GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Aeronautical
Subject Code: BE05001061
Subject Name: Manufacturing Processes and Production Techniques

w.e.f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Elective Course - 2

Prerequisite:	Fundamentals of Aeronautical engineering
Rationale:	This subject provides essential knowledge of manufacturing methods and production techniques required for aircraft parts. It helps students connect design with practical implementation, ensuring precision, quality, and safety in aerospace manufacturing. It also introduces modern technologies used in the aeronautical industry.

Course Outcomes:

Sr. No.	CO statement	RBT Level
CO-1	Explain materials and repair methods of wooden aircraft structures.	Remember, Understand
CO-2	Understand design and fabrication of sheet metal airframe components.	Application, Remember, Understand
CO-3	Describe conventional and unconventional machining processes.	Remember, Understand Application,
CO-4	Apply metal joining techniques like riveting and welding in aircraft structures.	Remember, Understand
CO-5	Understand strengthening mechanisms and heat treatment of materials.	Understand Application

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/CA (I)	TW/SL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Aeronautical
Subject Code: BE05001061
Subject Name: Manufacturing Processes and Production Techniques

**** Problem-Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.***

Content:

Module. No.	Detailed Content	Total Hrs	% 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.	4	10%
2	**Sheet Metal Airframe Construction:** Introduction, Design Philosophy, Factors affecting sheet metal parts and joints design, Preparation for layout work, Various sheet metal fabrication techniques-Shearing, Drawing, Squeezing, Blanking, Piercing, deep drawing, Coining and embossing.	6	15%
3	**Conventional and Unconventional Machining Processes:** General working principles, applications and operations of lathe, shaper, milling machines, grinding, drilling machine, computer numeric control machines. Working principles and applications of Electric discharge machining, abrasive jet machining, ultrasonic machining and electro chemical machining, laser beam, electron beam, plasma arc machining	12	25%
4	**Metal Joining Processes -** Rivet nomenclature, Types of rivet geometry, Types of rivets, Riveting and deriveting tools- hand tools and Machine tools. Riveting process. Principles and equipment used in) Gas Welding, Arc Welding (SMAW, GMAW, GTAW) Introduction, Construction of steel-tube Assemblies by welding, Inspections of steel tube structures, Aircraft tubing repair, Special welding repairs, Soldering and brazing,	11	25%
5	**Strengthening Mechanisms in Materials:** Diffusion, Dislocation, Strengthening Mechanisms – Solid Solution Strengthening, Grain Boundary Strengthening, Hardening – Work Hardening, Precipitation Hardening, Secondary Hardening Process. Iron – Carbon Phase Diagram, Heat Treatment -Annealing, Tempering, Carburizing**.**	12	25%
	TOTAL	**45 Hrs**	**100%**

Suggested Specification table with Marks (Theory): (For B.E. only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**30**	**25**	**15**	**00**	**00**

R: Remembrance; U:Understanding; A:Application, N:Analyzeand 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.

The syllabus of *Manufacturing Processes and Production Techniques* directly contributes to

Sr. No.	SDG No.	Relevance to Syllabus
1	SDG 9	**Industry, Innovation and Infrastructure:** Promotes sustainable industrialization, adoption of advanced manufacturing technologies, and innovation in production systems.
2	SDG 12	**Responsible Consumption and Production:** Encourages efficient resource utilization, waste minimization, recycling, and sustainable production practices.
3	SDG 7	**Affordable and Clean Energy:** Supports the use of energy-efficient machinery and integration of renewable energy in manufacturing processes.
4	SDG 8	**Decent Work and Economic Growth:** Ensures safe working conditions, enhances productivity, and generates employment in manufacturing industries.
5	SDG 13	**Climate Action:** Focuses on reducing carbon emissions through cleaner production techniques and environmentally friendly manufacturing processes.

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. Aircraft Manufacturing Processes- By Pradip K. Saha. ,Taylor and Francis
4. Introduction to Physical Metallurgy by Sydney H. Avner.

5. A Textbook of Production Technology (Manufacturing Processes) by P. C. Sharma.

List of Experiments:

1. To get an overview of various manufacturing processes.
2. To study different operations of a lathe machine and prepare a job on it.
3. To study drilling and allied operations.
4. To study different operations of a milling machine.
5. To study different grinding machines and their applications.
6. Introduction to various arc welding processes.
7. To study the effect of process parameters on Metal Removal Rate (MRR) in Electrical Discharge Machining (EDM).
8. Study the effects of quenching medium.
9. To get acquainted with CNC machines and preparation of part programs.
10. To study different types of aircraft wood used in aviation structures.

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

List of Open Source Software/learning website: https://nptel.ac.in/course.php

List of suggested activities for Term Work / Self Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.

4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software

****