UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2018/2019
MASTER'S DEGREE (MSC)	AEROSPACE ENGINEERING
SUBJECT	SCIENCE AND TECHNOLOGY OF COMPOSITE MATERIALS FOR AEROSPACE ENGINEERING
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20907-Attività formative affini o integrative
CODE	18552
SCIENTIFIC SECTOR(S)	ING-IND/22
HEAD PROFESSOR(S)	VALENZA ANTONINO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**VALENZA ANTONINO** Monday 15:00 16:00 Stanza 319 Edificio 6 Wednesday 15:00 16:00 Stanza 319 Edificio 6 Thursday 09:00 10:00 Stanza 319 Edificio 6

DOCENTE: Prof. ANTONINO VALENZA

PREREQUISITES	Basic knowledge on metals, polymers, ceramics and binders definition capabilities of the amorphous state and the crystalline state Knowledge on the constitutive behavior of the brittle and ductile materials Understanding of spectroscopic analysis of the structure of materials Study of theoretical models predict the mechanical behavior: micromechanics and theory of rolling
LEARNING OUTCOMES	The main purpose of the course covering the teaching of the following essential aspects of design, production and use of composite materials: • Principal types of matrices and reinforcements used • Major manufacturing technologies • Study of the theoretical / predictive models of mechanical behavior • Main experimental techniques of the properties' mechanical, chemical and physical • Traditional and innovative Industrial Sectors Knowledge and ability 'to understand The student at the end of the course will have 'full knowledge of the methods of analysis of the behavior of composite structures as well as hybrid structures that consist of traditional materials and elements in composite materials. Capacity to apply knowledge and understanding The student will have mastery of design and verification procedures relating LEARNING OUTCOMES EXPECTED The purposes' main course covering the teaching of the following essential aspects of design, production and use of composite materials and nanocomposites: • Principal types of matrices and reinforcements used • Major manufacturing technologies • Study of the theoretical / predictive models of mechanical behavior • Main experimental techniques of the properties' mechanical, chemical and physical • Traditional and innovative Industrial Sectors Knowledge and understanding The student at the end of the course will have full knowledge of the methods of analysis of the behavior of composite structures as well as hybrid structures that consist of traditional materials and elements in composite materials. Applying knowledge and understanding The student will master the sizing and verification procedures regarding the use of the material covered by this course as well as the experimental characterization procedures. It will also be able to correlate the structure of such materials to the macroscopic properties and then to their possible use function of the work conditions. Making judgments Compared to the plurality of design options, the students will acquire an independent judgment and a choice selection of capacity, with regard to the economic constraints, constructive and environmental, that are derived from analytical and evaluation tools that will have acquired during the course. The acquisition of judgment will be made by the evaluation in the examination.
ASSESSMENT METHODS	Oral examination. The interview is aimed at determining the student's ability to process the knowledge gained by using them to solve problems and the ability to express the teaching content using a technically correct language. The vote is expressed in thirtieths with possible praise, according to the scheme reported in the website The questions will cover the types of matrixes and reinforcements that can be used, as well as the main production technologies and the main experimental techniques for the chemical-physical characterization of composite and nanocomposite materials and will evaluate the student's ability to conduct a critical analysis Of the various possible solutions in terms of structure and composition of materials and their production and / or processing processes, based on their mechanical and functional properties in view of the specific application.
EDUCATIONAL OBJECTIVES	The course aims at provide knowledge of the preparation, characterization, structure, property 'and the technological applications of the main types of composite polymer materials and nanocomposites The student will also develop knowledge about the chemical and physical synthesis methods of the main classes of nanoparticles and other organic and inorganic nanostructures, nano-scale structure-properties correlations, and processes that can lead to self-assembly and / or integration Of these base units in more complex functional architectures.
TEACHING METHODS	Front lessons; exercises in class; visits to the Laboratory of Materials of DICAM.

SUGGESTED BIBLIOGRAPHY	Mallick, P.K. Fibre reinforced composites: materials, manufacturing and design. Marcel Dekker Inc. Agarwal BD, Broutman, LJ, Chandrashekhara K. Analysis and Performance of Fiber Composites. John Wiley & Sons. Dispense fornite dal docente

SYLLABUS

Hrs	Frontal teaching
2	Main structures in fiber-reinforced composite material: laminated and sandwich
3	Classifications fibers for composite materials: synthetic fibers (glass, carbon and Kevlar) and natural fibers (flax, hemp, jute, etc.)
2	Fiber-matrix interactions, of compatibilization methods: chemical treatment of the fibers, sizing
7	Production techniques of composite materials: hand layup, vacuum bagging, vacuum infusion, RTM, filament winding, pultrusion
4	Main property 'of composite materials: mechanical, thermal inertia, chemical inertness, conductivity' electrical and thermal
3	Charges classification: natural and synthetic clays, hydrotalcites, graphene, carbon nanotubes, etc.
3	Methods of preparation: in situ polymerization, intercalation from solution, by melt intercalation

Hrs	Practice
2	Examples of industrial applications of composite materials
2	Calculation of the degree of polymerization of a thermosetting resin
2	Determination of the resistance values of the fibers
2	Determination of the operating parameters of the main composite production processes
2	Calculation of the main properties of composite materials
4	Exercises on micromechanics and macromeccanica
3	Charge-matrix interaction and compatibilization methods
3	Techniques of characterization of polymeric composite materials: XRD, SEM, TEM, AFM, Rheology, spectroscopy, NMR
4	Examples of industrial applications of composite materials