GUJARAT TECHNOLOGICAL UNIVERSITY

AERONAUTICAL ENGINEERING (01)
FLIGHT MECHANICS
SUBJECT CODE: 2150101
B.E. 5th SEMESTER

Type of course: Engineering Science.

Prerequisite: Aircraft Science

Rationale: Flight mechanics signifies the physical phenomena associated with mostly aircraft wings and therefore offers to students the knowledge required to understand the phenomenon of flight.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	1	0	5	70	20	10	30	0	20	150

Content:

Sr. No	Topics	Teaching Hrs.	Module Weightage
1.	Standard Atmosphere: Definition of altitude, The hydrostatic equation, Relation between geopotential and geometric altitudes, Definition of standard atmosphere, Pressure, Density & temperature altitudes.	**04**	**10 %**
2.	Airfoils and Wings: Introduction, Lift, drag and moment coefficients, Attached Flow and Separated Flow, Types of Drag, Infinite and Finite Wings, Pressure Coefficient, Critical mach number and Critical pressure coefficient, Drag Divergence mach number, Wave drag, Swept back wing.	**12**	**25 %**
3	Airplane Performance: Introduction, Equation of motion, Thrust required for level unaccelerated flight, Thrust available and maximum velocity, Power required for level unaccelerated flight, Power available and maximum velocity for jet engine and reciprocating engine-propeller combination, Altitude effect on power required and available, Rate of climb, Gliding flight, Absolute and service ceilings, Time to climb, Range & endurance for propeller driven airplane and jet engine driven airplane, Take off	**12**	**30 %**
4	Principles of Stability and Control: Introduction, Definitions of Stability & Control, Moments on Airplane, Absolute angle of attack, Criteria for longitudinal static stability,Total pitching moment about C.G.,Equation of longitudinal static stability, Neutral point, Static margin, The concept of static longitudinal stability, Calculation of elevator angle to trim, Stick free & Stick fixed static stability, Elevator hinge moment, Stick free longitudinal static stability.	**12**	**25 %**

5	High lift Systems: Increasing area, Increasing lift coefficient, Multi-element airfoil, Leading edge trailing edge devices.	**04**	**10%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40%	**30%**	**20%**	**05%**	**05%**	**-**

Text Books:

1. Introduction to Flight by J D Anderson Jr., McGraw Hill, Inc
2. Aerodynamics for Engineering Students by E L Houghton and P W Carpenter, CBS Publisher and Distributors
3. Fundamentals of Aerodynamics J D Anderson Jr, McGraw Hill, Inc

Course Outcome:

After learning the course the students should be able to

1. Understand basic terms used in Aerodynamics.
2. Understand the effect of the flow on the aircraft.
3. Comprehend the concept of fluid flow.

List of Tutorial:

1. Introduction to ISA.
2. Thrust required for steady level flight
3. Optimum Thrust requires and Power required
4. Climbing flight
5. Gliding flight
6. Determination of Range and Endurance
7. Calculation of takeoff & landing distance
8. Turning Flight
9. Study and survey of reduction of wave drag by suggesting atleast two designs based on modifications required
10. Evaluation of high aspect-ratio wings and comparison of such wings keeping in mind overall drag and lift

Major Equipments:

Supersonic Wind Tunnel

List of Open Source Software/learning website: http://nptel.iitm.ac.in/courses.php

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.