

Course code	Course Name	L-T-P - Credits	Year of Introduction
AO404	STABILITY AND CONTROL	3-0-0-3	2016
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To introduce the basic concepts of stability and control of aircrafts</li> </ul>			
<b>Syllabus</b>			
Degrees of freedom of a system-Stick fixed-Dihedral effect-Weather cocking effect-Dutch roll- Auto rotation and spin - stability			
<b>Expected outcome</b>			
The students will be able to			
<ol style="list-style-type: none"> <li>analyze the stability of aircraft using dynamical analysis</li> <li>assess the requirement of control force and power plant</li> <li>understand the motion of unstable aircraft and related modes of instability</li> </ol>			
<b>Text Book:</b>			
1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:,Inc, New York, 1988.			
<b>References:</b>			
<ol style="list-style-type: none"> <li>Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.</li> <li>Bandu N. Pamadi., "Performance, Stability, Dynamics, and Control"</li> <li>Clancy, L.J., "Aerodynamics", Pitman, 1986</li> <li>Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.</li> <li>Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.</li> <li>Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	End Sem. Exam Marks
<b>I</b>	Degrees of freedom of a system	1	15%
	Static and dynamic stability	1	
	Need for stability in an airplane, purpose of controls	2	
	Inherently and marginally stable airplanes.	2	
<b>II</b>	Stick fixed: Basic equations of equilibrium, Stability criterion	1	15%
	Wing and tail moments, Effect of fuselage and nacelles, Effect of c.g. location, Power effects, Stabiliser setting and c.g. location, Elevator effects, stick fixed neutral point.	2	
	Stick free: Hinge moment coefficients, Stick free neutral point symmetric maneuvers, stick force gradients and stick force per cg.	2	
	Aerodynamic balancing of control surfaces.	3	
<b>FIRST INTERNAL EXAMINATION</b>			

<b>III</b>	Dihedral effect,	2	15%
	coupling between rolling moment and yawing moment	1	
	Adverse yaw, Aileron power,	3	
	Aileron reversal.	1	
<b>IV</b>	Weather cocking effect, rudder requirements.	2	15%
	One engine inoperative conditions,	2	
	rudder lock	2	
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	Equation of motion, Stability derivatives,	2	20%
	Routh's discriminant, solving the stability quadratic,	2	
	Phugoid motion, factors affecting the period and damping.	2	
<b>VI</b>	Dutch roll	2	20%
	spiral instability	2	
	Auto rotation and spin	1	
	Two control airplane	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.