



**Course Title: AIRCRAFT MATERIALS AND PROCESSES**

**Credit Units: 03**

**Course Code: AERO302**

**Course Level: UG**

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	-	-	-	3

### Course Objectives

This course builds up a strong knowledge base of aerospace students in respect of various important materials used in the manufacture of aircraft including certain salient manufacturing processes that are specific to the aircraft manufacturing. The course also covers the design principles of jigs and fixtures, Electron Beam welding, etc, that are used for manufacturing various components and assemblies of aircraft so as to ensure symmetry of the geometric shapes and to obtain accuracy / repeatability in dimensions.

**Pre-requisites:** Material Science.

### Course Contents/Syllabus:

	Weightage (%)
<b>Module I : Introduction</b>	<b>12</b>
<b>Descriptors / Topics:</b> Importance & selection of materials for Aircraft & aerospace vehicle designs. Structures & Importance of temperature variations, for different parts of airplane.	
<b>Module II : Light Metal Alloys &amp; Titanium Alloys</b>	<b>18</b>
<b>Descriptors/Topics :</b> Aluminum alloys, Heat treatment, High strength and high corrosion resistant alloys, Magnesium alloys and their properties. Titanium and its alloys. Application to Aerospace Vehicle of these alloys.	
<b>Module III : Aircraft Steels</b>	<b>12</b>
<b>Descriptors/Topics :</b> Classification of alloy steels, Effect of alloying elements, corrosion resistant steels, Heat treatment of steel alloys , Corrosion prevention methods.	
<b>Module IV : High Strength , Heat Resistant Alloys and Composites</b>	<b>22</b>
<b>Descriptors/Topics :</b> Nickel and cobalt base alloys, properties of Inconel, Monal and K-Monal, Nimonic and super alloys; Refractory materials; Composites their types, structure, multi-layering & hybrid materials, Stealth materials & Ceramics, Application to Aerospace vehicles.	
<b>Module V : Metal Joining Processes</b>	<b>8</b>

<b>Descriptors/Topics :</b> Standard aircraft welding practices, Inert-gas, arc welding, resistance welding. Welding of light alloys. Electron-beam & Plasma Welding. Basics of aircraft & aerospace vehicle Riveting, types of rivet heads & tools. Stress calculations.	
<b>Module VI : Jigs and Fixtures for Aircraft</b>	<b>8</b>
<b>Descriptors/Topics :</b> General design, Method of location of cylindrical and flat surfaces. Design principles of Wing Jig, Fuselage jig and other components.	
<b>Module VII : Aircraft Manufacturing Processes</b>	<b>20</b>
<b>Descriptors/Topics :</b> Profiling, Hydro forming, forming bending rolls, Spar milling, Spark erosion and Powdered metal parts, integral machining, Contour etching, High energy rate forming, Manufacturing of honeycomb structures, General methods of construction of aircraft and aero engine parts and aero engine parts.	

### Student Learning Outcomes:

- Describe and identify materials for development of aircraft and its components.
- Analyze Properties of Aircraft Light Alloys, Aircraft Steels & Composites.
- Review standardization of Aircraft materials viz-a-viz, Crystalline / material micro-structures.
- Describe standard engineering processes associated with aircraft manufacture.
- Evaluate modern aerospace component fabrication Techniques.

**Pedagogy for Course Delivery:** Session Plan / course-material uploading, Class-room teaching associated with assignments, presentations, quiz, viva-voce and evaluation.

### Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	NA	100

### Theory Assessment (L&T):

Continuous Assessment/Internal Assessment - 30					End Term Examination
Components (Drop down)	A	CT	S/V/Q	HA	70
Weightage (%)	5	10	8	7	70

**Text & References:**

- Chapman WAJ, “Workshop Technology”, Vol. I, II, III.
- Jindal UC , Material Sciences & Metallurgy
- G.F. Titterton, “Aircraft Materials and Processes”, Himalayan Books, New Delhi
- G.B. Ashmead, “Aircraft Production Methods”. :
- Lalit Gupta, “Advanced Composite Materials”, Himalayan Books, New Delhi,1998

**Any other Study Material:**

- MIT Lectures on A/c Materials