A) COURSE

Course Id:	Course
5699	Materials for Engineering

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
4	1	4	9	64 hrs. Theory 16 hrs. Lab. rs. total

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	II	N.A.	N.A.	III	II
Course Type (Required/Elective)	Mandatory			Mandatory	Mandatory
Prerequisite Course:	Chemistry A			Chemistry A	Chemistry A
CACEI Classification:	CI			CI	CI

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
The aim of this course is to analyze the basic concepts of the materials structure used in the engineering field. With the knowledge of these characteristics the student can understand many of the phenomena that are observed both in the evaluation of the properties of the materials, design and manufacture processes that are constituents of a mechanical, electrical and/or automated device. The structure of materials, will discuss its impact on the electrical, mechanical, physical and chemical properties. The foregoing aims that the student understands the impact that materials have in the application of engineering.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- Introduction to materials		**3 hours**
Specific Objective:	**Objective 1:** The student to know, identify, classify and describe the families of materials and their main applications.	
1.1 Introduction to materials 1.2 Types of materials Actual tendency to use modern materials		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching Methodologies	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning Activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

2.-Basic structure of material and imperfections		**8 hours**
Specific Objective::	**Objective 2:** The student to study and discuss the microstructure of materials, analyzing the relationship between Atomic arrangement of the material and its properties. Study the imperfections of the Atomic Agency and the impact of the mechanisms of plastic deformation, failure and mechanical properties of materials	
2.1 Atomic structure, bonds and bondage energy 2.2 Crystalline structures, crystaline cells, interstitial directions, planes and sites. 2.3 Crystal defects 2.4 Grain size		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methodologies	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

3.-Phases diagram		**6 hours**
Specific Objective:	**Objective 3:** The student to study the methodology of construction of the phase diagrams, how to interpret them and practice their use in different alloy systems. Studying how it affects the microstructure on the properties of materials.	
3.1 Definition and construction of phase diagrams 3.2 Diverse systems of a single component 3.3 Condensed systems of a two components 3.4 Composition and quantity of phases, microstructure formation		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

4.- Ferrous and non ferrous alloys		**8 hours**
Specific Objective:	**Objective 4:** Study, interpret and discuss the diagram iron carbide, analyzing the structure of different alloys in equilibrium condition and relate them to their properties. Study other alloy systems with applications in engineering distinguishing between heavy metals and light metals.	
4.1 Analysis of iron-carbide diagram 4.2 Alloy efects on low and high alloy steels 4.3 Thermical treatments, T-T-T charts 4.4 Alloys Al, Mg, Cu, Ti, Ni. 4.5 Dispersion and aging hardening		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	

Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports

5.- Polymers, ceramics and compound materials		**10 hours**
Specific Objective:	**Objective 5:** Define the concept of polymer. Study polymers thermoplastics, thermosets and elastomers. Analyze their properties, mechanical, electrical, etc. Define and classify to ceramic materials. Study the mechanical properties of ceramic materials. Processes of forming to a ceramic tile. Define the concept of composite material. Describe the particular functions of the matrix as reinforcement in composite materials. To study the properties of composite materials.	
5.1 Polymerical structures formation 5.2 Thermoplastic polymers 5.3 Thermofixed polymers 5.4 Elastomeric materials 5.5 Mechanical properties of polymers and elastomeric materials 5.6 Diferences between crystalline structure and amorphous structure 5.7 Crystalline ceramic and vitrea products 5.8 High temperature properties and applications 5.9 Fiber and particles reinforcement 5.10 Laminar		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
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6.- Mechanical properties and essays		**8 hours**
Specific Objective:	**Objective 6:** The student to learn about the several test methods to evaluate the mechanical properties in the selection of materials and their potential applications	
6.1 Basic concepts 6.2 Strain stress essay 6.3 Flexure essay 6.4 Meaning of hardness essay 6.5 Impact essay 6.6 Fracture tenacity 6.7 Endurance essay 6.8 Thermofluidity essay		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

7.- Hot rolled and cold rolled working processes		**4 hours**
Specific Objective:	**Objective 7:** Describe several mechanisms of hardening in metals. Describe the process of annealing and its effect on the properties and microstructure of cold-worked metal.	
7.1 Cold rolled: sliding and twinning or macle; hardening by deformation 7.2 Hot rolled. Annealing		

Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.
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8.- Electrical and magnetical properties		**10 hours**
Specific Objective:	**Objective 8:** To study the electrical properties of greater utility, as well as the procedures of trials to conductive and insulating materials. Analyze the origin and the magnetic behavior of materials. Discuss its structure and properties.	
8.1 Ohm´s law; conductivity and resistivity 8.2 Bondage´s theory 8.3 Conductivity control in metals 8.4 Semiconductors 8.5 Constitutional structure of isolators 8.6 Magnetic properties 8.7 Soft magnetic materials. Hard magnetic materials. 8.8 Magnetic behavior 8.9 Dipolar and magnetic moments 8.10 Magnetic field: magnetization and permeability 8.11 Curie´s temperature 8.12 Histeresys cicle and magnetic dominios 8.13 Material´s Project. It should consist of theoretical fundaments, requirements analysis, analysis of alternatives of solution, preliminary draft proposal, proposed solution, tests, bill of materials, cost analysis and conclusions.		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

9.- Thermal properties		**3 hours**
Specific Objective:	**Objective 9:** Understand, analyze, and calculate the main thermal properties of materials.	
9.1 Thermal expansion 9.2 Calorific capacity 9.3 Conductivity 9.4 Thermal crash		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
Learning activities	Lab practicing to apply concepts taught during class. It is mandatory to present task reports	

10.-Optical properties		**4 hours**
Specific Objective:	**Objective 10:** Study the different phenomena of emission and the way in which radiation interacts with matter, as well as obtaining electric energy based on sunlight.	
10.1 Introduction to optical properties 10.2 Luminescence as and emitting phenomena 10.3 Phosphorescent materials: laser ray 10.4 Light trasmitters: optical fibers 10.5 Photovoltaic energy: solar panels 10.6 Photoresistors (LRD)		
Readings and other resources	Callister, W. Introducción a la Ciencia de Materiales. Reverté. Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998	
Teaching methods	Inductive method: going from general to particular knowledge. Group based learning to cope with basic theoretical knowledge.	
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E) LEARNING AND TEACHING STRATEGIES

Exposure of issues, theories and experimental methods by the professor. Laboratory practicing. Testing, evaluation and technical reports of practices. Tasks, exercises and research. Investigating the field reports related to the topics seen in class. PC working in the classroom for the resolution of examples and the presentation of an exhibit of units 9 and 10. Preparing of a final project which will be evaluated by external consultants and experts in the field of interest.

F) EVALUATION AND ACCREDITATION

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st. Partial Evaluation	Session 16	Examen 100%	1,2,3
2nd Partial Evaluation	Session 32	Examen 100%	4, 5
3rd Partial Evaluation	Session 48	Examen 100%	6, 7, 8
4th Partial Evaluation	Session 56	Exposición de tema del proyecto asignado 100%	9, 10
Final Ordinary Evaluation	Week 16th of the semester	1st. Partial Evaluation 25%, 2nd Partial Evaluation 25%, 3rd Partial Evaluation 25%, 4th Partial Evaluation 7.5%, Final Ordinary Exam covering all partial units 17.5%	All units
Extra Activity:	Includes Lab (16 hrs.) Specific activities shown at the correspondent lab practicing manual.		

Extraordinary Exam	17th week of the semester	100% Exam	100% Themes
Title Exam	According Scholar Secretariat	100% Exam	100% Themes

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

Callister, W. Introducción a la Ciencia de Materiales. Reverté.
Askeland, Donald R. Ciencia e ingeniería de los materiales. Internacional Thomson Editores. D.F., México, 1998.

Complementary Books

Smith, W. Fundamentos de Ciencia e Ingeniería de Materiales. McGraw-Hill.
Fink Standard Handbook For Electrical Engineer, McGraw Hill
Pat L. Mangonon. Ciencia de los materiales, Selección y Diseño. Prentice Hall, México, 2001.
Encyclopedia of Materials, parts and finishes, Schwartz
Mangonon, P. L. The principles of Materials Selection for Engineering Design. Prentice Hall.

Internet Links

Moodle Platform
Sociedad Americana de Ingenieros Mecánicos: ASME
https://www.asme.org

Data Bases:

About materials properties.
http://www.matweb.com

Fundamental knowledge on Mechanic Engineering materials, unit conversion factors, mechanical design, equations and formulae, fabricating processes, solid mechanics, fluids and mathematics.
http://www.efunda.com/home.cfm

Simulators:

Simulate Software:
MD Solid Simulator