A) COURSE

Course Id:	Course
5666	Materials Engineering II

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
3 Hours	1 hour	0	7	48 Hours 16 Hours Total Hours: 64

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:		IV	IV		
Course Type (Required/Elective)		Required	Required		
Prerequisite Course:		MATERIALS ENGINEERING I	MATERIALS ENGINEERING I		
CACEI Classification:		CI	CI		

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
Analyzing the basic aspects of the structure of the four basic groups of materials that have application in engineering. Establish the relationship between the structure and the properties of these groups of materials. Relate the characteristics of processing with the structural characteristics and the effect that may have the process conditions with the properties expected for each group of materials.

D) TOPICS (CONTENTS AND METHODOLOGY)

1- INTRODUCTION		3 Hours
Specific Objective:	**Objective: Presentation of the course, approach to the way of working. Review of specific cases to help the student understand the importance of the study of materials.**	
1.1 background check 1.2. Ratio structure-propiedadesprocesamiento-applications 1.3 classification of materials 1.4 review of phase diagrams		

Readings and other resources	SMITH, W. F. y HASHEMI, J. Fundamentos de la ciencia e ingeniería de materiales. 4a. Edición. McGraw Hill. ASKELAND, D. R. Ciencia e Ingeniería de los Materiales. 3a. Edición. International Thomson Editores. SHACKELFORD, J. F. Introducción a la ciencia de materiales para ingenieros. 6a. Edición. Prentice Hall. CALLISTER Jr., W. D. Materials Science and Engineering an Introduction. 5th. Edition John Wiley & Sons, Inc. FLINN, R, A. Y TROJAN, P, K. Engineering Materials and Their Applications, 4th, Edition, John Wiley & Sons, Inc. AVNEr, S, H. Introduccion a la metalurgia fisica 2da, Edicion, McGraw Hill.
Teaching Methodologies	EXPOSURE OF SUBJECTS OF STUDY OF DIAGRAMS, EXPLANATION OF CONCEPTS, MANAGEMENT OF LABORATORY, PROBLEM-SOLVING TECHNIQUES. VISITS TO COMPANIES AND RESEARCH WORK.
Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.

2. METALLIC MATERIALS		**2 Hours**
Specific Objective:	Objective: Distinguish between plain carbon steel, alloy steel and cast iron. Study phase transformations and invariants present in the equilibrium diagram iron-carbon and target system diagram stable iron-Fe3C study the effect that different heat treatments on the microstructural evolution of the Fe-C alloys.	
2.1 phases in equilibrium and balance stable goal diagram 2.2 Simple carbon steels 2.3 Endurecimientopordispersion 2.4. simple heat treatment 2.5 treatments isothermal 2.6 hardenability low alloy steels 2.7. Foundry		
Readings and other resources	SMITH, W. F. y HASHEMI, J. Fundamentos de la ciencia e ingeniería de materiales. 4a. Edición. McGraw Hill. ASKELAND, D. R. Ciencia e Ingeniería de los Materiales. 3a. Edición. International Thomson Editores. SHACKELFORD, J. F. Introducción a la ciencia de materiales para ingenieros. 6a. Edición. Prentice Hall. CALLISTER Jr., W. D. Materials Science and Engineering an Introduction. 5th. Edition John Wiley & Sons, Inc. FLINN, R, A. Y TROJAN, P, K. Engineering Materials and Their Applications, 4th, Edition, John Wiley & Sons, Inc. AVNEr, S, H. Introduccion a la metalurgia fisica 2da, Edicion, McGraw Hill.	

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3. NON-FERROUS ALLOYS		**6 Hours**
Specific Objective:	Objective: To study other alloy systems with applications in engineering and thermal treatments which allow to modify its microstructure and properties. Distinguish between heavy metals and light metals. Review some processes of forming applicable to these families of alloy.	
3.1 ageing hardening **3.2 aluminum alloys** **3.3 titanium alloys** **3.4 alloys of beryllium and magnesium** **3.5 nickel alloys** **3.6 Refractory metals** **3.7 copper alloys**		
Readings and other resources	SMITH, W. F. y HASHEMI, J. Fundamentos de la ciencia e ingeniería de materiales. 4a. Edición. McGraw Hill. ASKELAND, D. R. Ciencia e Ingeniería de los Materiales. 3a. Edición. International Thomson Editores. SHACKELFORD, J. F. Introducción a la ciencia de materiales para ingenieros. 6a. Edición. Prentice Hall. CALLISTER Jr., W. D. Materials Science and Engineering an Introduction. 5th. Edition John Wiley & Sons, Inc. FLINN, R, A. Y TROJAN, P, K. Engineering Materials and Their Applications, 4th, Edition, John Wiley & Sons, Inc. AVNEr, S, H. Introduccion a la metalurgia fisica 2da, Edicion, McGraw Hill.	
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Learning Activities	Dynamics of working in team, assignments, and discussion of these. Studies of reproducibility and repeatability, estimation error, uncertainty, calibration. Analysis of readings and presentations in Powerpoint.	

4. - POLYMERS		**6 Hours**
Specific Objective:	Objective: To review the different methods of classification of polymers. Review the importance of determination of molecular weights in polymeric materials. Study mechanical and thermal behavior of the polymers, thermoplastics, thermosets and elastomers. Analyze the behavior of these materials viscoelastic. Review the processing methods used for these materials	

4.1 classification of polymer 4.2. molecular structure of polymers 4.3 synthesis of polymers. Degree of polymerization. Index of polydispersity, molecular weight 4.4 critical temperatures of thermoplastic polymers 4.5. mechanical behaviour in tension, force-deflection curves. 4.6 Viscoelasticity 4.7 additives 4.8 processes of forming polymers	
Readings and other resources	SMITH, W. F. y HASHEMI, J. Fundamentos de la ciencia e ingeniería de materiales. 4a. Edición. McGraw Hill. ASKELAND, D. R. Ciencia e Ingeniería de los Materiales. 3a. Edición. International Thomson Editores. SHACKELFORD, J. F. Introducción a la ciencia de materiales para ingenieros. 6a. Edición. Prentice Hall. CALLISTER Jr., W. D. Materials Science and Engineering an Introduction. 5th. Edition John Wiley & Sons, Inc. FLINN, R, A. Y TROJAN, P, K. Engineering Materials and Their Applications, 4th, Edition, John Wiley & Sons, Inc. AVNEr, S, H. Introduccion a la metalurgia fisica 2da, Edicion, McGraw Hill.
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5.- CERAMIC		**5 Hours**
Specific Objective:	Objective: Define and classify to ceramic materials. Study and describe various structures of ceramic crystal. Differentiate between Ceramic Crystal and ceramic amorphous. To study the mechanical properties of ceramic materials and mechanisms of deformation based on the structure of the material. Processes of forming for ceramic Crystal and ceramic amorphous.	
5.1 classification of ceramic materials 5.2. crystal structures of simple ceramics 5.3 silicates 5.4 vitreous ceramic 5.5 mechanical properties of the ceramic 5.6. refractory ceramic 5.7 processes of forming for ceramic Crystal and for ceramic amorphous.		

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6. COMPOSITE MATERIALS		**2 Hours**
Specific Objective:	Objective: To define the concept of composite material. Review the different classifications of composite materials. Describe the particular functions of the matrix as reinforcement in composite materials. Study the properties of the materials compounds laminar, multilayer structures, compounds type panel and compounds sandwich type.	
6.1 definition and classification of composite materials 6.2 characteristics of reinforcement 6.3. characteristics of the matrix 6.4 rule of mixtures 6.5 compounds reinforced with particles, fibres and lamellar compounds 6.6 compounds of metal matrix, ceramic matrix and matrix polymer 6.7 processes of forming composite materials.		

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7. ELECTRICAL PROPERTIES		**4 Hours**
Specific Objective:	Objective: To study the electrical behavior of metals, ceramics and polymers. Explain the concepts of electrical conductivity, resistivity, and half in metals free path. Study how varies according to temperature conductivity and Crystal imperfections in metals. Review the basics of the theory of bands and help explain the behavior of conductors, semiconductors and insulators.	
7.1. basic concepts 7.2 classical conductors 7.3 theory of bands 7.4 semiconductors 7.5 superconductors 7.6 isolates		
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8.-OPTICAL PROPERTIES		**4 Hours**
Specific Objective:	Objective: Optical phenomena will be revised considering photon emission processes and processes of interaction of photons with the structure of the various groups of materials.	
8.1. basic concepts 8.2. the electromagnetic spectrum 8.3 Fenomenosdeemision 8.4. interaction of photons with a material 8.5 applications		
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9 PROPERTIES MAGNETIC		**4 Hours**
Specific Objective:	Objective: To study the characteristics that give rise to the different behaviours of magnetic materials. Distinguish the magnetic behaviors that have applications in engineering. Analyze the effect of temperature on the alignment of magnetic dipoles in ferro materials and ferromagnetic. Study the magnetic hysteresis in a material. Classify the magnetic materials according to their magnetic hysteresis.	
9.1 dipoles and magnetic moments 9.2 Magnetization, permeability and magnetic field 9.3 Types of magnetic behavior 9.4 Structure of domains 9.5 Hysteresis cycle. applications 9.6 Effect of Temperature on ferromagnetic properties. Curie temperature 9.7 Examples of magnetic materials		

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10. THERMAL PROPERTIES		**2 Hours**
Specific Objective:	Objective: To review the main thermal properties of materials.	
10.1 Specific heat and heat capacity 10.2 Thermal Expansion 10.3 Thermal conductivity 10.4 Thermal shock.		
Readings and other resources	SMITH, W. F. y HASHEMI, J. Fundamentos de la ciencia e ingeniería de materiales. 4a. Edición. McGraw Hill. ASKELAND, D. R. Ciencia e Ingeniería de los Materiales. 3a. Edición. International Thomson Editores. SHACKELFORD, J. F. Introducción a la ciencia de materiales para ingenieros. 6a. Edición. Prentice Hall. CALLISTER Jr., W. D. Materials Science and Engineering an Introduction. 5th. Edition John Wiley & Sons, Inc. FLINN, R, A. Y TROJAN, P, K. Engineering Materials and Their Applications, 4th, Edition, John Wiley & Sons, Inc. AVNEr, S, H. Introduccion a la metalurgia fisica 2da, Edicion, McGraw Hill.	
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E) TEACHING AND LEARNING METHODOLOGIES

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1er. Partial Evaluation	Session	Exam, Assignment, Presence	
2º Partial Evaluation	Session	Exam, Assignment, Presence	
3er. Partial Evaluation	Session	Exam, Assignment, Presence	
Final Evaluation Ordinary		100% (average partial evaluations)	
Other Activity:			
Special Exam:	Week 17 of the Semester	100% Exam	100% topics
Special Exam	According to schedule school secretary	100% Exam	100% topics
Regularization Exam	According to schedule school secretary	100% Exam	100% topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

SMITH, W. F. y HASHEMI, J. Fundamentos de la ciencia e ingeniería de materiales. 4a. Edición. McGraw Hill.

ASKELAND, D. R. Ciencia e Ingeniería de los Materiales. 3a. Edición. International Thomson Editores.

SHACKELFORD, J. F. Introducción a la ciencia de materiales para ingenieros. 6a. Edición. Prentice Hall.

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AVNEr, S, H. Introduccion a la metalurgia fisica 2da, Edicion, McGraw Hill.

Complementary Books

ASM, Metals Handbook, Manuales de la Sociedad Americana de los Metales.

SCHEY, J. A. Procesos de manufactura. 3a. Edición. McGraw-Hill.

MANGONON, P. L. The principles of Materials Selection for Engineering Design. Prentice Hall

Internet Links