GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3150109

MANUFACTURING PROCESSES AND PRODUCTION TECHNIQUES

B.E. 5th SEMESTER

Type of course: Engineering Science

Prerequisite: Fundamentals of Aeronautical Engineering

Rationale: Understanding of basics of aircraft science and manufacturing technology

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Fabrication and Repair of Wooden Aircraft Structures**: Introduction, Aircraft woods, Glues and Gluing procedures, Construction and repairs of wood structures, Care of aircraft with wood structures, Inspection of aircrafts having wood structures.	03	7
2.	**Fabric Covering**: Introduction, Fabric types and terminology, Dopes and Finishing Materials, Facilities and Equipment for Aircraft Covering, Selection for Fabric covering material, Application of Fabric covers for Aircraft, Fabric Inspection, Repair of Fabric Covering	02	4
3.	**Sheet Metal Airframe Construction**: Introduction, Design Philosophy, Factors affecting sheet metal parts and joints design, Preparation for layout work, Various sheet metal fabrication techniques- Sheering, Bending, Rolling-Taper Rolling, Different sheet metal forming processes, Embossing, Edge finishing, drilling. Hand tools for sheet metal work, Floor and Bench machinery for sheet metal work, Fabrication for sheet metal parts. Heat Treatment of aluminum and steel sheet metal components.	10	23
4.	**Miscellaneous parts manufacturing Techniques:** Turning, Taper turning, Facing, Knurling, Milling, Chemical Milling, Shaping, Extrusion, Surface finishing, Introduction of NC and CNC machines.	05	11
5.	**Riveting**- Rivet nomenclature, Types of rivet geometry, Types of rivets, Riveting and deriveting tools- hand tools and Machine tools. Riveting Process.	05	11
6.	**Welded Aircraft Structures and Construction**: Introduction, Construction of steel-tube assemblies by welding, Inspections of steel tube structures, Aircraft tubing repair, Special welding repairs, soldering and brazing,	05	11

7.	**Aircraft Composite Materials and manufacturing techniques**: Types of aircraft composite materials used for airframes, advantages and disadvantages of using composite materials over aluminum sheet metal construction.	07	16
8.	**Honeycomb Sandwich Construction**: Fabrication, Machining and forming of FRP composite structures like honeycomb sandwich construction. Reinforcement materials for composites, Composite matrices, Wrap orientation techniques, Construction techniques of fabrication of fuselage, wings and tail plane of composite materials.	04	9
9.	**Adhesives and Adhesive bonding processes:** Introduction, Surface preparation, application of primer, application of adhesive, tools for application of adhesives, different types of adhesive bonded joints. Selection of adhesives.	02	4
10.	**Aircraft Painting and Marking**: Introduction, Aircraft finishing materials, Templates and Spray paint equipments, Finishing metal aircraft and parts, Registration marks for aircraft	02	4

Suggested Specification table with Marks (Theory):

R Level Remembering	U Level Understanding	A Applying	A Level Analyzing	E Level Evaluating	C Level Creating
10%	**30%**	**20%**	**10%**	**10%**	**20%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Aircraft Maintenance and Repair (Sixth Edition)- TATA McGraw-Hill EDITION by-Croes, Watkins, Delp
2. Elements Workshop Technology – Volume-1 and 2 . By S K Hajra Choudhary , A K Hajra Choudhary, Nirjhar Roy
3. Composite Materials for Aircraft Structures- By A. A. Baker, S. Dutton, D. Kelly
4. Aircraft Manufacturing Processes- By Pradip K. Saha. ,Taylor and Francis
5. Aircraft Sheet Metal- By Nick Bonacci – Jeppesen / Aviation Technician Training Series.
6. Workshop Technology- By B. S. Rahguvanshi, Dhanpat Rai & Co.

Course Outcome:

After learning the course the students should be able to

		% of CO
1.	Understand about how wooden airframe structure is Fabricated.	10
2.	Understand about how sheet metal work is performed over an aircraft and how parts are joined together.	35
3.	Learn about steel tube truss type structures for light aircrafts.	15
4.	Know about how airframe components are fabricated by paper or aluminum honeycomb.	15
5.	Construct various parts of aircrafts using composite materials.	25

List of Practicals:

Sr No	List of Practicals
1	To Prepare geometry of sheet metal assembly having riveted joints.
2	To fabricate sheet metal parts as per given design.
3	To study stiffening techniques of aircraft sheet metal components.
4	To prepare riveted joints of single chain, Double chain and zigzag riveting.
5	To study different types of adhesives for airframe construction.
6	To study painting techniques for various sheet metal aircraft components using standard methods.
7	To study honeycomb sandwich construction for primary and secondary control surfaces.
8	To study fabrication process of fiber glass / Carbon fiber components.
9	To study wooden airframe construction techniques.
10	To study welded steel tube- truss type fuselage construction.

Major equipment: Lathe Machine, Shaper Machine, Milling Machine, Sheet shearing and cutting saw, Sheet bending machine, air compressor, rivet gun, bucking bars, rivets, Aviation Snip, Drill machine with drill bits set, clamps, bench vice, mini angle grinder, sabre saw, straight grinder, pen grinder, heat guns, wood working tools, file set for wood and metal, Basic hand tools, spanner sets, Beading Machine, Beading die set.

Video Links:

1. **https://www.youtube.com/watch?v=hqiVF6JMRZI**
2. **https://www.youtube.com/watch?v=mY6UBWywLQ8**
3. **https://www.youtube.com/watch?v=PF6ZuBDlNjY**