UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2017/2018
MASTER'S DEGREE (MSC)	CHEMICAL ENGINEERING
SUBJECT	APPLIED PHYSICAL CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20911-Attività formative affini o integrative
CODE	17559
SCIENTIFIC SECTOR(S)	ING-IND/23
HEAD PROFESSOR(S)	INGUANTA ROSALINDA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**INGUANTA ROSALINDA** Tuesday 15:00 18:00 Studio Secondo Piano ed. 6 Thursday 15:00 18:00 Studio Secondo Piano ed. 6

DOCENTE: Prof.ssa ROSALINDA INGUANTA

PREREQUISITES	Fundamentals of Chemistry and Applied Chemistry Fundamentals of Thermodynamics and Transport Phenomena Fundamentals of Electrotechnics
LEARNING OUTCOMES	Knowledge and understanding skills Knowledge of the structure of solid materials, and of the chemical-physical properties of metals, starting from the crystalline structure and the electron energy. Knowledge of the properties of semiconductors and their behavior in solid state junctions. Ability to apply knowledge and understanding Selection of material type for different applications. Ability to intervene in the manufacturing processes of devices used for electronics and for the conversion of electric light into electricity. Judgment autonomy To be able to establish the appropriate procedures for the choice and tailoring of metallic, insulating or semiconductor materials for technological applications. Communication skills Ability to communicate with other technical figures and with experts in the field of electronics manufacturing. Learning ability Update skills with the consultation of the scientific publications of the metallurgical and physical chemistry sectors.
ASSESSMENT METHODS	The final examination consists in a oral test. The questions will relate to the contents covered during the course and listed at the end of this document. The final assessment, properly graded, will be made on the basis of the following conditions: a) sufficient knowledge of subjects addressed in the course; sufficient degree of awareness and autonomy in the application of theories to solve chemical problems (rating 18-21); b) Good knowledge of subjects addressed in the course; fair degree of awareness and autonomy in the application of theories to solve chemical problems (rating 22-25); c) Good knowledge of subjects addressed in the course; good degree of awareness and autonomy in the application of theories to solve chemical problems (rating 26-28); d) Excellent knowledge of subjects addressed in the course; excellent level of awareness and autonomy in the application of theories to solve chemical problems (rating 29-30L).
EDUCATIONAL OBJECTIVES	Provide a basic understanding of the structure, the chemical-physical characteristics of metallic, insulating and semiconductor materials, as well as on the operation and manufacturing processes of electronic and photovoltaic devices.
TEACHING METHODS	The course takes place in in the second half of the first year, and consists of lectures and laboratory exercises.
SUGGESTED BIBLIOGRAPHY	- P. Wilkes, Solid State Theory in Metallurgy, Cambridge University Press (1973). - R. H. Bube, Electrons in Solids, 3a Ed., Academic Press, New York (1992). - W.G.Moffatt, G.W.Pearsall, J Wulff, Struttura e proprieta' dei materiali, C.E.A., Milano (1975). - C.S. Solanki, Solar Photovoltaics, 2a Ed., PHI Learning Private Ltd. (2011)

SYLLABUS

Hrs	Frontal teaching
2	Presentation of the course. Structure of solids: Atoms, Electrons, Conductivity. Work Function of a Metal.
2	Quantum Mechanics: Discoveries and Fundamental Principles. Electrons as waves
2	Wave properties. Reticular, radianat and matter waves
3	Schroedinger's equation for non-stationary and stationary states. Auto-functions and Auto-values
2	The electron in an infinite and finite potential hole. Degeneration of energy levels. Tunneling effect.
2	The theory of free electron in metals. Space k, state density function, occupation function.
5	The properties of metals. Conductivity: scattering phenomena. Superconductivity. Electronic Contribution to Specific heat. Emission phenomena.
5	Structure of solids. Direct and reciprocal patterns. Types of bond. Quantum mechanical of metallic bond .
3	The mechanical properties of the materials: elastic region, elastic constants. Propagation of elastic waves in the solid. Phonons. Reticulum contribution to the specific heat of the solids.

SYLLABUS

Hrs	Frontal teaching
5	Defects in solids: point defects. Dislocations, plastic deformation. Surface defects. Polycrystalline Solids; Grain edges.
4	Band theory in the Solids: Kronig-Penney's model. Brillouin areas. Metals, insulators, semiconductors. Driving in the Bands.
5	Semiconductor Physics. Intrinsic and extrinsic semiconductors. Doping. Fermi Level and Density carriers. Optical Transitions.
5	Junctions M-M, MIS, M-SC. Study of the Schottky Barriers. SC-electrolyte junction. Amorphous semiconductors. P-n junction.
5	Production of EGS and silicon micro and monocrystals. Production stages of p-n micro-junctions. Microlithography, etching, doping. Micro-transistors, VLSI technology.
2	World energy situation and growth prospects for photovoltaic generators.
3	Photovoltaic solar cells: description and principles of operation
4	Description of the various types of photovoltaic cells. Silicon technology and thin film technology
3	New technologies: organic semiconductor cells, nano-structured cells, dye cells, perovskite cells
4	Multi-junctions cells and solar concentrators

Hrs	Practice
3	Laboratory exercise: operating principles of a field emission microscope
3	Laboratory exercise: principles of operation of an XRD and identification of crystalline structures
3	Laboratory Exercise: Metallographic Attachment
3	Laboratory Exercise: electrochemical methods for deposition of semiconductors
3	Laboratory Exercise: Working tests on thin film solar cells