

Course code	Course Name	L-T-P - Credits	Year of Introduction
AO305	FLIGHT MECHANICS	3-0-0-3	2016
<b>Prerequisite: Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To understand the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.</li> </ul>			
<b>Syllabus</b>			
Measurement of speed - Streamlined and bluff bodies- Drag -Straight and level flight-Gliding and Climbing flight- Range and Endurance- Aero foil geometry, characteristics and symbols- Lift, drag and L/D ratio devices- Take off and landing performance, turning performance-V-n diagram-Static and dynamic stability- aerodynamic balancing- Aircraft equations of motion- stability derivatives			
<b>Expected Outcome</b>			
<ul style="list-style-type: none"> <li>The students will be able to analyze the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.</li> </ul>			
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>Houghton, E.L., and Caruthers, N.B., Aerodynamics for engineering students, Edward Arnold Publishers, 1988.</li> <li>Perkins C.D., &amp; Hage, R.E. Airplane performance, stability and control, Wiley Toppan, 1974.</li> </ol>			
<b>References:</b>			
<ol style="list-style-type: none"> <li>Babister, A.W. Aircraft stability and response, Pergamon Press, 1980.</li> <li>Clancey, L.J. Aerodynamics, Pitman, 1986.</li> <li>Kuethe, A.M., and Chow, C.Y., Foundations of Aerodynamics, John Wiley &amp; Sons, 1982.</li> <li>McCormic, B.W., Aerodynamics, Aeronautics &amp; Flight Mechanics John Wiley, 1995.</li> <li>Nelson, R.C. Flight Stability &amp; Automatic Control, McGraw-Hill, 1989.</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	End Sem. Exam Marks
<b>I</b>	Measurement of speed & Mach number	1	15%
	True, Indicated and Equivalent air speed, Streamlined and bluff bodies	2	
	Various Types of drag in airplanes, drag polar curve	3	
	Methods of drag reduction of airplanes.	2	
<b>II</b>	Aero foil characteristics and symbols.	3	15%
	Fundamental equation for lift and drag and L/D ratio	2	
	Shape and dimension of aero foil Aspect ratio of its effects. Mean aerodynamic chord and airflow control devices	3	
<b>FIRST INTERNAL EXAMINATION</b>			
<b>III</b>	Straight and level flight, thrust required and available	1	15%
	Power required and available, Effect of altitude on thrust and power	3	
	Conditions for minimum drag and minimum power required	2	
	Gliding and Climbing flight, Range and Endurance.	4	
<b>IV</b>	Take off and landing performance	2	15%

	Turning performance, horizontal and vertical turn	2	
	Pull up and pull down, maximum turn rate	1	
	V-n diagram	1	
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	Degrees of freedom of a system, static and dynamic stability, static longitudinal stability	2	20%
	Contribution of individual components, neutral point, static margin, Hinge moment, Elevator control effectiveness	3	
	Aircraft equations of motion, stability derivatives, stability quartic, Phugoid motion	2	
<b>VI</b>	Yaw and side slip, Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory	2	20%
	Aileron reversal, weather cock stability, directional control, rudder requirements, dorsal fin	2	
	Dutch roll, spiral and directional divergence, autorotation and spin(descriptive)	2	
<b>END SEMESTER EXAM</b>			

### Question Paper Pattern

Maximum marks: 100

Exam duration: 3 hours

The question paper shall consist of three parts

**Part A**

4 questions uniformly covering modules I and II. Each question carries 10 marks  
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**

4 questions uniformly covering modules III and IV. Each question carries 10 marks  
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**

6 questions uniformly covering modules V and VI. Each question carries 10 marks  
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub questions, if needed.