UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2016/2017
MASTER'S DEGREE (MSC)	MATERIALS SCIENCE AND ENGINEERING
INTEGRATED COURSE	MATERIALS PROCESSING TECHNOLOGIES - INTEGRATED COURSE
CODE	17377
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	ING-IND/22, ING-IND/16
HEAD PROFESSOR(S)	LA MANTIA FRANCESCO PAOLO — Professore a contratto in quiescenza — Univ. di PALERMO
OTHER PROFESSOR(S)	BUFFA GIANLUCA — Professore Ordinario — Univ. di PALERMO LA MANTIA FRANCESCO PAOLO — Professore a contratto in quiescenza — Univ. di PALERMO
CREDITS	15
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**BUFFA GIANLUCA** Tuesday 11:00 13:00 ufficio Friday 11:00 12:00 ufficio **LA MANTIA FRANCESCO PAOLO** Tuesday 08:00 10:00 Ufficio al terzo piano dell'edificio & Viale delle Scienze Thursday 08:00 10:00 Ufficio al terzo piano dell'edificio & Viale delle Scienze

DOCENTE: Prof. FRANCESCO PAOLO LA MANTIA

PREREQUISITES	In order to understand the topics and to easily achieve the learning goals of the teaching course, the student must know the mechanical properties of materials and the mechanics of solids. Additionally, he must be confident with the following subjects: Physics, Science e Technology of materials, transport phenomena and Termodynamics, , Science of Construction, Materials Technology.
LEARNING OUTCOMES	Knowledge and understanding At the end of the modulo the student will have acquired knowledge on the four main manufacturing techniques (casting, machining, plastic deformation, welding) of metals. The didactic approach aimed to define the technological and physical problem and to link it with the basic knowledge and similar problems Applying knowledge and understanding The student will be able to understand the most advanced manufacturing techniques and optimize the process parameters Ability to identify and discuss the following topics: Linear and non linear visco-elasticity Rheologic properties Main technological operations for metals and polymers. Relations properties-structure-processing Making judgements The student will be able to understand the choice of the main parameters for the different processes and to modify them based on specific needs. Additionally, he will have acquired the ability to identify the correct material for a given application. Communication skills The student will acquire the ability to express and discuss the main issues related to the studied processes. He will be able to hold a conversation on topics related to the manufacturing of metals and polymers. Learning skills The student will be able to independently tackle any issue related to the identification of the main mechanical properties of polymeric and non-polymeric materials, to their characterization and to the optimization of the production process and applications
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	The course includes lessons, exercitations and laboratory.

MODULE
POLYMERIC MATERIALS TECHNOLOGY AND PROCESSING

Prof. FRANCESCO PAOLO LA MANTIA

SUGGESTED BIBLIOGRAPHY

• AIM - “Fondamenti di Scienza dei Polimeri”, a cura di M. Guaita, F. Ciardelli, F.P. La Mantia, E. Pedemonte, Pacini Editore 1998.
• J. M. Dealy, K.F. Wissbrun, “Melt rheology and its role in plastics processing”, Chapman & Hall, 1990.
• L.E. Nielsen, R.F. Landel, “Mechanical properties of polymers and composites”, Marcel Dekker, Inc. 1994.
• Dispense distribuite dal docente

AMBIT	50482-Discipline dell'ingegneria
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81

EDUCATIONAL OBJECTIVES OF THE MODULE

Goal of this module is to deepen some subjects about the viscoelasticity, the rheology and the processing operations of the polymer systems. In particular, the course will treat the viscoelastic behavior of the polymers, the concept of relaxation times spectrum and the Maxwell and Kelvin-Voigt models. The Non-Newtonian behavior in shear flow will be correlated with the molecular structure of the polymers as for the elongational flow. As for the solid state, the main mechanical and dynamic-mechanical properties will be correlated with the molecular structure and the morphology. All the processing operations in molten state will be treated. Finally, the structure-properties-processing relationships will be deepen. The final part of the course will be devoted to the polymer blends.

SYLLABUS

Hrs	Frontal teaching
3	Polymers, polymerization and chemical and molecular structure
3	Amorphous and semicrystalline polymers. Glass transition temperature. Elastic and viscous materials.
12	Viscoelasticity, Maxwell and Kelvin-Voigt models. Relaxation time and relaxation times spectrum-Superposition effects principle. Time -temperature equivalence principle
12	Rheology of polymer systems. Non-Newtonian viscosity. Effect of the molecular structure on the flow curves and on the normal stresses. eElongational flow
6	Dynamic-mechanical properties. Effects of physical and molecular parameters on the dynamic-mechanical properties.
16	Processing operations: extrusion, film blowing, spinning, calendering, injection molding.
6	Mechanical properties and effect of molecular structure and morphology
4	Properties-structure-processing relationships
6	Mixing and polymer blends

Hrs	Practice
3	Relaxation times spectrum

Hrs	Workshops
3	Flow curves and Bagley and Rabinowitsch corrections
3	Determination of the stress-strain curves of fragile and ductile polymers.
6	Processing operations: extrusion, film blowing, compression molding, spinning, injection molding

MODULE
NON-POLYMERIC MATERIALS TECHNOLOGY AND PROCESSING

Prof. GIANLUCA BUFFA

SUGGESTED BIBLIOGRAPHY	
Gabrielli, Ippolito, Micari “Analisi e tecnologia delle lavorazioni meccaniche”, Mc Graw Hill Dispense del corso	
AMBIT	20973-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
EDUCATIONAL OBJECTIVES OF THE MODULE	
Proper knowledge of the methodology and operative aspects of the main manufacturing processes of metals as well as the capability to use this knowledge to identify, understand and describe the main issues relative t the studied processes	

SYLLABUS

Hrs	Frontal teaching
5	Sand casting. Die casting. Defects in casting parts. Production costs
10	Machining operations. Process mechanics in turning, milling, drilling and grinding. Machines for cutting. Machine tools. Costs and production time. Machining optimization
10	Plastic deformation processes. Recall of Plasticity theory. Bulk and sheet forming processes
7	Welding and joining techniques. Fusion welding processes. Solid state processes

Hrs	Practice
5	Casting technology: pattern and mould design
5	Machining operations. Machine and tool geometry. Turning optimization
5	Bulk and sheet forming: extrusion, drawing, rolling, forging, deep drawing, sheet stamping and springback
5	Fusion and solid state techniques