

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM****BASICS OF AERODYNAMICS****(Code: 3350101)**

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

1. RATIONALE

This course is specially designed with a view to impart basic knowledge of aerodynamics and it encompasses the major and general areas of aerodynamics. Aerodynamics is one of the core areas of Aeronautical discipline. The concepts of aerodynamics are vitally important to an aeronautical engineer.

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:

- i. To perform the simple tasks related to aerodynamics.**
- ii. To conduct various activities to impart basic knowledge of aerodynamics.**
- iii. Understand basic terms used in Aerodynamics.**
- iv. Understand the effect of the flow on the aircraft.**

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		
			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. DETAILED COURSE CONTENTS

Unit	Major Learning Topics and Sub-topics	Outcomes (in cognitive domain)
UNIT– I AERODYNAMICS OF FLIGHT	<ul style="list-style-type: none"> • Study of various forces acting on aircraft. • Study of principle of lift generation & axis of aircraft. 	1.1 Forces Acting on the Airplane a. Thrust b. Drag c. Weight d. Lift. 1.2 Principle of lift generation 1.3 Wingtip Vortices 1.4 Ground Effect 1.5 Axes of an Airplane 1.6 Moments and Moment Arm 1.7 Introduction to wind tunnel
UNIT– II AERODYNAMIC FORCES IN FLIGHT MANEUVERS	<ul style="list-style-type: none"> • Various forces acting during operation of flights. 	2.1 Forces in Turns 2.2 Forces in Climbs. 2.3 Forces in Descents. 2.4 Stalls
UNIT– III INCOMPRESSIBLE FLOW OVER WING	<ul style="list-style-type: none"> • To study about various airfoils and flow characteristics 	3.1 Airfoil Nomenclature and Characteristics 3.2 Types of Airfoils 3.3 Low speed flow over an Airfoil 3.4 Introduction to Finite Wing & Infinite wing.
UNIT - IV HIGH SPEED FLIGHT	<ul style="list-style-type: none"> • Study various speeds of aircraft, Mach number & flight controls. 	4.1 Introduction 4.2 Supersonic vs. Subsonic Flow 4.3 Speed Ranges 4.4 Mach Number vs. Airspeed 4.5 Boundary Layer 4.6 Shock Waves 4.7 Sweepback

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	AERODYNAMICS OF FLIGHT	10	06	08	06	20
II	AERODYNAMIC FORCES IN FLIGHT MANEUVERS	06	04	02	04	10
III	INCOMPRESSIBLE FLOW OVER WING	10	08	08	04	20
IV	HIGH SPEED FLIGHT	10	06	08	06	20
TOTAL		36	24	26	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	I	Calibration of a subsonic Wind tunnel.	2
2	IV	Pressure distribution over a smooth circular cylinder.	2
3	IV	Pressure distribution over a rough circular cylinder.	2
4	IV	Pressure distribution over a symmetric aerofoil.	2
5	IV	Pressure distribution over a cambered aerofoil.	2
6	IV	Flow visualization using smoke in subsonic flows.	2

7. SUGGESTED LIST OF STUDENT ACTIVITIES.

Following is the list of proposed student activities like:

Sr. No.	Details of activity.
1	Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work
2	Prepare different types model of airfoil, flat plate, cylinder etc...

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

SR. NO.	TITLE OF BOOK	AUTHOR	PUBLICATION
1.	Fundamentals of Aerodynamics	J D Anderson	McGraw Hill, Inc
2.	Aerodynamics	L J Clancy	Sterling Book House
3	Aerodynamics for Engineering Students	E L Houghton and P W Carpenter	Elsevier

B. List of Major Equipment/ Instrument.

- Subsonic Wind tunnel, Scaled model of Airfoils, Flat Plate, and Cylinder is needed to perform aerodynamics analysis.

C. List of Software/Learning Websites

- a. : <http://nptel.iitm.ac.in/courses.php>
- b: <https://www.youtube.com/watch?v=5ltjFEei3AI>
- c: https://www.youtube.com/watch?v=_W9Y44iUA2M
- d: <https://www.youtube.com/watch?v=ooQ1F2jb10A>
- e: <https://www.youtube.com/watch?v=syqSwgyRbHQ>
- f: <http://freevidelectures.com/Course/3264/Introduction-to-Aerodynamics>
- g: <https://www.youtube.com/watch?v=f0tvhjIpjSE>
- h: <https://www.youtube.com/watch?v=E9ZSAX56m0E>
- i: <https://www.youtube.com/watch?v=XAgRNI6tY58>
- j: <https://www.youtube.com/watch?v=Ftj6A2P7lmw>
- k: https://www.youtube.com/watch?v=P_0R0eWOKns
- l: <https://www.youtube.com/watch?v=aGUBswKQUeQ>
- m: <https://www.youtube.com/watch?v=oEHJXTlu6B8>
- n: https://www.youtube.com/watch?v=q_eMQvDoDWk
- o: <https://www.youtube.com/watch?v=XWdNEGr53Gw>

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

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

Faculty Members from Engineering

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

Coordinator and Faculty Members from NITTTR Bhopal