GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

AIRCRAFT MATERIALS & MANUFACTURING TECHNIQUES
(Code: 3330105)

Diploma Programme in which this course is offered	Semester in which offered
Aeronautical Engineering	THIRD

1. RATIONALE.

This subject of aircraft materials & processes 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 & production technologies generally involved in aircraft manufacturing. As an engineer the knowledge and practical skills in different manufacturing processes are essential and hence emphasis is also given in this course towards skills development. Further the engineer should be able to handle machine, equipment, tools and accessories in the recommended manner and also follow safety precautions.

2. COMPETENCY.

The course content leading to the achievement of the following competencies;

i. Study the concepts of materials, its properties and application.
ii. Processes used to manufacture the aircrafts

3. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
04	00	02	06	70	30	20	30	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **ESE** -End Semester Examination; **PA** - Progressive Assessment.

4. COURSE DETAILS

UNIT	MAJOR LEARNING	TOPICS AND SUB-TOPICS
UNIT–I INTRODUCTION TO AEROSPACE MATERIALS	• Define different types of Engineering Materials • Classify materials & its properties • Composition & heat treatment of materials	1.1 Classification 1.2 Composition, properties, heat treatment & application of materials. 1.3 Plastic, wood, plywood, glue, dopes and rubber used in aircraft manufacturing.
UNIT–II INTRODUCTION TO COMPOSITE MATERIALS	• Define different types of composites materials. • Advantages of composites materials. • Application of composites materials. • Behaviour of composites materials.	2.1 Composite material 2.2 Fibers 2.3 Matrix 2.4 Advantages of Composite Materials and Structures. 2.5 Applications of Composite materials in Present world. 2.6 Mechanical Behaviour of Composite Materials.
UNIT–III MANUFACTURING OF ADVANCED COMPOSITES	• Classification of composites manufacturing processes • Methods of manufacture the composites materials	3.1 Contact moulding • Mould preparation • Spray-up • Hand lay-up 3.2 Compression moulding methods • Matched die moulding • Forming methods employing gas pressure • Pultrusion 3.3 Filament Winding
UNIT–IV CASTING & WELDING	• Classification of casting processes • Different types of casting processes principle • Classification of welding processes • Principle of different types of welding processes • Application of welding processes	4.1 General principles of various Casting Processes • Sand casting, • die-casting, • centrifugal casting, • Investment casting 4.2 Welding Techniques • Arc welding • Gas welding • Friction welding, • Laser welding • Electron Beam welding • TIG welding • MIG welding, • Soldering and brazing techniques.

UNIT–V MACHINES , SHEET METAL , GRINDING & RIVET OPERATION	• Classification and working of basic machine tools • Basic cutting & shearing operation used in aircraft manufacturing	5.1 General Principles (with schematic diagram only) of working and types of • Lathe • Shaper • Milling machines • Grinding • Drilling m/c 5.2 Sheet metal operations • Shearing, • Punching, • Bending • Forming, • Spinning, • Drawing etc. 5.3 Types of rivets & its operations 5.4 Grinding Operations
UNIT–VI UNCONVENONAL MACHINING	• Understand the unconventional machining • Principle of working different unconventional techniques	6.1 Principles of working and applications of • EDM • Abrasive jet machining • Ultrasonic machining • Electron beam and • Plasma arc machining.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY).

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	**INTRODUCTION TO AEROSPACE MATERIALS**	04	04	02	02	08
2.	**INTRODUCTION TO COMPOSITE MATERIALS**	07	02	04	08	14
3.	**MANUFACTURING OF ADVANCED COMPOSITES**	07	02	02	04	08
4.	**CASTING & WELDING**	12	04	04	08	16
5.	**MACHINES & SHEET METAL OPERATION**	13	04	04	08	16
6.	**UNCONVENTIONAL MACHINING**	05	02	02	04	08
	Total	**48**	**18**	**18**	**34**	**70**

Legends: R = Remember **U**= Understand; **A**= Apply and above levels (Bloom's revised taxonomy).

6. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The tutorial exercises should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the above mentioned competencies.

SR. NO.	UNIT NO.	EXPERIMENT	Hours
1	IV	Demonstration of metal melting, metal pouring, metal casting and casting finishing.	2
2	IV	Prepare at least one jobs using arc welding processes.	2
3	IV	Prepare two jobs, one using soldering and another using brazing.	2
4	V	Demonstration of lathe machine operations.	2
5	V	Demonstration of shaper machine operations.	2
6	V	Demonstration of drilling machine operations.	2
7	V	Demonstration of milling machine operations.	2
8	V	Demonstration of grinding machine operations.	2
9	V	Demonstration of sheet metal operations.	2
10	V	Demonstration and perform riveting operations.	2
11	VI	Demonstration of EDM operations.	2

7. SUGGESTED LIST OF STUDENTACTIVITIES

1. Prepare fuselage sectional piece of semi monocoque frame using hardboard.
2. Prepare wing airframe using hardboard.
3. Make a model of all stabilizing surfaces using hardboard.

8. SUGGEST EDLEARNIN ACTIVITIES

A. List of Books

SR. NO.	TITLE OF BOOK	AUTHOR	PUBLICATION
1.	Aircraft Materials	C G K Nair	Interline
2.	Aerospace Materials	Balram Gupta,	S Chand
3.	Mechanics of Composite Materials and Structures	Madhujit Mukhopadhyay	Universities press
4.	Production Technology.	P. C. Sharma	S Chand

B. List of Major Equipment/Instrument

Sheet shearing and cutting saw, Sheet bending machine, air compressor, rivet gun, rivets, Drill machine with drill bits set, clamps, bench vice, mini angle grinder, wood working tools, file set for wood and metal, One meter steel rule, Some stationary, Welding equipments. Lathe, Shaper, Milling machines, Grinding & Drilling m/c, EDM m/c, Casting equipments.

C. List of Software/ Learning Websites

- https://en.wikipedia.org/wiki/List_of_aircraft_manufacturers
- http://www.airbus.com/company/aircraft-manufacture/
- https://www.eaa.org/en/eaa-museum
- https://www.youtube.com/watch?v=S-dClmeig_U
- https://www.youtube.com/watch?v=hlV6hVKyZG4
- http://www.ranker.com/list/aircraft-manufacturing-companies/reference?var=4&utm_expid=16418821-179.L_j85cRBSIGuH4I7Qr719g.3&utm_referrer=https%3A%2F%2Fwww.google.co.in%2F
- https://www.youtube.com/watch?v=X7qJjj2RNvE
- https://www.youtube.com/watch?v=-y0U1Qux9EA
- https://www.youtube.com/watch?v=7GUu03CV5DQ
- https://www.youtube.com/watch?v=dglh5Znr6Uw
- https://www.youtube.com/watch?v=bBxDjAZkN3w
- https://www.youtube.com/watch?v=UiOViPMJOB4
- https://www.youtube.com/watch?v=FTUw0OWWMLU
- https://www.youtube.com/watch?v=SN8-gZwNDCs
- https://www.youtube.com/watch?v=i6n8cpLKzHE
- https://www.youtube.com/watch?v=wXxn-8OA8Ac
- https://www.youtube.com/watch?v=4MoHNZB5b_Y
- https://www.youtube.com/watch?v=bRjU4na-ol8
- https://www.youtube.com/watch?v=sxWtzlitq1A
- https://www.youtube.com/watch?v=ign6W5ENJAA
- https://www.youtube.com/watch?v=NZwvRRoR1xw
- https://www.youtube.com/watch?v=HPBmbkyi9Tw

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics.

- **Prof. ANKIT PATEL**, H.O.D., Aeronautical Dept. Parul institute of engg. & tech-Diploma studies