Aerospace Manufacturing

Academic Year: (2018 / 2019) **Review date: 22-06-2018**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: FENZA , ANGELO DE

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

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.

OBJECTIVES

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 CETIFICATION, 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
Joning
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 (assigments, 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