Universidad Carlos III de Madrid

COURSE: ADVANCED COMPOSITE MATERIALS		
MÁSTER: MASTER IN MATERIALS SCIENCE AND ENGINEERING Professors: Jon Molina Aldareguia / Claudio Lópes	ECTS: 3	CUATRIMESTRE: 1

WEEKLY PLANING

WEEK	LECTURE	DESCRIPTION	GROUPS (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	WEEKLY PROGRAMMING FOR STUDENT		
			1	2		DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h week)
1	1	**1. Introduction** 1.1. Present and future of composite materials 1.2 Multifunctional composites **PART 1. Structure and properties of composite materials** 2. **Types of matrices** 2.1 Ceramic and metallic matrices. 2.2 Polymeric matrices: thermosets and thermoplastics: curing parameters.	X			Review of contents delivered in class	1.5	2
	2	**3. Types of reinforcement** 3.1 Carbon, glass, polyamides, carbides, alumina and aluminosilicate reinforcements. Structure and properties. 3.2 Geometry and architecture of the reinforcement: short fibers, continuous fibers, textiles and laminates. 3.3. Interphases. Adhesion mechanisms. Mechanical characterization of interfaces.	X			Review of contents delivered in class	1.5	2
2	3	**4. Processing of metal-matrix composites** 4.1. Solid-state processing 4.2 Liquid state processing **5. Processing of ceramic matrix composites**	X			Review of contents delivered in class	1.5	2

		5.1 Powder consolidation, impregnation and infiltration techniques.						
	4	**6. Processing of polymer matrix composites** 6.1 Prepreg consolidation 6.2 Infiltration methods 6.3 Other techniques: filament winding, pultrusion,…	X			Review of contents delivered in class Visit to external company	3	2
3	5	**7. Quality control** 7.1 Certification 7.1 Non-destructive evaluation: ultrasounds and X-Rays.	X			Review of contents delivered in class.	1.5	2
	6	**8. Recycling of composite materials**	X			Review of contents delivered in class. Individual evaluation test	1.5	4
4	7	**PART 2. Mechanics of composite materials** **9. Elastic behavior of long fiber composites** 9.1 Elastic anisotropy 9.2 Stiffness tensor 9.3 Effect of fiber length. Shear Lag models	X			Review of contents delivered in class	1.5	2
	8	Exercises – Elastic constants of a unidirectional lamina	X			Review of contents delivered in class. Individual assessment report.	1.5	4
5	9	**10. Laminate theory** 10.1 Orthotropic lamina 10.2 Elastic constants of a unidirectional lamina 10.3 Classical theory of laminates	X			Review of contents delivered in class	1.5	2

	10	Computer practice – Stress and strain analysis of composite laminae and laminates by the finite element method (ABAQUS)	X		Computer lab	Analysis of computer practice. Group assessment report.	1.5	4
6	11	**11. Failure of composite materials** 11.1 Failure modes: longitudinal, transversal, shear, compression 11.2 Failure criteria	X			Review of contents delivered in class	1.5	2
	12	Computer practice – Faliure analysis of laminates by the finite element method (ABAQUS)	X		Computer lab	Analysis of computer practice. Group assessment report.	1.5	4
7	13	**12 Damage in composite materials** 12.1 Mechanisms and contributions to the fracture energy 12.2 Damage tolerance 12.3 Continuum damage models 12.4 Cohesive elements	X			Review of contents delivered in class	1.5	2
	14	Computer practice – Analsyis of damage propagation in laminates by the finite element method (ABAQUS)	X		Computer lab	Analysis of computer practice. Group assessment report. Preparation of final exam.	1.5	4
TOTAL HORAS							21	38