

## 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	-	-	3	30	70	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: Nil</b>			<b>Practical Classes: Nil</b>			<b>Total Classes: 45</b>

### I. COURSE OVERVIEW:

The subject aircraft Production Technology provides knowledge regarding different types of manufacturing processes and materials used to produce variety of metal products used in aircraft industries. To make the student aware of various materials and production technologies generally involved in aircraft manufacturing. Further the engineer should be able to handle machine, equipment, tools and accessories in the recommended manner and also follow safety precautions.

### II. OBJECTIVES:

**The course should enable the students to:**

- I The methods of improving the mechanical properties of aerospace materials and their alloys using heat treatment processes and corrosion prevention methods.
- II The concepts of welding, casting, forming, riveting process and quality inspection techniques used in manufacturing the aerospace components at low cost with minimum wastage.
- III The working principles, advantages and disadvantages of conventional and unconventional machining process used in aerospace industries.
- IV The characteristics and applications of aircraft materials including composites used in aerospace industry.

### III. COURSE OUTCOMES:

**After successful completion of the course, students should be able to:**

- |      |   |            |
|------|---|------------|
| CO 1 | <b>Illustrate</b> the engineering materials, heat treatment and corrosion prevention process for the enhancement of mechanical properties of aircraft components.   | Understand |
| CO 2 | <b>Demonstrate</b> the manufacturing processes and NDT testing methods viz, Dye penetrating technique, ultrasonic testing, magnetic particle inspections and radiography testing for producing defect free aircraft components. | Understand |
| CO 3 | <b>Develop</b> the sheet metal operations and Riveting process in aerospace and automobile industries for assembling fuel tanks and components.   | Apply      |
| CO 4 | <b>Make use of</b> machine tools and Jigs and fixtures used in manufacturing process for improving productivity with minimum cost of products in aircraft and allied industries.  | Apply      |
| CO 5 | <b>Summarize</b> the principles and applications of non conventional machining process for selecting suitable processes based on design and materials of aircraft components.   | Understand |
| CO 6 | <b>Utilize</b> appropriate composite materials, Super alloys, indigenized alloys based on suitability and applications of aircraft components.  | Apply      |

### IV. SYLLABUS:

<b>UNIT-I</b>	<b>AIRCRAFT ENGINEERING MATERIALS</b>	<b>Classes: 09</b>
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.		
<b>UNIT-II</b>	<b>CASTING, WELDING AND INSPECTION TECHNIQUES</b>	<b>Classes: 09</b>
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.		
<b>UNIT-III</b>	<b>SHEET METAL PROCESSES IN AIRCRAFT INDUSTRY</b>	<b>Classes: 09</b>
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.		
<b>UNIT-IV</b>	<b>CONVENTIONAL AND UNCONVENTIONAL MACHINING PROCESSES</b>	<b>Classes: 09</b>
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.		
<b>UNIT-V</b>	<b>AIRCRAFT COMPOSITES</b>	<b>Classes: 09</b>
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.		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. S. Kalpakjian, Steven R. Schmid, "Manufacturing Engineering and Technology", Addison Wesley 5<sup>th</sup> Edition, 1991.</li> <li>2. S. C. Keshu, K. K Ganapathy, "Aircraft production technology and management", Interline Publishing House, Bangalore, 3<sup>rd</sup> Edition, 1993.</li> <li>3. Douglas F. Horne, "Aircraft production technology", Cambridge University Press, 1<sup>st</sup> Edition, 1986.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. S. C. Keshu, K. K Ganapathy, "Air craft production techniques", Interline Publishing House, Bangalore, 3<sup>rd</sup> Edition, 1993.</li> <li>2. R. K. Jain, "Production technology", Mc Graw Hill, 1<sup>st</sup> Edition, 2002.</li> <li>3. O. P. Khanna, M. Lal, "Production technology", Dhanpat Rai Publications, 5<sup>th</sup> Edition, 1997.</li> </ol>		
<b>Web References:</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/112107145/">https://nptel.ac.in/courses/112107145/</a></li> <li>2. <a href="https://nptel.ac.in/courses/112105126/">https://nptel.ac.in/courses/112105126/</a></li> </ol>		
<b>E-Text Books:</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://books.google.co.in/books?id=6wFuw6wufTMC&amp;redir_esc">https://books.google.co.in/books?id=6wFuw6wufTMC&amp;redir_esc</a></li> <li>2. <a href="https://royalmechanicalbuzz.blogspot.in/2015/04/manufacturing-engineering-by-kalpakjian.html">https://royalmechanicalbuzz.blogspot.in/2015/04/manufacturing-engineering-by-kalpakjian.html</a></li> </ol>		
<b>Course Home Page:</b>		