect the discipline topics with the referring professional and technological context. The practical design project consists in the development of a device-object in the frame of a theme assigned at the beginning of the course. In this task, the student will have to apply the notions learnt to produce a conceptual design and, eventually, a prototype. The final assessment is on a 30 basis according to the criteria reported below: 30-30+: excellent knowledge of the topics, excellent language and vocabulary, good analytical capability, the student is able to apply knowledge to solve the proposed problems 26-29: Good management of the topics, nice language and vocabulary, the student is able to apply knowledge to solve the proposed problems 24-25: basic knowledge of the topics, fair language and vocabulary, limited capability to apply autonomously knowledge to solve the proposed problems 21-23: the student does not show full management of the main topics while possessing the knowledge, satisfactorily language and vocabulary, poor capability to apply autonomously the acquired knowledge 18-20: minimal basic knowledge of the main topics and of the technical language and vocabulary, poor or no capability to apply autonomously the acquired knowledge. The exam will be not passed if the student will show a not acceptable knowledge of the topics.
TEACHING METHODS	Lectures, Class excercise, lab visits

MODULE
SCIENCE AND TECHNOLOGY OF MATERIALS

Prof. ROBERTO SCAFFARO

SUGGESTED BIBLIOGRAPHY

- W.F. Smith, J. Hashemi, Scienza e Tecnologia dei Materiali, Mc Graw Hill
- AA. VV. Materiali per il design – CEA Casa Editrice Ambrosiana
- Dispense del corso

AMBIT	50238-Formazione tecnologica
INDIVIDUAL STUDY (Hrs)	119
COURSE ACTIVITY (Hrs)	56

EDUCATIONAL OBJECTIVES OF THE MODULE

Goals
Main goal of the course is to provide students with essential tools and basic notions related to materials science and technology, materials characteristics, materials preparations methods and theirmain applications in the field of Industrial Design.
Program:
Matter structure and properties
Basic notion of solid state chemistry and physics. Crystalline and amorphous state. Basics on mechanical, electric, optical properties of materials. Properties-structure relationships in materials.
Metals
Iron based metals: production, properties, processing and applications of cast iron and steel. Thermal and surface hardening treatments of steels. Cast irons. Special steels and their main properties and applications. Non-iron based metals: production, properties and processing of copper, aluminum and their alloys.
Plastics
Structure and properties of main commercial polymers. Main processing method of polymers. Basics on properties-structure-processing properties in polymers. Applications on polymeric materials. Recycling and environmental sustainability.
Ceramics
Composition and structure. Classification. Fabrication technologies. Mechanical and thermal properties. Floor/wall ceramic tiles, sanitary ceramics.
Glasses
Definition. Composition and structure. Typologies of glasses. Special glasses. Forming methods. Mechanical, optical, chemical properties.
Composites
- polymer matrix: Definition. Particulate composites. Fibrous composites. Fillers typologies. Main fabrication processes. Mechanical, thermal rheological properties. Nanocomposites.
- ceramic or metallic matrix: Definition. Fibrous and particulate composites.
- natural origin: wood. Composition and structure. Main properties. Processing and applications.
Laboratory of mechanical properties: measurement of tensile, flexural and impact properties.
Laboratory of plastic processing: Extrusion. Compression moulding. Injection moulding. Film blowing.

SYLLABUS

Hrs	Frontal teaching
6	Structure and Properties of Matter
6	Metals
10	Plastic Materials
9	Ceramic Materials
10	Glass
12	Composites and wood

Hrs	Practice
3	Lab: mechanical properties and processing of plastics materials

MODULE
MATERIALS FOR DESIGN

Prof.ssa CARMELINA ANNA CATANIA

SUGGESTED BIBLIOGRAPHY

Dispense fornite dal docente
A. Catania, Materiali, design e ambiente. Guida per prodotti eco-efficienti, Edizioni Fotograf, Palermo, 2008
M. Ashby, K. Johnson, Materiali e Design, Casa Ed. Ambrosiana, Milano, 2005
A.Catania, “DaiPolimeri ai biopolimeri” (pp.II-IX) in disegno industriale/industrial design, Novembre/Dicembre 2009 n.41, ISSN 1594-8528
C. Vezzoli, E. Manzini, Design per la sostenibilita' ambientale, Zanichelli, Bologna, 2007
Fuad-Luke Alastair, Eco-Design progetti per un futuro sostenibile, Logos, Modena, 2003

AMBIT	50234-Design e comunicazioni multimediali
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

The course examines the issue of materials, through the history of industrial product since the Industrial Revolution to the present day. In addition, during the course, we intend to analyze the identification of tools and strategies for a planning that takes into account the environmental impact of materials, products and their production processes according with the current regulations on environmental policies of the European Union.

After an analisys of the relationship between design and materials, the course propose the study of tradizional and innovative materials, deepening the products and the production processes and their application in industrial product realization. The course, in addition to glass, wood, cardboard, composites, describes in more detail the new generation materials and innovative use of traditional materials. The lessons, continuing to take into account the nature of materials and related technologies applied in the design, devote special attention to the environmental impact related to the choice of materials and processing technologies. It will be illustrated the potential recycling of materials obtained from retired products and innovative outcomes arising from recycling, and the use of biodegradable and green composites. Furthermore, it will be illustrated the possible methodological approaches for the eco-oriented design and analytical instrumentation to control the environmental quality of a product, the integration of the production system with the environment (eco-efficiency of the products, Life Cycle Design, Lyfe Cycle Assessment), and the instruments for a preventive environmental policy (ISO, EMAS Ecolabel, Integrated Product Polyce, etc.).
The lectures will be supplemented by seminars moments with the intervention of designers and manufacturers. The course is divided in lectures, with an ongoing evaluation and a planning exercise. The ongoing evaluation will focus on the selection of a product and the analysis of the same product, identifying the materials and the critical criteria in terms of eco-oriented view. The exercise will illustrate the design process and the choice of materials for the realization of an industrial product

SYLLABUS

Hrs	Frontal teaching
4	The materials and the history of the industrial product from the industrial revolution to today
8	Analysis and application of traditional materials (wood, glass, aluminum, composites)
8	Analysis and application of biodegradable and recyclable materials
8	Analysis and applications of new generation materials (smart materials - Shape Memory Alloys) and innovative use of traditional materials
8	Analysis on the environmental impact associated to the choice of materials and processing technologies for the realization of a product. We will illustrate the possible methodological approaches for eco-oriented design (Life Cycle Design, Life Cycle Assessment)

Hrs	Practice
12	The test session is organized in an ongoing evaluation and planning exercise. The ongoing evaluation will focus on the selection of a product and the analysis of the same product, by identifying the materials and the critical criteria in terms of eco-oriented view. The exercise will illustrate the design process and the choice of materials for the construction and assembly of an industrial product.