

GUJARAT TECHNOLOGICAL UNIVERSITY

AERONAUTICAL ENGINEERING (01) AIRCRAFT SCIENCE AND MANUFACTURING PROCESSES SUBJECT CODE: 2130106 B.E. 3RD SEMESTER

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: Understanding of basics of aircraft science and manufacturing technology

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
		PA	ALA		ESE	OEP				
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction of principles of flights: Principles of generation of lift, Nomenclature of aerofoil, Four forces acting upon an aircraft, three axes of manoeuvring, primary control surfaces- Elevator, Aileron, stabilators and rudder. Secondary control surfaces-Trim Tabs, Flaps, Spoilers, Air-Brakes, Slats-Slots.	04	08
2	Aircraft Structures: Introduction, Aircraft Structural Design, Principal Aircraft Structures, Aircraft Station numbers, Zoning, Nomenclature and Definition- Aileron, Fuselages, General Construction of fuselages, Cockpits, Cabins and Compartments, Wings, Tail and Control Surfaces, Landing Gear, Power plant structures, Rotorcraft Structures.	06	16
3	Fabrication and Repair of Wood Aircraft Structures: Introduction, Aircraft woods, Glues and Gluing procedures, Construction and repairs of wood structures, Care of aircraft with wood structures, Inspection of airplanes having wood structures.	06	16
4	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	06	16
5	Sheet Metal Airframe Construction: Introduction, Design Philosophy, Factors affecting sheet metal parts and joints design, Fundamentals calculations for structures, Preparation for layout work, Hand tools for sheet metal work, Floor and Bench machinery for sheet metal work, Fabrication for sheet metal parts, Riveting.	08	24
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	14
7	Aircraft Painting and Marking: Introduction, Aircraft finishing	04	08

materials, Spray paint equipments, Finishing metal aircraft and parts, Registration marks for aircraft,		
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Reference Books:

1. Aircraft Maintenance and Repair (Sixth Edition)- TATA McGraw-Hill EDITION by-Croes, Watkins, Delp
2. Flight without Formula- By. A. C. Kermode
3. Introduction to Flight. By John D. Anderson Jr. (Mc.Graw Hill)
4. Ground Studies for Pilots (G.S.P.)

Course Outcome:

After learning the course the students should be able to

1. To know about basic principle of flight that how an aircraft actually flies in air.
2. To understand about what types of forces act upon an aircraft while flying.
3. To understand about how a sheet metal work is performed over an aircraft and how parts are joined together. This concept is applied in 90-95% of existing aircrafts.
4. To understand about how wooden airframe structure is developed, manufactured and assembled which is very cheap in cost.
5. To know about steel tube truss type structures which are widely used in Microlight and sports planes.
6. To develop skill about aircraft painting processes and technics and marking.

List of Practicals:

Sr No	List of Practicals	Equipment required
1	Make geometry of sheet metal assembly required having riveted joints.	Stationaries will be brought by students.
2	Make a sheet metal parts as per given design.	Set of Aviation Snip, Sheet bending machine, Drill kit, G-Clamps.
3	Using beading machine stiffen aircraft components.	Hand operated Beading machine with dye set.
4	On given aircraft parts prepare riveted Joints of single chain, Double chain and zigzag riveting.	Rivet Fan, Drill kit, Reamer tool kit, Pneumatic Rivet Gun, set of Bucking bars, Rivet shaver, clicos.
5	On given aircraft parts prepare riveted Joints of triple or multiple rows.	As per mentioned above.
6	Paint sheet metal aircraft components using standard methods.	Spray paint gun, paint, Templates, paint brush, kerosene, turpentine.
7	Prepare design of a steel tube assembly as per given data.	Stationaries will be brought by students.

Open Ended Problems:

Apart from above experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below.

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.

Major equipment: 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, beading

machine, beading machine dye set. One meter steel rule, Some stationary, Templates for letter drafting, paint brush, turpentine, Welding equipments for steel tube structures, adhesives for wooden works,

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.