Universidad Carlos III de Madrid

Department of Materials Science and Engineering and Chemical Engineering

BACHELOR IN AEROSPACE ENGINEERING	CREDITS: 6 ECTS	COURSE: 2017/18
LECTURE COURSE : AEROSPACE MATERIALS II (251 - 15338)	YEAR: 2	SEMESTER: 2nd

Session	DATE	PART	Topic	Large Group/ Small Group	Professor.	TITLE	DESCRIPTION
1	25-26Jan	**PRESENTATION OF LECTURE COURSE**	1	**SG**	**ST/SM**	**Introduction to Aerospace Materials II**	Introduction to the course. Course structure and Evaluation. Classification of engineering metallic materials
2	29 Jan	**1. METALLIC MATERIALS**	2	**LG**	**SM**	**Solidification of Metals**	- Solidification of Metals. Generation of the Microstructure
3	1-2.-Feb	**1. METALLIC MATERIALS**	2	**SG**	**ST/SM**	**Metal Casting Processes**	Metal Casting Processes. Cast Structures Defects in Castings.
4	4 Feb	**1. METALLIC MATERIALS**	3	**LG**	**SM**	**Metal Forming Fundamentals**	Work hardening. Recovery, Recrystallization and Grain Growth..
5	8-9 Feb	**1. METALLIC MATERIALS**	3	**SG**	**ST/SM**	**Metal Forming Processes**	Metal forming processes. Effect of metal forming processes on properties and microstructure
6	12 Feb	**1. METALLIC MATERIALS**	4	**LG**	**SM**	**Heat Treatments I**	- TTT diagrams: ITT and CCT. Heat Treatments: Quenching, Tempering, Annealing, Normalizing. Hardenability
7	15-16 Feb	**1. METALLIC MATERIALS**	4	**SG**	**ST/SM**	**Heat Treatments II**	- TTT diagrams: ITT and CCT. Heat Treatments. **Problems.**
8	19 Feb	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	5	**LG**	**SM**	**Mechanisms of deformation and fracture I : Fracture**	-Introduction to Fracture. Types of Fracture. Fracture modes. Fracture mechanics. Stress concentration. Griffith's theory. Stress intensity factor. **Problems**
9	22-23 Feb	**1. METALLIC MATERIALS.**	4	**SG**	**ST/SM**	**Heat Treatments II**	**Problems**
10	26 Feb	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	5	**LG**	**SM**	**Mechanisms of deformation and fracture I : Fracture**	-Fracture. Fracture toughness and Impact test Brittle Ductile transition. **Problems.** **DEADLINE FOR SIGNING UP VOLUNTARY PRESENTATIONS: 28/02/2018.**
11	1-2 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	6	**SG**	**ST/SM**	**Mechanisms of deformation and fracture II: Fatigue**	- Introduction to Fatigue. High cycle fatigue. Low cycle fatigue Effect of variable cycles. Fatigue crack growth **TEST 1.**
12	5 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	6	**LG**	**SM**	**Mechanisms of deformation and fracture II: Fatigue**	-Fatigue. Structural features of fatigue Designing against fatigue failure. **Problems.**
13	8-9 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	7	**SG**	**ST/SM**	**Thermomechanical behaviour : Creep**	-Creep. Creep curve. Effect of stress and temperature on creep. Creep stages. **Problems**.

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14	12 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	7	**LG**	**SM**	**Thermomechanical behaviour : Creep**	Creep design and life prediction. Developing creep-resistant materials. **Problems**.
15	15-16 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	8	**SG**	**ST/SM**	**Joining Processes** *(Voluntary presentations by students)*	Introduction to joining processes. Welding. Welding processes for aerospace applications.
16	19 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	9	**LG**	**SM**	**Corrosion and Wear: Corrosion**	Corrosion. Basic electrochemical corrosion. Types of corrosion. Corrosion control and prevention. High temperature corrosion
17	22-23 March	**2. BEHAVIOUR IN SERVICE CONDITIONS.**	9	**SG**	**ST/SM**	**Corrosion and Wear: Wear** *(Voluntary presentations by students)*	Friction. Wear. Friction and wear tests. Lubricants. Wear and friction in metal-working processes. Materials selection for tribological system.
18	5-6 April March-	**3. APPLICATIONS**	10	**SG**	**ST/SM**	**Ti alloys** *(Voluntary presentations by students)*	Introduction to Ti. Fundamentals of Ti and Ti alloys. Classification of Ti alloys. Production processes and manufacturing **TEST 2**.
19	9 April	**3. APPLICATIONS**	10	**LG**	**SM**	**Ti alloys**	Phase transformations in Ti alloys. Characteristics of Ti alloys. Heat Treatments for Ti alloys. Applications of Ti in aerospace
20	12-13 April	**3. APPLICATIONS**	11	**SG**	**ST/SM**	**Surface Treatments** *(Voluntary presentations by students)*	Main surface treatments: Galvanizing; Electrodepostion; Organic Coatings; CVD; PVD: Thermal Spraying. Thermochemical Treatments. Thermal Barrier Coatings
21	15 April	**3. APPLICATIONS**	12	**LG**	**SM**	**Al- alloys**	History of Aluminum Applications Aluminium Obtaining. Designation of Aluminium Alloys Hardening mechanisms.
22	19-20 April	**3. APPLICATIONS**	12	**SG**	**ST/SM**	**Al- alloys** *(Voluntary presentations by students)*	Non Heat treatable Wrought Aluminium Alloys Heat treatable Wrought Aluminium Alloys. Cast Aluminium alloys. Applications in aerospace. Aluminium Processing and Joining
23	23 April	**3. APPLICATIONS**	13	**LG**	**SM**	**Special Steels**	Special ultra high strength steels , PH stainless steels. Maraging Steels.
24	26-27 April	**3. APPLICATIONS**	14	**SG**	**ST/SM**	**Non-destructive Testing** *(Voluntary presentations by students)*	Common NDT method. Visual Inspection. Liquid Penetrants Magnetic Particle. Eddy Current. Radiographic. Ultrasonic Acoustic Emissions. Non-destructive testing. Method comparison.
25	3-4 Mayo	**3. APPLICATIONS**	15	**SG**	**ST/SM**	**Alloys for high Temperature applications: Superalloys amd Intermetallics**	Superalloys: Microstructure, strengthening Mechanisms. Properties Applications. Intermetallics: Nickel Aluminides. Titanium aluminides. Manufacturing properties and applications. Thermal Barrier coatings
26	7 Mayo	**3. APPLICATIONS**		**LG**	**SM**	**REVISION**	**TEST 3**
27	10-11 Mayo			**SG**	**ST/SM**	**REVISION**	Problems Revision