

Academic Year: ( 2017 / 2018 )

Review date: 03-10-2017

Department assigned to the subject: Department of Bioengineering and Aerospace Engineering

Coordinating teacher: DIAZ ALVAREZ, JOSE

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

**STUDENTS ARE EXPECTED TO HAVE COMPLETED**

Student must own basic knowledge relative to the following fields:

**MATERIALS:**

- + Properties and common uses in aerospace applications of polymeric, ceramic and composite materials.
- + Properties and common uses in aerospace application of metallic materials.

**ENGINEERING GRAPHICS:**

- + Descriptive geometry.
- + Standard specification for the representation of basic industrial and aerospace elements.
- + Geometric dimensioning and tolerancing.
- + Computer aided design.

**MANUFACTURING PROCESSES:**

- + Manufacturing in the aerospace industry:
  - Manufacturing processes.
  - Geometric and functional specifications.
  - Tooling and assembly processes.

**COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.**

At the end of the course the student should be able to:

- Identify manufacturing process capabilities.
- Select properly the technology or group of technologies to product a piece, component or mechanism attending to its application.
- Select the type of material to manufacture a piece, component or mechanism considering different aspects as service life, machinability and maintenance.
- Recognize and predict a potential failure in aerospace structures and propulsion systems with analytical and numerical techniques.

**DESCRIPTION OF CONTENTS: PROGRAMME****REQUIREMENTS TO MANUFACTURING PROCESSES: PROCESS CERTIFICATION, DESIGN**

- Engineering requirements: data for manufacturing
- Quality requirements.
- Cost requirements
- Environmental requirements
- Lead time
- Plant lay-up
- Stability of the process: development vs production.
- Certification of manufacturing processes.

**MANUFACTURING PROCESS CAPABILITIES.**

- Why we need to fix these capabilities
- How to define process capabilities
- Repeatability of the process

Statistical analysis of manufacturing capabilities  
Tolerances  
Defects (composite materials)

#### CONCURRENT ENGINEERING: MATERIALS, DESIGN AND PRODUCTION INTEGRATION

Why concurrent engineering  
Product view from different company areas: local target vs global target  
Thinking out of the box. Mutual challenge and collaboration  
Concurrent engineering vs technologies  
Advanced Composite Materials

#### MANUFACTURING PROCESSES FOR ADVANCED COMPOSITE MATERIALS: AUTOCLAVE PROCESS, RTM, FILAMENT WINDING.

Processes  
Tooling (thermal effects)  
Vacuum bag  
Sandwich  
Defects  
Drilling  
Bonded  
Final trimming  
Joining  
FEM (Machining process simulation)

#### MANUFACTURING PROCESS FOR POLYMERIC MATERIALS

#### MANUFACTURING PROCESSES FOR SUPERALLOYS.

FEM (Machining process simulation)

#### INFLUENCE OF MACHINING AND ASSEMBLY PROCESSES ON SERVICE INSPECTION.

Maintenance and inspection activities for in Service aircrafts  
Accessibility  
Design/production for maintenance  
In service damage. Allowable damage definition.  
In Service inspection  
Temporary/permanent repairs  
Non conformance material. Repairs in the production site.

#### ASSEMBLY PROCESSES

Definition of assembly process based on design requirements  
Consideration of small tooling on the assembly process. Back to the design phase.  
Ergonomic considerations  
Torsion boxes and fuselage examples on assembly

#### INSPECTION METHODS

Visual inspection and Tap coin  
Ultrasonic inspection: factory and in Service inspection.  
Defects vs inspection methods  
. ¿Uninspectable¿ details  
Thermography

#### TOTAL QUALITY: KEY CHARACTERISTICS, PFMEA, FEEDBACK LOOPS.

From quality control to total quality  
Impact of different Company areas on the final quality of the product  
Quality plans  
Key characteristics  
PFMEA-DFMEA  
Management of non conformance material.  
Feedback loop. Learning from the non quality.

#### MAINTENANCE.

#### FAILURE MECHANISM COMPOSITES

#### FAILURE MECHANISM SUPERALLOYS

#### LEAN MANUFACTURING

## LEARNING ACTIVITIES AND METHODOLOGY

Theoretical lessons.

Practical lessons

Lab sessions

## ASSESSMENT SYSTEM

The following requirements have to be met in order to pass the subject:

- 1) to have a MINIMUM mark of 4.0/10 in the end-of-term exam;
- 2) to have a minimum overall mark of 5.0/10 (weighing 60% the end-of-term exam mark and 40% the mark of the continuous evaluation).

Continuous evaluation 40%

**% end-of-term-examination:** 60

**% of continuous assessment (assignments, laboratory, practicals...):** 40

## BASIC BIBLIOGRAPHY

- Jamal Y. Sheikh-Ahmad Machining of Polymer Composites, Springer, 2009
- Michael C.Y.Niu Composite Airframe structures, Hong Kong Conmilit Press Ltd., 1992