

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM****FUNDAMENTALS OF PROPULSION****(Code : 3350104)**

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

1. RATIONALE

The main objective of this course is to understand the working of the aircraft power plant. This subject addresses the understanding and functioning of different propulsion system of an aircraft and associated components like compressor, diffuser, combustion chamber & nozzles.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with an aim to develop different types of skills leading to the achievement of the following competencies:

- **To know about different propulsion system of an aircraft.**
- **To study about details information of an aircraft powerplant.**

3. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
				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. DETAILED COURSE CONTENTS

Unit	Major Learning Topics and Sub- topics	Outcomes (in cognitive domain)
UNIT- I INTRODUCTION	<ul style="list-style-type: none"> • Basic of thermodynamics • Newton laws of motion • To study about thrust & its factor • To study about 	1.1 Reviews of thermodynamic principles 1.2 Newton's laws of motion 1.3 Modes of heat transfer 1.4 Thrust 1.5 Factors effecting the thrust 1.6 Efficiency

	governing cycle of gas turbine engines	1.7 Brayton cycle 1.8 Governing equation
UNIT– II AIRCRAFT ENGINES	<ul style="list-style-type: none"> • To Study propulsion history • To study about IC engines • To study about various gas turbine engines • To study about Accessory section. • To study about propeller. 	2.1 Classification propulsion system 2.2 Internal combustion engines 2.3 Gas turbine engine 2.4 Ramjet engine 2.5 Rocket engine 2.6 Turbojet engine 2.7 Turboprop engine 2.8 Turbofan engines 2.9 Thrust augmentation 2.10 Diffusion mass transfer 2.11 Accessory section 2.12 Auxiliary power unit 2.13 Noise 2.14 Propeller
UNIT– III INLET, COMPRESSOR & DIFFUSER	<ul style="list-style-type: none"> • To study about inlet of engine. • To study about compressor & its types. • To about diffuser. 	3.1 Inlet 3.2 Compressor <ul style="list-style-type: none"> a. Types of compressor b. Efficiency of compressor c. Compressor design parameters d. Bleed air utilization e. Dual compressor theory f. Variable inlet vane & stator 3.3 Diffuser
UNIT– IV COMBUSTION CHAMBER & NOZZLE	<ul style="list-style-type: none"> • To study about combustion chamber • To study about combustion characteristic • To study about fuel injection system • To study about nozzles • To nozzles performance & its efficiency 	4.1 Combustion chamber 4.2 Factors affecting combustion chamber design, process & performance 4.3 Requirements of combustion chamber 4.4 Combustion chamber process 4.5 Types of combustion chamber 4.6 Combustion chamber stability & instability 4.7 Fuel injection system 4.8 Nozzle 4.9 Types of nozzle 4.10 Throat condition for supersonic nozzle 4.11 Nozzle efficiency 4.12 Under expanding & over-expanding nozzle 4.13 Variable area nozzle 4.14 Thrust reversal
UNIT– V TURBINES	<ul style="list-style-type: none"> • To study principle turbine. • To study about compounding of turbines. 	5.1 Operating principle of impulse turbines 5.2 Operating principle of Reaction turbines 5.3 Velocity Triangle 5.4 Blades

		5.5 Velocity & Pressure compounding of multistage impulse turbine 5.6 Degree of Reaction
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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
I	INTRODUCTION	06	04	02	04	10
II	AIRCRAFT ENGINES	10	06	08	06	20
III	INLET, COMPRESSOR & DIFFUSER	06	04	03	03	10
IV	COMBUSTION CHAMBER & NOZZLE	10	06	08	04	18
V	TURBINES	06	06	03	03	12
TOTAL		38	26	24	20	70

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

6. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The Practical 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	II	Performance study of propeller.	2
2	II	Study of subsonic ramjet.	2
3	III	Performance of Axial compressor.	2
4	IV	Study of Flame characteristics.	2
5	IV	Wall pressure distribution of nozzle.	2
6	IV	Performance measurement of nozzle	2
7	V	Velocity profiles of free jets.	2
8	V	Velocity profiles of wall jets.	2

7. SUGGESTED LIST OF STUDENT ACTIVITIES.

Following is the list of proposed student activities like:

SR.NO. ACTIVITY

- 1 Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and experiment work.
- 2 Prepare a charts & model of aircraft combustion chamber.

8. SUGGESTED LEARNING RESOURCES.**A. List of Books:**

SR. NO.	TITLE OF BOOK	AUTHOR	PUBLICATION
1.	Aircraft Propulsion	Mayur R Anvekar	Phi Learning Pvt Ltd
2.	Elements Of Gas Turbine Propulsion	Mattingly	Mc graw Hill
3.	Aircraft Propulsion and Gas Turbine Engines	Ahmed F. El-Sayed	Crc Press

B. List of Software/Learning Websites

- a. <https://www.youtube.com/watch?v=mn34mnnDnKU>
- b. <https://www.youtube.com/watch?v=ln1TDuayIIA>
- c. <https://www.youtube.com/watch?v=1DG4f2umclK>
- d. <https://www.youtube.com/watch?v=KjiUUJdPGX0>
- e. <https://www.youtube.com/watch?v=niqByUi5DRo>
- f. https://www.youtube.com/watch?v=uxZQa5s_94c
- g. <https://www.youtube.com/watch?v=FCyagN2-OBw>
- h. <https://www.youtube.com/watch?v=t56hZJl4wo0>
- i. <http://www.explainthatstuff.com/jetengine.html>
- j. <https://defencyclopedia.com/2015/05/13/explained-how-jet-engines-work/>
- k. <http://aerospaceengineeringblog.com/rocket-science-101-fuel-engine-nozzle/>
- l. <http://nandang-smart.blogspot.in/2009/09/engine-combustion-chamber.html>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnic.**

- **Prof.Ankit Patel**, H.O.D., Aeronautical Dept. Parul institute of Engg. & tech- Diploma studies

Faculty Members from Engineering

- **Dr.Dipali Thakkar**, H.O.D., Aeronautical Engineering Dept. SVIT Vasad.

Coordinator and Faculty Members from NITTTR Bhopal.