UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2017/2018
BACHELOR'S DEGREE (BSC)	ENERGY ENGINEERING
SUBJECT	GENERAL TECHNOLOGY OF MATERIALS AND APPLIED CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50301-Ingegneria dei materiali
CODE	07322
SCIENTIFIC SECTOR(S)	ING-IND/22
HEAD PROFESSOR(S)	BOTTA LUIGI Professore Associato 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	**BOTTA LUIGI** Monday 15:00 17:00 Ufficio (Ed. 6, terzo piano) Thursday 15:00 17:00 Ufficio (Ed. 6, terzo piano)

DOCENTE: Prof. LUIGI BOTTA

PREREQUISITES	In order to understand the topics and to easily achive the learning goals of the teaching course, the student must be confident with the following subjects: Chemistry, Mathematics and Physics I.
LEARNING OUTCOMES	Knowledge and understanding: Knowledge of the main classes of engineering materials and ability of correlating chemical composition, structure and properties. Knowledge of the main parameters that characterize the water for domestic and industrial uses, and of the related treatment processes. Knowledge of the chemical and physical properties of fuels. Knowledge of theoretical principles and management practices of the combustion reactions. This learning outcome will be verified through the written test. Applying knowledge and understanding: Ability to choose the most suitable materials for the production of a deviceconsidering its characteristics and the final application. Methods of detection and characterization of materials on the basis of their properties. Structure-property relationships for the materials, water and fuels. Ability to connect the studied topics with real issues. This learning outcome will be verified through the written test and the oral examination. Making judgements: Ability to identify the properties and the processing methods for the main materials used in engineering applications . Ability to evaluate the water quality and consequently to identify the most suitable treatments in relation to the final application. Run of the industrially employed combustion processes. This learning outcome will be verified through the written test and the oral examination. Communication: The student will be able to communicate problems regarding the physical and chemical properties of water and fuels and the structure-property relationships of materials by using a suitable technical language. This learning outcome will be verified through the oral examination. Lifelong learning skills: The student will be able to address issues related to the treatments of natural and industrial water, the treatment of fuels and the choice of materials, incluiding their characterization and the most suitable processing methods. This learning outcome will be verified through the oral examination.
ASSESSMENT METHODS	The evaluation will be based on two tasks: a preliminary written test followed by an oral examination. The written examination consists in a test containing 5 exercises and 3 questions to be answered openly in a maximum time of 3 hours. The oral examination includes questions relating to the written test and at least a further question about different topics covered during the course. These examinations aim to evaluate some basic competences and problem solving capability of the student. Furthermore, the aim is to assess the competences and the knowledge learnt during the course. 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 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 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.
EDUCATIONAL OBJECTIVES	The aim of the course is to provide students with the skills to operate design and management choices such as: - Evaluate the quality of water in order to suggest processes and equipment to treat it depending on the final use. - Select the materials according to their properties and applicaations. - Evaluate the technical data sheet of a fuel and perform stoichiometric and thermodynamic calculations regarding combustion reactions.
TEACHING METHODS	Lectures and exercises.
SUGGESTED BIBLIOGRAPHY	- William F. Smith, SCIENZA E TECNOLOGIA DEI MATERIALI, McGraw-Hill. - Cesare Brisi, CHIMICA APPLICATA, Ed. Levrotto-Bella (Combustibili: Cap.li

	5-8). - G. Polizzotti, “L’Acqua”, Ed. Ambrosiana.

SYLLABUS

Hrs	Frontal teaching
10	WATER (Introduction, properties, features and analysis of water. Sedimentation, coagulation, flocculation, filtration. Aeration and degassing. Hard water and softening treatments. Lime and soda softening. Cation-exchange softening. Demineralisation by ion-exchange. Other treatments.)
5	COMBUSTION (Introduction, combustion, enthalpy and heat of combustion. Complete and incomplete combustion. Combustion smokes. Flammability limits, ignition temperature, flame temperature.)
5	FUELS (Solid, liquid and gaseous fuels. Petroleum derivatives, cracking and reforming. Gaseous fuels, natural gas and gas-producer . Liquid fuels, octane and cetane number.)
2	INTRODUCTION TO MATERIALS (Introduction to materials: metals, polymers and ceramics. Comparing the properties. Criteria for the selection.)
6	METALS (Chemical bonds, crystallography and Bravais lattices. Defects and solutions. Number of coordination. Atomic packing factor. Crystallization. Phase diagrams. Phase transformations. Microstructures. Isomorphic binary systems. Eutectic systems and other systems. Examples of metal alloys.)
6	STEEL AND CAST IRON (Iron-Carbon phase diagram. TTT and CCT diagrams. Thermal and thermochemical treatments: hardening, annealing, carburization of steel. Classification of steels and cast irons. Production of steel and cast iron.)
2	MECHANICAL PROPERTIES (Tensile test, compression test, bending test, impact test, hardness, fatigue behavior.)
6	POLYMERS (Introduction and features. Solid state, glass transition and crystalline state. Processing methods, extrusion and injection molding. Industrial polymers and related applications.)
2	CERAMIC AND GLASSES (Structure, amorphous and crystalline phases, viscosity, processing methods.)

Hrs	Practice
10	- WATER (calculation of water hardness and of reactives for lime and soda softening; sedimentation) - COMBUSTION (calculation of key parameters related to fuels and combustion reactions) - METALS (calculation of theoretical density, determination of the Miller indices , phase diagrams) - MECHANICAL PROPERTIES (stress-strain curve, resilience calculation)