uc3m | Universidad Carlos III de Madrid

SUBJECT: Thermal subsystem		
MASTER DEGREE: Master in Space Engineering	ECTS: 2	TERM: 3rd

WEEKLY PLANNING

WEEK	SESSION	DESCRIPTION	TEACHING (MARK X) LECTURES	TEACHING (MARK X) SEMINARS	SPECIAL ROOM FOR SESSION (Computer room, audiovisual room)	WEEKLY PROGRAMMING FOR STUDENT DESCRIPTION	CLASS HOURS (1,66 h = 50 min + 50 min)	HOMEWORK HOURS (max. est. 3,25 h)
1	1	**1.- Introduction.** Thermal control in space systems. Classification of thermal control subsystems. **2.- Spacecraft thermal loads.** Spacecraft thermal environment. Heat sources.	x			Reading of notes and personal study.	1,66	3,25
2	2	2.- Spacecraft thermal loads (continuation). Thermal balance. Practical examples and problems. **3.- Thermal modelling.** Heat transfer modes. Exact and approximate thermal mathematical models (TMM). Modelling of heat conduction exchange.	x			Reading of notes, personal study and assignment work.	1,66	3,25
3	3	3.- Thermal modelling (continuation). Modelling of heat convection Exchange. Modelling of radiative heat Exchange. Combined heat exchange. Thermal analysis codes. Practical examples and problems.	x			Reading of notes, personal study and assignment work.	1,66	3,25
4	4	**LABORATORY SESSION-1:** Computational modelling of heat transfer.	x		Computer room	Reading of notes, work on the lab report.	1,66	3,25
5	5	**4.- Thermal subsystem design.** Thermal requirements and constraints. Passive thermal control: surface finishes, insulation systems, radiators, heat pipes, etcetera.	x			Reading of notes, personal study and assignment work.	1,66	3,25
6	6	4.- Thermal subsystem design (continuation). Active thermal control: heaters, louvers and shutters, refrigeration cycles, thermoelectric coolers, cryogenic systems, etcetera. Case study examples.	x			Reading of notes, personal study and assignment work.	1,66	3,25
6	7	**LABORATORY SESSION-2:** Design and analysis of a thermal control subsystem.	x		Computer room	Reading of notes, work on the lab report.	1,66	3,25
7	8	**5.- Thermal subsystem testing.** Thermal verification of models and hardware. Thermal balance and thermal vacuum tests. Case study examples.	x			Reading of notes, personal study and assignment work.	1,66	3,25
7	9	**6.- Thermal control normative.** Aim and scope of thermal control normative. The ECSS standards. Requirements for the definition, analysis, design, manufacture, verification and in-service operation of thermal control subsystems.	x			Reading of notes, personal study and assignment work.	1,66	3
	15	Additional session						
						Subtotal 1	15	29
						Total 1 (Hours of class plus student homework)	44	
8		Tutorials, handing in, etc.,					0,83	0,5
8		Assessment				Personal study.	1,66	3
						Subtotal 2	2,5	3,5
						Total 2 (Hours of class plus student homework)	6	
						Total *(Hours)*	50	