Universidad Carlos III de Madrid
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COURSE: AEROSPACE MATERIALS I (251 - 15333)		
DEGREE: BACHELOR IN AEROSPACE ENGINEERING	**YEAR: 2**	**TERM: 1ST**

WEEKLY PLANNING

WEEK	SESSION	DESCRIPTION	GROUPS (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	Indicate YES/NO If the session needs 2 teachers	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINARS			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h week)
1	1	**PRESENTATION OF THE COURSE. TOPIC 1. BONDING IN SOLIDS**		X		NO	Introduction to the course. Course structure and evaluation. Bonding in solids. Relationship between bonding, structure, and materials properties.	1.6	3
2	2	**TOPIC 2. STRUCTURE OF MATERIALS I**	X			NO	Crystalline systems and some definitions. Important metallic structures. Atomic positions. Directions in the crystalline cells. Planes in the crystalline cells.	1.6	7
2	3	**TOPIC 2. STRUCTURE OF MATERIALS II**		X		NO	Calculation of the atomic density. Crystalline defects. Solid solutions. Polymorphism and Allotropy. Amorphous Materials.	1.6	
3	4	**TOPIC 3. DIFFUSION IN SOLIDS. MASS TRANSPORT**	X			NO	Definition of diffusion. Diffusion mechanisms. Fick's diffusion laws. Diffusivity. Industrial applications: examples	1.6	5

3	5	**PROBLEMS ON TOPICS 2 AND 3**		X		NO	Resolution of Problems.	1.6	
4	6	**TOPIC 4. PHASE DIAGRAMS I**	X			NO	Basic concepts: Component, phase, micro constituent. One component phase diagrams. Binary isomorphous phase diagrams. Gibbs Phase Rule. Tie line and lever rule. Non equilibrium solidification. Binary eutectic systems.	1.6	7
4	7	**TOPIC 4. PHASE DIAGRAMS II**		X		NO	Precipitation in solid state. Invariant reactions. Intermetallic components. Congruent and incongruent melting.	1.6	
5	8	**TOPIC 4. PHASE DIAGRAMS III**	X			NO	Fe-C System. Equilibrium transformations in the metastable Fe-C system. Eutectoid steels. Pearlitic transformations. Hypoeutectoid and hypereutectoid steels. Influence of alloy elements in metastable Fe-C.	1.6	7
5	9	**TOPIC 4. PHASE DIAGRAMS IV**		X		NO	**TEST 1** Ceramic phase diagrams. Ternary phase diagrams. Ternary phase diagrams in metallic alloys and ceramics.	1.6	
6	10	**PROBLEMS ON TOPIC 4**	X			NO	Resolution of PROBLEMS.	1.6	3
7	11	**TOPIC 5. MECHANICAL PROPERTIES I**	X			NO	Basic Concepts. Uniaxial Tension Test. Stress-strain Curve: Elastic Zone and Plastic Zone. Slip Systems Stress-strain Curve: Calculations. Ductility concepts. True Stress-strain Curves.	1.6	7
7	12	**TOPIC 5. MECHANICAL PROPERTIES II**		X		NO	Strengthening Mechanisms. Hardness.	1.6	
8	13	**TOPIC 6. ELECTRICAL PROPERTIES**	X			NO	Classic Model. Classification. Diagrams of Energy-Bands. Conducting materials. Metallic conductors. Ceramic conductors. Semiconducting materials. Intrinsic. Extrinsic. Insulating materials.	1.6	7
8	14	**PROBLEMS ON TOPICS 5 AND 6**		X		NO	Resolution of PROBLEMS	1.6	
9	15	**TOPIC 8 CERAMIC MATERIALS I**	X			NO	Introduction. Structure of Ceramic materials. Glasses. Mechanical properties of Ceramic materials.	1.6	7
9	16	**TOPIC 8 CERAMIC MATERIALS II**		X		NO	Processing of Ceramic materials. Applications.	1.6	
10	17	**TOPIC 7. MAGNETIC AND THERMAL PROPERTIES**	X			NO	MAGNETIC PROPERTIES. General concepts. Origin of the magnetic behaviour of materials. Types of magnetism. ferromagnetic, ferrimagnetic; paramagnetic; diamagnetic; anti-ferromagnetic. Magnetic domains. Hysteresis cycles. Types of materials according to their hysteresis cycles.	1.6	5

							Factors affecting the hysteresis cycle. Applications. THERMAL PROPERTIES		
10	18	**PROBLEMS ON TOPICS 7 AND 8**		X		NO	**TEST 2** Resolution of PROBLEMS.	1.6	
11	19	**TOPIC 9 POLYMERS I**	X	X		NO	Introduction. General overview. Historical development. Chemical structure of polymers. Nomenclature. Size and shape of polymers. Molecular weight and its distribution. Solid state of polymers. Crystalline polymers. Thermal transitions. Mechanical properties of polymers Viscoelasticity.	1.6	7
11	20	**TOPIC 9 POLYMERS II**		X		NO	Processing and applications of polymeric materials.	1.6	
12	21	**TOPIC 10 COMPOSITES I**	X			NO	Concept of composite materials. Constituents of composite materials. Classification. Why polymers are used in Composite Materials? Reinforcements. Particles. Composite materials reinforced with large particles. Fibres and prepregs. Mechanical properties of different reinforcement materials.	1.6	7
12	22	**TOPIC 10 COMPOSITES II**		X		NO	Polymer matrix in Composite materials. Thermoset and Thermoplastic matrices. Epoxy matrix. Epoxy/amine network formation. Additives used to modify resin properties. Thermoplastic matrices. The interface region. Mean elastic properties of composites. Direction relative to a composite with an uniformly dispersed aggregate.	1.6	
13	23	**TOPIC 10 COMPOSITES III**	X			NO	Fabrication Processes. Composite materials and Aerospace Construction Certification requirements for composites structures.	1.6	5
13	24	**PROBLEMS ON TOPICS 8, 9, AND 10**		X		NO	Resolution of PROBLEMS.	1.6	
14	25	**TOPIC 11. ADHESIVES**	X			NO	Mechanisms of Adhesion. Modes of failure. Types of adhesives. Processing and design considerations. Testing methods and degradation mechanisms of adhesives.	1.6	4
15	26	**TEST 3**	X			NO	**TEST 3**	1.6	
							Subtotal 1	**41.6**	**81**
			Total 1 *(Hours of class plus student homework hours between weeks 1-15)*					**122.6**	

15		Tutorials, handing in, etc						5	
16		Assessments						3	21
17									
18									
							Subtotal 2	**3**	**26**
			Total 2 *(Hours of class plus student homework hours between weeks 15-18)*					**29**	

		LABORATORY SESSION I: CRYSTALLINE STRUCTURES			Lab. 1.0.A02	NO	Closed packed and non-compact crystalline structures. X-ray diffraction pattern	1.6	2
		LABORATORY SESSION II: COMPOSITE MATERIALS					Composite materials and their application in designing of engineering structures.	1.6	2
		LABORATORY SESSION III: TENSILE TEST					Strength and elongation of materials.	1.6	2
		LABORATORY SESSION IV: IDENTIFICATION OF POLYMERS					Identification of different type of polymers used industrially.	1.6	2
							Subtotal 3	**6.4**	**8**
			Total 3 *(Hours of laboratory class plus student homework hours)*					**14.4**	

TOTAL *(Total 1 + Total 2 + Total 3. Maximum 180 hours)*	**166**