AIRCRAFT MANUFACTURING PROCESS

ENAS 252

Lecture : 3 **Year : II**
Tutorial : 0 **Part : II**
Practical : 3/2

Course Objectives:
This course will enable students to understand the fundamentals of a manufacturing process with a proper balance of fundamentals of an aircraft's structure, along with analysis and application of materials that are used during the aircraft manufacturing process. To enable students to acquire knowledge of picking different aerospace materials as per manufacturing principles and processes to fabricate components of an aircraft.

1 Overview of Aircraft Manufacturing (3 hours)

1.1 Definition of manufacturing and materials in manufacturing
1.2 Manufacturing processes and phases
1.3 Recent developments in manufacturing

2 Major Aircraft Materials and its Classification (6 hours)

2.1 Major aircraft materials: Aluminum, titanium, steel, composite materials
2.2 Wood and fabric in aircraft construction and specification
2.3 Components in composite materials
2.4 Fibers (glass, Kevlar or aramid, boron)

3 Major Manufacturing Processes in Aerospace (8 hours)

3.1 Major forming process of various metal products
3.2 Welding and joining
3.3 Metal cutting and machining
3.4 Abrasive metal removing and cutting process
3.5 Chemical metal removal and chemical
3.6 Role of friction (adhesive friction and flowing friction)

4 Material Removal Processes: Chip-Forming (7 hours)

4.1 Modeling the cutting process
  4.1.1 Operation of lathes, milling, drilling, shapers and drilling machines
  4.1.2 Application of shaping, planning and slotting machines
4.2 Force, power and productivity relationship

4.3 Methods of mounting of jobs and cutting tools in machine tools
4.4 Uses of various attachments in machine tools
4.5 Cutting off process: Saws, flame cutting, arc cutting

5 Welding Technology in Aerospace (8 hours)

5.1 Types of weld joints
5.2 Friction welding: Rotary friction welding, linear friction welding
5.3 Friction-stir welding
5.4 Fusion welding with external heating sources: laser, electron beam, tungsten inert gas (TIG), metal inert gas

6 Manufacturing Systems (8 hours)

6.1 Automation technologies for manufacturing system
  6.1.1 Automation fundamentals
  6.1.2 Hardware for automation
  6.1.3 Computer numerical control
  6.1.4 Industrial robotics
6.2 Integrated manufacturing systems
  6.2.1 Material handling
  6.2.2 Fundamental of production lines
  6.2.3 Automated production lines
6.3 Process planning and production control
6.4 Quality control and inspection

7 Corrosion and its Prevention (5 hours)

7.1 Corrosion of dissimilar metals
  7.1.1 Carbon steel and aluminum alloy joint
  7.1.2 Stainless steel and aluminum alloy joint
  7.1.3 Copper, brass, bronze, and aluminum alloy joint
7.2 Corrosion protection
7.3 Plating operations
7.4 Anodic oxidation process

Assignments

1. Major manufacturing processes in aerospace
2. Welding technology in aerospace
3. Manufacturing systems

Practical (22.5 hours)

1. Fabricate of an Aircraft at Laboratory using wood composite and adhesive
2. 3D Printing of Aircraft's Components
3. Failure Strength of Joints: Riveted Joints, Welding Joints at workshop.
4. Non-Destructive Test
5. Aircraft Structure Design Practice Work on XFLR Open-Source Software

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	3	6
2	6	10
3	8	10
4	7	8
5	8	8
6	8	10
7	5	8
Total	**45**	**60**

* There may be minor deviation in marks distribution.

Reference

1. Groover, M. P. (2013). Fundaments of Modern Manufacturing: Materials, Processes, and System. Wiley & Sons, Inc.
2. Saha, P. K. (2016). Aerospace Manufacturing Process. CRC Press.
3. Titterton, G. F. (2015). Aircraft Materials and Processes. Himalayan Books, New Delhi.
4. Zhang, S., Zhao, D., (2016). Aerospace Materials Handbook. CRC Press.