Universidad Carlos III de Madrid
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	COURSE: AEROSPACE MATERIALS I (251-15333)		
	DEGREE: BACHELOR IN AEROSPACE ENGINEERING	**YEAR: 2**	**TERM: 1st**
	La asignatura tiene 29 sesiones que se distribuyen a lo largo de 14 semanas. Los laboratorios pueden situarse en cualquiera de ellas. Semanalmente el alumno tendrá dos sesiones, excepto en un caso que serán tres		

WEEKLY PLANNING

WEEK	DATE	SESSION	DESCRIPTION	CLASSES Master: Tue 2.3.B04 (15:00-17:00 h) Tutorials: G45: Thu 7.2.J06 (17:00-19:00 h) G46: Wed 7.1.J07(15:00-17:00h) G47: Thu 7.2.J03(15:00-17:00 h)		WEEKLY PROGRAMMING FOR STUDENT		
				MASTER CLASS	TUTORIAL CLASSROOM G45 G46 G47	DESCRIPTION	CLASS HOURS	HOME WORK HOURS
1	6 Sept	1	**PRESENTATION OF THE COURSE. TOPIC 1. BONDING IN SOLIDS**	**X**		Introduction to the course. Course structure and Evaluation. Bonding in solids. Relationship between bonding, structure and properties of materials	1.6	3
	7 -8 Sept	2	**TOPIC 2. STRUCTURE OF MATERIALS I**		**X**	Crystalline systems and some definitions. Important metallic structures. Atomic positions. Directions in the crystalline cells. Planes in the crystalline cells	1.6	7
2	13 Sept	3	**TOPIC 2. STRUCTURE OF MATERIALS II**	**X**		Calculation of the atomic density. Crystalline defects. Solid solutions. Polymorphism and Allotropy. Amorphous Materials. **PROBLEMS**	1.6	5
	14-15 Sept	4	**TOPIC 2. STRUCTURE OF MATERIALS**		**X**	**RESOLUTION OF PROBLEMS**	1.6	
3	20 Sept	5	**TOPIC 3. DIFFUSION IN SOLIDS. MASS TRANSPORT**	**X**		Definition of diffusion. Diffusion mechanisms. Fick's diffusion laws. Diffusivity. Industrial applications. Examples.	1.6	5

	21-22 Sept	6	**TOPIC 4. PHASE DIAGRAMS I**		**X**	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	
4	27 Sep	7	**TOPIC 4. PHASE DIAGRAMS II**	**X**		Precipitation in solid state. Invariant reactions. Intermetallic components. Congruent and incongruent melting. **PROBLEMS**	1.6	7
	28-29 Sept	8	**TEST 1 AND PROBLEMS ON TOPIC 4**		**X**	**TEST 1 (Topics 1, 2, and 3) Resolution of PROBLEMS.**	1.6	
5	4 Oct	9	**TOPIC 4. PHASE DIAGRAMS III**	**X**		Fe-C System. Equilibrium transformations in the metastable Fe-C system. Eutectoid steels. Pearlitic transformations. Hypoeutectoid steels. Hypereutectoid steels. Influence of alloy elements in metastable Fe-C.	1.6	5
	5-6 Oct	10	**TOPIC 4. PHASE DIAGRAMS IV**		**X**	Ceramic phase diagrams. Ternary phase diagrams. Ternary phase diagrams in metallic alloys. Ternary phase diagrams in ceramics. **Resolution of PROBLEMS.**	1.6	
6	11 Oct		**PUBLIC HOLIDAYS**					
	12-13 Oct		**PUBLIC HOLIDAYS/ NO LESSON DAY**					
7	18 Oct	11	**TOPIC 5. MECHANICAL PROPERTIES I**	**X**		Basic Concepts. Uniaxial Tension Test. Stress-strain Curve: Elastic Zone. Stress-strain Curve: Plastic Zone. Slip Systems Stress-strain Curve: Calculations. Ductility concepts. True Stress-strain Curves.	1.6	7
	19-20 Oct	12	**TOPIC 5. MECHANICAL PROPERTIES II**		**X**	Strengthening Mechanisms. Hardness. **PROBLEMS.**	1.6	
8	25 Oct	13	**TOPIC 6. ELECTRICAL PROPERTIES**	**X**		Classic Model. Classification. Diagrams of Energy-Bands. Conducting materials. Metallic conductors. Ceramic conductors. Semiconducting materials. Intrinsic. Extrinsic. Insulating materials.	1.6	7
	26-27 Oct	14	**TOPIC 7. MAGNETIC AND THERMAL PROPERTIES**		**X**	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. Factors affecting the hysteresis cycle. Applications. THERMAL PROPERTIES.	1.6	
9	1 Nov		**PUBLIC HOLIDAYS**				1.6	
	2-3 Nov	15	**TEST 2 AND PROBLEMS**		**X**	**TEST 2 (Topics 4, 5 and 6) Resolution of PROBLEMS.**	1.6	
10	8 Nov	16	**TOPIC 8 CERAMIC MATERIALS I**	**X**		Introduction. Structure of Ceramic Materials. Glasses. Mechanical Properties of Ceramic Materials.	1.6	7

	9-10 Nov	17	**TOPIC 8 CERAMIC MATERIALS II**		**X**	Processing of ceramic materials. Applications. **PROBLEMS.**	1.6	
11	15 Nov	18	**TOPIC 9 POLYMERS I**	**X**		Introduction. General overview. Historical development. Basics. 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
	16-17 Nov	19	**TOPIC 9 POLYMERS II**		**X**	Processing and practical applications of polymeric materials **PROBLEMS.**	1.6	
12	22 Nov	20	**TOPIC 10 COMPOSITES I**	**X**		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
	23-24 Nov	21	**TOPIC 10 COMPOSITES II**		**X**	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 and uniformly dispersed aggregate	1.6	7
13	29 Nov	22	**TOPIC 10 COMPOSITES III**	**X**		Fabrication Processes. Composite materials and Aerospace Construction Certification requirements for composites structures.	1.6	
	30 Nov-1 Dec	23	**PROBLEMS ON TOPICS 7, 8, 9 AND 10**		**X**	**Resolution of PROBLEMS**	1.6	7
14	6 Dec		**PUBLIC HOLIDAY**					
	7-8 Dic		**PUBLIC HOLIDAY/NO LESSON DAY**					
15	13 Dic	24	**TOPIC 11. ADHESIVES**	**X**		Mechanisms of Adhesion. Modes of failure. Types of adhesives. Processing and design considerations. Testing methods and degradation mechanisms of adhesives. **PROBLEMS**		
	14-15 Dec	25			**X**	**TEST 3 (Topics 7, 8, 9 and 10)**		
						Subtotal 1	**62.4**	**78**
			Total 1 *(Hours of class plus student homework hours between weeks 1-15)*				**140.4**	
8	G45: 28 Oct G46: 26 Oct G47: 27 Oct	26	**LABORATORY SESSION I: CRYSTALLINE STRUCTURES**	**Lab. 1.0.A01/ Lab 1.0.A02**			1.6	7
8	G45: 28 Oct G46: 26 Oct G47: 27 Oct	27	**LABORATORY SESSION II: TENSILE TEST**	**Lab. 1.0.A01/ Lab 1.0.A02**			1.6	7

13	G45: 2 Dec G46: 30Nov G47: 1 Dec	28	**LABORATORY SESSION III: COMPOSITE MATERIALS**	**Lab. 1.0.A01/ Lab 1.0.A02**		1.6	7
13	G45: 2 Dec G46: 30Nov G47: 1 Dec	29	**LABORATORY SESSION IV: IDENTIFICATION OF POLYMERS**	**Lab. 1.0.A01/ Lab 1.0.A02**		1.6	7
					Subtotal 2	**6.4**	28
				Total 2 *(Hours of class plus student homework hours for laboratory session in weeks 10-13)*		**34.4**	

	TOTAL *(Total 1 + Total 2 Maximum 180 hours)*	**174.8**