Aircraft Performance, Stability and control with experiments in Flight - Web course

COURSE OUTLINE

Module Number	Topics	Number of Lectures
1	Introduction to flight dynamics and experiments, Standard Atmosphere, Altitude and Airspeed	3
2	Introduction to Performance of Flight and Experiments, Steady and level flight - Equations of motion, Drag polar and Trust required, Cruise Flight - Power required, Velocity for Minimum Power required, Cruise Flight - Thrust and Power available, Maximum and minimum cruise velocity, Effects of altitude on power , Cruise Flight - Range and Endurance of Propeller Driven Aircraft, Cruise Flight - Range and Endurance of Jet driven Aircraft, Estimation of profile Drag coefficient (C_{D0}) and Oswalds efficiency (e) of an aircraft from experimental data obtained during steady and level flight, Climb Performance - Introduction, Equations of Motion and Flight test for steady climb.	7
3	Stability and Control - Fundamental concepts of stability, Stability and Control - Discussion on Equilibrium, Static and Dynamic Stability, Stability and Control - Discussion on Center of Pressure, Aerodynamic Center and Trim, Static Stability - Wing contribution, Tail contribution and Static Margin, Static Stability and Control - Elevator Control power, Elevator Angle to trim and Flight test to estimate Stick Fixed Neutral Point, Stick Free Stability and Control, Static Free Stability and Control - Stick free Neutral Point, Stick force, Flight test to estimate Stick free neutral Point.	7
4	Maneuvering Flight: Introduction, Steady Coordinated turn, Maneuvering Flight: Steady Pull up, Relationship between stick fixed Neutral and Maneuvering point, Maneuvering Flight: Stick Fixed Maneuvering point and Flight test to estimate stick fixed Maneuvering point, Maneuvering Flight: Stick free maneuvering point, Stick force Gradient and Flight test to estimate Stick free Maneuvering point,	4

NPTEL

http://nptel.ac.in

Aerospace Engineering

Coordinators:

Dr. A.K. Ghosh
Department of Aerospace EngineeringIIT Kanpur

Dr. Deepu Philip
Department of Industrial & Management EngineeringIIT Kanpur

Mr.Yogendra Singh
BrahMos Aerospace Pvt. Ltd

5	Lateral and Directional Aerodynamic Model, Directional Stability and Control, Lateral Stability and Control	3
6	Various Coordinate System, Conservation of Linear Momentum Equation, Conservation of Angular Momentum Equation, Euler Angles, Kinematic Equations, Flight Path Equations, Gravity Equations and Combined 6-DOF model	4
7	Flight Experiment: Instruments used in flight test, Flight Experiment: Cruise and climb performance, Flight Experiment: Flight tests to estimate stick free and fixed, neutral and maneuvering points, Static Lateral and Directional Stability: Flight Test to estimate Side-Slip Coefficient (C_{y_β}), Flight Test to estimate yawing Moment Coefficient (C_{n_β}), Flight Test to estimate Roll Derivative (C_{l_β}), Static Lateral and Directional Stability: Steady Coordinated turn, Flight Test to estimate Roll Derivative (C_{lr}), Flight Test to estimate Yawing Moment Coefficient (C_{nr}), Phugoid Effect and Dutch Roll Motion	6

References:

1. Anderson, John D. "Introduction To Flight.", McGraw-Hill, 1978.
2. Phillips, Warren F. "Mechanics Of Flight.", J. Wiley, 2004.
3. Nelson, Robert C. "Flight Stability And Automatic Control.", McGraw-Hill, 1989.
4. Napolitano, Marcello R. "Aircraft Dynamics.", J. Wiley, 2012.
5. Perkins, C.D. & Hage, R.E., "Aircraft performance, stability and control.", J. Wiley, 1949.