

AIRCRAFT MATERIALS AND PRODUCTION

IV Semester: AE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AAE005	Core	L	T	P	C	CIA	SEE	TOTAL
		3	1	3	4	30	70	100
Contact Classes: 45		Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45	

OBJECTIVES:

1. Understand about traditional engineering materials like steel and iron material behavior, and to know the enhancement of material properties using heat treatment.
2. Remember the technical areas of aerospace engineering production techniques using casting, different types of casting processes used in aircraft production.
3. Understand methodology and experience of welding techniques and inspection of welding area s using NDT.
4. Achieve basic engineering production techniques using lathe and various operations such as plane turning, threading, tapering and drilling.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand the different phases of iron carbon diagram for manufacturing the different materials with different carbon content.
2. Study different material properties and process of heat treatments- annealing, normalizing, hardening and tempering..
3. Structure and properties of copper and aluminum and their alloys. Understand the corrosive protective methods for metals
4. Discuss different casting procedures- sand casting, metal casting, investment casting, centrifugal casting, etc.
5. Understand the procedure of welding processes like arc welding, gas welding, spot welding, Soldering and for different materials.
6. Understand the different NDT testing procedures for metals and non-metals by using ultrasonic testing, radiography testing and magnetic particle testing.
7. Getting knowledge about the sheet metal techniques to produce different objects like punching, blanking, piercing, shearing, etc.
8. Understand the concept of spinning, stretch forming and drawing of different materials.
9. Understand the different fastening techniques riveting, tooling of aircraft by using jigs and fixtures.
10. Gain knowledge about the basic convectional, unconventional riveting and welding for knowledge based exams.
11. Getting knowledge to implement the chemical and electro chemical machining techniques.
12. Understand the processes parameters of electrical energy based machining processes.
13. Demonstrate a good understanding of types and properties of composites used in aircraft.

14. Possess knowledge in processing and fabrication of structural composites.		
15. Understand mechanical behaviors of aircraft composite materials.		
UNIT-I	AIRCRAFT ENGINEERING MATERIALS	Classes: 10
Engineering materials Steels, study of iron, iron carbon phase diagram, heat treatment-annealing, normalizing, hardening and tempering of Aluminum and steel, Non-Ferrous metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys, Corrosion - Types of Corrosions - Prevention – Protective Treatments.		
UNIT-II	CASTING, WELDING AND INSPECTION TECHNIQUES	Classes: 08
General principles of various casting processes Sand casting, die-casting, centrifugal casting, investment casting, Shell molding types; Principles and equipment used in arc welding, gas welding, resistance welding, solid, laser welding, and electron beam welding, soldering and brazing techniques. Need for NDT, ultrasonic testing, Radiographic testing, Flight testing.		
UNIT-III	SHEET METAL PROCESSES IN AIRCRAFT INDUSTRY	Classes: 10
Sheet metal operations: shearing, punching, super plastic forming; operations in bending like stretch forming spinning drawing. Riveting, types and techniques, equipment, fasteners, integral tanks, final assembly of aircraft, Jigs and Fixtures, stages of assembly, aircraft tooling concepts.		
UNIT-IV	CONVENTIONAL AND UNCONVENTIONAL MACHINING PROCESSES	Classes: 09
General working principles, applications and operations of lathe, shaper, milling machines, grinding, drilling machine, computer numeric control machining. Working principles and applications of abrasive jet machining, ultrasonic machining, Electric discharge machining and electro chemical machining, laser beam, electron beam, plasma arc machining.		
UNIT-V	AIRCRAFT COMPOSITES	Classes: 08
Introduction, Physical metallurgy, Wrought aluminum alloys, Cast aluminum alloys, Production of semi-fabricated forms, Aerospace applications, Plastics and rubber, Introduction to fiber reinforced plastics, glass and carbon composites; Fibers and resins; Characteristics and applications, Classification of aircraft materials; Materials used for aircraft components, Application of composite materials, Super alloys, indigenized alloys, emerging trends in aerospace materials.		
Text Books:		
<ol style="list-style-type: none"> 1. S. Kalpakjian, Steven R. Schmid, “Manufacturing Engineering and Technology”, Addison Wesley 5th Edition, 1991. 2. S. C. Keshu, K. K Ganapathy, “Aircraft production technology and management”, Interline Publishing House, Bangalore, 3rd Edition, 1993. 3. Douglas F. Horne, “Aircraft production technology”, Cambridge University Press, 1st Edition, 1986. 		
References:		
<ol style="list-style-type: none"> 1. S. C. Keshu, K. K Ganapathy, “Air craft production techniques”, Interline Publishing House, Bangalore, 3rd Edition, 1993. 2. R. K. Jain, “Production Technology”, McGraw-Hill, 1st Edition, 2002. 3. O. P. Khanna, M. Lal, “Production Technology”, Dhanpat Rai Publications, 5th Edition, 1997. 		

Web References:

1. <http://www.aerospacemanufacturinganddesign.com/article/amd0814-materials-aerospace-manufacturing/>
2. <https://www.mdpi.com/journal/aerospace>
3. <http://library.stanford.edu/guides/aircraft-materials-and-avionics>
4. <https://www.cranfield.ac.uk/courses/taught/aerospace-materials>
5. <https://onlinelibrary.wiley.com/doi/full/10.1002/9781118985960.meh110>

E-Text Books:

1. <https://bookboon.com/en/manufacturing-processes-and-materials-exercises-ebook#download>
2. <https://www.amazon.com/Introduction-Aerospace-Materials-Woodhead-Publishing-ebook/dp/B00HLLNFYO>
3. <https://www.accessengineeringlibrary.com/browse/aircraft-materials-and-analysis>

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