UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2018/2019
BACHELOR'S DEGREE (BSC)	CIVIL AND BUIDING ENGINEERING
INTEGRATED COURSE	CHEMISTRY/TECHNOLOGY OF MATERIALS - INTEGRATED COURSE
CODE	10050
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	CHIM/07, ING-IND/22
HEAD PROFESSOR(S)	FIORE VINCENZO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	FIORE VINCENZO Professore Associato Univ. di PALERMO BELLARDITA MARIANNA Professore Associato Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**BELLARDITA MARIANNA** Monday 10:00 12:00 Tutti i giorni, previo appuntamento da concordare via mail: marianna.belardita@unipa.itPer il momento i ricevimenti si svolgeranno on-line **FIORE VINCENZO** Tuesday 09:00 11:00 Viale delle Scienze, Edificio 6, terzo piano, stanza 3012 Thursday 09:00 11:00 Team "Didattica telematica Prof. Fiore" codice: opuh3tj

DOCENTE: Prof. VINCENZO FIORE

PREREQUISITES	Basic knowledge of mathematics and physics
LEARNING OUTCOMES	LEARNING OUTCOMES of Chemistry Knowledge and understanding • At the end of the course, the student will acquire the basic knowledge of the structure of matter, the principles governing its chemical-physical transformations and the energy variations that accompany it. In particular, will have acquired the basic knowledge about: atoms and atomic structure; Chemical bond theory; Phase equilibria; Aggregation states; Chemical equilibria; Thermodynamic Functions; Electrochemistry; Nomenclature of organic and inorganic compounds; Material properties (melting and boiling temperature, vapor pressure, heat conductivity and current). Applying knowledge and understanding •Logical reasoning ability and aptitude to tackle problems scientifically rigorously. •Ability to correlate the structure of matter with its properties (melting and boiling temperature, vapor pressure, conductivity). • Capacity in solving problems regarding combustion, molecular, ionic and acid-base equilibrium. • Ability to understand the transformations of the matter according to chemical reactions. Making judgements •The student will have gained autonomy in the application of the basic concepts of Chemistry and in the resolution of problems regarding the combustion, molecular, ionic and acid-base equilibria, electrochemical cells and electrolytic phenomena. Communication skills • The student will be able to communicate with competence and properties of language about the problems relating to the matter structure and its transformations in order to better understand the behavior of the materials. Learning skills • The student will be able to deal independently the study of problems concerning all aspects presented during the course. LEARNING OUTCOMES of TECHNOLOGY OF MATERIALS Knowledge and understanding • At the end of the course, the student will acquire the basic knowledge of the main classes of engineering materials used in civil and construction field, in addition to the ability of correlating their chemical composition, structure and properties. • Knowledge of the basic principles of materials technology and the use of specific languages. Applying knowledge and understanding • Ability to choose the most suitable materials for the production of a device considering its characteristics and the final application. • Methods of detection and characterization of materials on the basis of their properties. • Ability to understand the structure-property relationships for materials used in construction field. •Ability to connect the studied topics with real issues. •Structure-property relationships for the materials and water. • Capacity in solving problems regarding water treatments and mix design of concrete. • Ability to apply the knowledge in the design and construction of civil engineering works Making judgements •The student will have gained autonomy in the application of the basic concepts of Chemistry and in the resolution of problems regarding the combustion, molecular, ionic and acid-base equilibria, electrochemical cells and electrolytic phenomena. Communication skills • The student will be able to communicate with competence and properties of language about the problems relating to the matter structure and its transformations in order to better understand the behavior of the materials. Learning skills • The student will be able to address issues related to the treatments of water and the choice of materials, including their characterization and the most suitable processing methods. This learning outcome will be verified through the oral examination.
ASSESSMENT METHODS	Assessment methods of Chemistry Learning of the contents presented during the course will be evaluated using two tests: one written and one oral. An on-going test will also be carried out on the subjects covered during the first part of the course and of the same type of

	examination test, to help the student to afford the final examination and make him aware of the degree of preparation he has achieved. The on-going test will not weigh on the final evaluation. The written examination, which tends to verify the skills and the knowledge relating to the disciplinary scope of the course, will be composed of ten clear questions and uniquely interpretable, numerical and theoretical, with open answers that meet constraints that make them comparable with the predetermined correction criteria. It will be considered the logic followed by the student in the resolution of the questions; the correctness of the procedure identified for the solution of the question; the accuracy of the final result; the adequacy of the numerical found result; the ability to understand the results obtained; the use of an adequate language. Numerical questions presented in the written examination will cover the following topics: stoichiometry, ideal gas laws, colligative properties of solutions, Hess law, molecular equilibria, ionic equilibria (pH of aqueous solutions, solubility), balancing oxidation reactions, calculation of the electromotive force of a stack, Faraday's laws. Theoretical questions will address less applicable topics such as atomic theories (quality), acid-base theories, the description of the ideal gas model, the description of the parameters that affect a chemical balance, the fundamental laws of chemistry. The total score of the written tests will be out of thirty and will result from the sum of the scores given to each question depending on its complete resolution, partial or no resolution. The expected duration of the written examination is two hours and achieving a score of at least 15/30 is a necessary condition for access to the oral examination. The oral examination consists of an interview to ascertain the possession of the skills and the knowledge provided by the course, the computing capacity and un adequate display capacity. The candidate will have to answer at least to three topics concerning the program, with reference to the recommended texts. The assessment is expressed in thirtieths. Final assessment aims to evaluate whether the student has knowledge and understanding of the topics, and has acquired an independent judgment on specific cases. The final evaluation will be expressed in hirtieths and will be the average of the written and oral examinations. The threshold of sufficiency will be achieved when the student shows the knowledge and understanding of the topics at least in the general guidelines and has minimum application competencies in order to solve concrete cases; they must also have exhibiting and arguing skills that will enable them to pass their knowledge to the examiner. Below this threshold, the examination will be insufficient. The more, instead, the student is able to interact with the examiner with his arguments and exhibit skills, and the more his knowledge and application skills go into detail of the discipline being tested, the more the evaluation will be positive. Assessment methods of TECHNOLOGY OF MATERIALS Learning of the contents presented during the course will be evaluated using two tests: one written and one oral. The written examination, which tends to verify the skills and the knowledge relating to the disciplinary scope of the course, will be composed of four clear numerical questions, that meet constraints that make them comparable with the predetermined correction criteria. It will be considered the logic followed by the student in the resolution of the questions; the correctness of the procedure identified for the solution of the question; the accuracy of the final result; the adequacy of the numerical found result; the ability to understand the results obtained. Numerical questions presented in the written examination will cover the following topics: determination of the hardness of the water: lime and soda softening and cation-exchange softening; Iron-Carbon phase diagram; evaluation of mechanical properties of composite materials; Mix design of concrete. The total score of the written tests will be out of thirty and will result from the sum of the scores given to each question depending on its complete resolution, partial or no resolution. The expected duration of the written examination is two hours and achieving a score of at least 18/30 is a necessary condition for access to the oral examination. The oral examination consists of three topics concerning the program, with reference to the recommended texts. 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 evaluation will be expressed in thirtieths and will be the average of the written and oral examinations. The threshold of sufficiency will be achieved when the student shows the knowledge and understanding of the topics at least

	in the general guidelines and has minimum application competencies in order to solve concrete cases; they must also have exhibiting and arguing skills that will enable them to pass their knowledge to the examiner. Below this threshold, the examination will be insufficient. The more, instead, the student is able to interact with the examiner with his arguments and exhibit skills, and the more his knowledge and application skills go into detail of the discipline being tested, the more the evaluation will be positive. Description of the evaluation methods EvaluationVoteOutcome Excellent30 - 30 and lodeExcellent knowledge of the topics, excellent properties of language, good analytical ability, the student is able to apply the knowledge to solve problems proposed. Very good26-29Good mastery of the subjects, full ownership of the language, the student is able to apply the knowledge to solve problems proposed. Good24-25Basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems. Satisfactory21-23The student does not have full command of the main teaching subjects but it has the knowledge, satisfactory property language, poor ability to independently apply the acquired knowledge. Sufficient18-20Minimum basic knowledge of major teaching and technical language issues, very little or no ability to independently apply the acquired knowledge. His language is enough to communicate with the examiners. InsufficientIt does not have an acceptable knowledge of the contents of the topics covered in the teaching.
TEACHING METHODS	Lectures and numerical exercises carried out in class.

MODULE
TECHNOLOGY OF MATERIALS

Prof. VINCENZO FIORE

SUGGESTED BIBLIOGRAPHY

- W. Smith, J. Hashemi - "Scienza e Tecnologia dei Materiali", MacGraw–Hill.
- W.D. Callister, D.G Rethwisch - Materiali per l'Ingegneria Civile ed Industriale, Edises.
- D.R. Askeland, P.P. Fulay, W. J. Wright - "Scienza e tecnologia dei materiali", Cittastudi Edizioni.
- M. Lucco Borlera, C. Brisi. "Tecnologia dei materiali e chimica applicata", Ed. Levrotto e Bella.

AMBIT	10685-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

At the end of the course the student will be able to understand how the knowledge of some basic concepts of material science and technology are fundamental in the performance of their profession. The student will be able to correlate the properties of the main materials currently used in civil engineering field to their structure and to apply such knowledge in design and construction of civil works (e.g., roads, railways, airports, aqueducts, sewers, maritime works and hydraulic defense, elevated structures and foundation, retaining structures, etc.) and for the design, management and maintenance constructions of ordinary complexity. Overall, the course aims to provide knowledge about the structure, properties and technological applications of the main types of materials currently used in the construction industry.

SYLLABUS

Hrs	Frontal teaching
8	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.)
6	METALS STRUCTURE (Chemical bonds, crystallography and Bravais lattices. Defects and solutions. Number of coordination. Atomic packing factor. Crystallization. Phase diagrams. Phase transformations. Microstructures. Eutectic systems and other systems.)
4	STEEL AND CAST IRON (Iron-Carbon phase diagram. TTT diagrams. Thermal and thermochemical treatments: hardening, annealing, carburization of steel. Classification of steels and cast irons. Production of steel and cast iron.)
2	METALS AND THEIR ALLOYS (aluminum and copper)
4	MECHANICAL PROPERTIES (Tensile test, compression test, bending test, impact test, hardness, fatigue behavior.)
4	CERAMIC AND GLASSES (Structure, amorphous and crystalline phases, viscosity, processing methods.)
4	POLYMERS (Introduction and features. Solid state, glass transition and crystalline state. Processing methods, extrusion and injection molding. Industrial polymers and related applications.)
4	COMPOSITE MATERIALS (Introduction and features, manufacturing technologies, synthetic and natural fiber as reinforcement, mechanical properties evaluation, main applications.)
10	BINDERS (Air binders: lime and gypsum. Hydraulic binders. Portland cement: production, setting and hardening, properties' end. Other cements as alternative to Portland one: pozzolanic cement and concrete blast furnace. Mix design of concrete

Hrs	Practice
8	WATER (calculation of water hardness and of reactives for lime and soda softening; sedimentation); METALS (calculation of theoretical density, determination of the Miller indices, phase diagrams); MECHANICAL PROPERTIES (stress-strain curve, resilience calculation); COMPOSITE MATERIALS (micromechanics prediction of the elastic properties along the principal directions); BINDERS (Mix-design examples

MODULE
CHEMISTRY

Prof.ssa MARIANNA BELLARDITA

SUGGESTED BIBLIOGRAPHY

M. Schiavello e L. Palmisano “Fondamenti di Chimica” V Ed. Edises.
L. Palmisano e M. Schiavello “Elementi di Chimica” Ed. Edises (in alternativa al primo).
F. Cacace, M. Schiavello “Stechiometria” Ed. Bulzoni (facoltativo).

AMBIT	50106-Formazione scientifica di base
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

At the end of the course the student will be able to understand how the knowledge of some basic concepts of General Chemistry is the basis of almost all technologies and how they can be used in the performance of their profession. An important example concerns the graduated in civil engineering that could be involved, in the course of its professional activity, in the preparation and study of materials used in the field of building construction. The student will be able to correlate the properties of the main materials currently used in Civil Engineering to their structure and to apply such knowledge in design and construction of civil engineering works (roads, railways, airports, aqueducts, sewers, maritime works and hydraulic defense, elevated structures and foundation, retaining structures, etc.) and for the design, management and maintenance constructions of ordinary complexity. In general, the main goal is to provide the students with awareness of the key role that Chemistry has in the production of all types of materials used in building.

SYLLABUS

Hrs	Frontal teaching
3	Introduction to the course. Fundamental laws of chemistry
2	Atomic theory
2	Periodic table of the elements
3	The chemical bond
1	The gaseous state
1	The liquid state
1	The solid state
3	Thermodynamics
2	Chemical kinetics
1	Phase diagrams for one-component systems
2	Two-component systems
2	Chemical equilibrium
3	Ionic equilibria
2	Electtrochemistry

Hrs	Practice
1	Atomic theory of the matter.
1	The chemical bond
2	Inorganic nomenclature. Red-ox reactions
3	The gaseous state
3	Thermodynamic’s elements
3	Two-component systems
3	Chemical equilibrium
4	Ionic equilibria
4	Electrochemistry
2	Background of organic chemistry: nomenclature