

Flight dynamics II - Airplane stability and control - Web course

COURSE OUTLINE

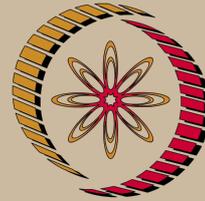
FLIGHT DYNAMICS - II - AIRPLANE STABILITY AND CONTROL

1. Basic concepts of stability and control. Subdivisions of the subject.
2. Static longitudinal stability and control
 - Equations of equilibrium and stability.
 - Contributions of major components.
 - Stick - fixed stability.
 - Control, effectiveness, hinge moments and effect of freeing the stick.
 - Control forces and gradients.
 - Effect of manoeuvres.
 - Critical conditions for longitudinal stability and control.
3. Static directional and lateral stability and control.
 - Contributions of major components to directional stability and its desirable level.
 - Directional control. Critical conditions for rudder design.
 - Dihedral effect and contributions of major components to it. Lateral control..
 - Design of control surfaces and aerodynamic balancing.
4. Dynamic stability.
 - Equations of motion of a disturbed airplane, stability derivatives. Characteristic equation for stick-fixed case.
 - Modes of motion and simplification. Effect of freeing the stick.
 - Characteristic equation for lateral and direction of dynamic stability.
 - Spiral divergence and Dutch roll.
5. Miscellaneous topics. Stability after stall. Response. Automatic control.
6. Drag polar, stability derivatives and characteristic roots of a jet airplane.

COURSE DETAIL

A Web course shall contain 40 or more 1 hour lecture equivalents.

S.No	Topics	No.of Hours
1	Chapter 1 : Introduction.	3
2	Chapter 2 : Longitudinal static stability.	12



NP-TEL

NPTEL

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Aerospace Engineering

Pre-requisites:

1. It is expected that the student has undergone course on Flight mechanics-I-airplane performance.

Additional Reading:

1. Etkin , B. and Reid L.D. "Dynamics of Flight-Stability and Control" 3rd edition, John Wiley (1996).
2. Roskam, J. (a) "Methods for estimating drag polars of subsonic airplanes" and (b) "Methods for Estimating stability and control derivatives of conventional subsonic airplanes" published by author 1973.
3. Stengel, R.F. " Flight dynamics " Princeton University Press, Princeton , N.J., USA, 2004.

Coordinators:

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3	Chapter 3 : Lateral and directional static stability.	8
4	Chapter 4 : Dynamic stability.	12
5	Chapter 5 : Miscellaneous topics.	2
	Drag polar, stability derivatives and characteristic roots of a jet airplane	3

References:

1. Nelson, R.C. "Flight stability and automatic control", McGraw Hill 2nd Edition 1998.
2. Houghton, E.L. & Carruthers, N.B., "Aerodynamics for Engineering students" Arnold 1982.
3. Perkins, C.D. & Hage, R.E., "Aircraft performance, stability and control", John Wiley 1949.
4. McCormick, B.W. "Aerodynamics, aeronautics and flight mechanics", John Wiley 1995.
5. Pamadi, B. "Performance, stability, dynamics and control of airplanes", AIAA 2004.