



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Architettura		
<b>ACADEMIC YEAR</b>	2023/2024		
<b>BACHELOR'S DEGREE (BSC)</b>	INDUSTRIAL DESIGN		
<b>INTEGRATED COURSE</b>	SCIENCE AND TECHNOLOGY OF MATERIALS AND MATERIALS FOR DESIGN - INTEGRATED COURSE		
<b>CODE</b>	15333		
<b>MODULES</b>	Yes		
<b>NUMBER OF MODULES</b>	2		
<b>SCIENTIFIC SECTOR(S)</b>	ING-IND/22, ICAR/13		
<b>HEAD PROFESSOR(S)</b>	CATANIA CARMELINA ANNA	Professore Associato	Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	CATANIA CARMELINA ANNA	Professore Associato	Univ. di PALERMO
	GULINO EMMANUEL FORTUNATO	Ricercatore a tempo determinato	Univ. di PALERMO
<b>CREDITS</b>	14		
<b>PROPAEDEUTICAL SUBJECTS</b>			
<b>MUTUALIZATION</b>			
<b>YEAR</b>	2		
<b>TERM (SEMESTER)</b>	1° semester		
<b>ATTENDANCE</b>	Not mandatory		
<b>EVALUATION</b>	Out of 30		
<b>TEACHER OFFICE HOURS</b>	<p><b>CATANIA CARMELINA ANNA</b>  Wednesday 11:30 13:30 Dipartimento di Architettura Ed.14 I stanza 133 previo appuntamento</p> <p><b>GULINO EMMANUEL FORTUNATO</b>  Monday 15:00 18:00 Viale Delle Scienze Edificio 6, Piano 3°, Studio 3015  Tuesday 15:00 18:00 Viale Delle Scienze Edificio 6, Piano 3°, Studio 3015</p>		

DOCENTE: Prof.ssa CARMELINA ANNA CATANIA

<b>PREREQUISITES</b>	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).
<b>LEARNING OUTCOMES</b>	<p><b>Knowledge and understanding ability</b> 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.</p> <p><b>Ability to apply knowledge and understanding</b> 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.</p> <p><b>Judging autonomy</b> 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.</p> <p><b>Communication ability</b> 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.</p> <p><b>Learning ability</b> 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.</p>
<b>ASSESSMENT METHODS</b>	<p>The evaluation will be based on a written composition consisting in a test containing eight questions (four related to Materials Science and Technology and four related to Materials Design) to be answered openly in a maximum time of 120 minutes. This 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. 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.</p> <p>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.</p> <p>The exam will be not passed if the student will show a not acceptable knowledge of the topics. The exam and the related evaluation will be the same for non-attending students.</p>
<b>TEACHING METHODS</b>	Lectures, Class exercise, lab visits

**MODULE  
SCIENCE AND TECHNOLOGY OF MATERIALS**

*Prof. EMMANUEL FORTUNATO GULINO*

**SUGGESTED BIBLIOGRAPHY**

- W.F. Smith, J. Hashemi, *Scienza e Tecnologia dei Materiali*, Mc Graw Hill, qualsiasi edizione a partire dal (any edition since) 2018, ISBN: 8838698791
- W.F. Smith, J. Hashemi, *Foundations of Materials Science and Technology*, Mc Graw Hill, qualsiasi edizione a partire dal (any edition since) 2018, ISBN: 9780073529240
- AA. VV. *Materiali per il design* – CEA Casa Editrice Ambrosiana, qualsiasi edizione (any edition), ISBN: 8808187500
- Dispense del corso

<b>AMBIT</b>	50238-Formazione tecnologica
<b>INDIVIDUAL STUDY (Hrs)</b>	119
<b>COURSE ACTIVITY (Hrs)</b>	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 their main 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**

<b>Hrs</b>	<b>Frontal teaching</b>
6	Structure and Properties of Matter
6	Metals
10	Plastic Materials
9	Ceramic Materials
10	Glass
12	Composites and wood
<b>Hrs</b>	<b>Practice</b>
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

A. Catania, "Dai Polimeri ai biopolimeri" (pp.II-IX) in *disegno industriale/industrial design*, Novembre/Dicembre2009 n.41, ISSN 1594-8528

V. Rognoli, M. Levi, *Materiali per il Design: espressività e sensorialità*, Ed. Polipress, 2005 B. Del Curto, E. Fiorani, C.

Passaro, *La pelle del design*, Lupetti, Milano, 2010

M. Cardillo, M. Ferrara, *materiali intelligenti, sensibili, interattivi*, Lupetti, Milano, 2008

M. Ashby, K. Johnson, *Materiali e Design*, Casa Ed. Ambrosiana, Milano, 2005

C. Vezzoli, E. Manzini, *Design per la sostenibilita' ambientale*, Zanichelli, Bologna, 2007

Fuad-Luke Alastair, *Eco-Design progetti per un futuro sostenibile*, Logos, Modena, 2003M. Ashby, K. Johnson, M. Ashby, K. Johnson, *Materials and Design*, Elsevier, 2013

<b>AMBIT</b>	50231-Formazione di base nel progetto
<b>INDIVIDUAL STUDY (Hrs)</b>	119
<b>COURSE ACTIVITY (Hrs)</b>	56

**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 analysis of the relationship between design and materials, the course propose the study of traditional 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.

**SYLLABUS**

Hrs	Frontal teaching
10	The materials and the history of the industrial product from the industrial revolution to today
12	Analysis and application of traditional materials (wood, glass, aluminum, composites)
12	Analysis and application of biodegradable and recyclable materials
12	Analysis and applications of new generation materials (smart materials - Shape Memory Alloys) and innovative use of traditional materials
10	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)