

| Course code | Course Name | L-T-P - Credits | Year of Introduction |
|---|--|-----------------|----------------------|
| AO305 | FLIGHT MECHANICS | 3-0-0-3 | 2016 |
| Prerequisite: Nil | | | |
| Course Objectives | | | |
| <ul style="list-style-type: none"> To understand the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime. | | | |
| Syllabus | | | |
| 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 | | | |
| Expected Outcome | | | |
| <ul style="list-style-type: none"> The students will be able to analyze the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime. | | | |
| Text Books: | | | |
| <ol style="list-style-type: none"> Houghton, E.L., and Caruthers, N.B., Aerodynamics for engineering students, Edward Arnold Publishers, 1988. Perkins C.D., &Hage, R.E. Airplane performance, stability and control, Wiley Toppan, 1974. | | | |
| References: | | | |
| <ol style="list-style-type: none"> Babister, A.W. Aircraft stability and response, Pergamon Press, 1980. Clancey,L.J. Aerodynamics, Pitman, 1986. Kuethe, A.M., and Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons, 1982. McCormic, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995. Nelson, R.C. Flight Stability & Automatic Control, McGraw-Hill, 1989. | | | |
| Course Plan | | | |
| Module | Contents | Hours | End Sem. Exam Marks |
| I | 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 | |
| II | 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 | |
| FIRST INTERNAL EXAMINATION | | | |
| III | 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 | |
| IV | Take off and landing performance | 2 | 15% |

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|------------------------------------|--|---|-----|
| | Turning performance, horizontal and vertical turn | 2 | |
| | Pull up and pull down, maximum turn rate | 1 | |
| | V-n diagram | 1 | |
| SECOND INTERNAL EXAMINATION | | | |
| V | 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 | |
| VI | 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 | |
| END SEMESTER EXAM | | | |

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.