


INTRODUCTION TO AIRPLANE PERFORMANCE

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INTENDED AUDIENCE : UG/PG of B.Tech/BE in any discipline of engineering

INDUSTRIES APPLICABLE TO : DRDO, HAL, Boeing, Airbus, Bell, McDonnell Douglas, UAV Factory, Lockheed Martin

COURSE OUTLINE :
This course is designed to provide an integrated introductory treatment of airplane performance with flavor of aircraft design and flight testing.

ABOUT INSTRUCTOR :
Prof. A.K. Ghosh is a faculty of Aerospace Engg. Department of IIT Kanpur. He is also the in-charge of the flight laboratory and unmanned aerial vehicle of IIT Kanpur. His research areas include system identification through flight tests using conventional and neural network based methods, design of aircrafts and airborne projectiles, supercavitation, unmanned aerial systems. Before joining IIT Kanpur, he worked as a scientist with Defense Research Development Organization (DRDO). He has published many peer reviewed journal papers and conference papers, guided 13 doctoral students, and 38 masters students. He is also a mentor of multiple aerospace start-up companies, and also been associated with major industry contributions of high speed low drag aircraft bomb, Pinaka Mk-I, 105mm sabot round for tracked vehicles, etc.

Prof. Deepu Philip is a faculty of Industrial & Management Engg. Department and Design Programme of IIT Kanpur. He works in the area of Production and Operations, Systems Simulation, Product Life Cycle Management, Unmanned Aerial Systems, and Systems Engineering. He holds bachelor degree in Industrial Engineering with his doctorate in Industrial & Management Engineering from MSU Bozeman. He has both academic and industrial experience with leading organizations of the world. He has experience in designing and implementing complex system of systems in different fields including defense, aviation, fertilizer, strategic chemical plants, transportation, banking, automation, health care, energy, and communication.

COURSE PLAN :

Week 1: General Introduction: Airplane Performance Characteristics, George Cayley: Concept of Lift and Drag, Introduction to airplane and its components, Hansa 3 Aircraft and its Primary Systems, Concept of Lift: Aerofoil, Wing, and Complete Aircraft, Drag Polar

Week 2: Revision, Standard Atmosphere: Description and Modelling, Measuring Instruments: Altimeter, Airspeed Indicator, Equations of Motion: Static Performance, Thrust Required, Power Required: Cruise, Excess Thrust and Power: Climb Angle and Rate of Climb

Week 3: Review, Thrust Required: A Closer Look, Modelling of CL: Dimensional Analysis, A Closer Look: Point Mass Model, Dimensional Analysis, Estimation of Drag Polar Through Flight Test, Estimation of Rate of Climb

Week 4: Revision, Range and Endurance, Range and Endurance(Continued), Gliding Flight, Accelerated Flight, V-n Diagram

Week 5: Revision, V stall: Cruise and Manoeuvre, Flaps: High Lift Devices to Reduce Take off / Landing Distance, Take off: Warm-up Lecture, Take off Performance, Take off Performance (Continued)

Week 6**:** Revision, Landing Performance, Landing Performance (Continued), Challenges in Take-off and Landing: Single and Twin Engines, Introduction to Static Stability, Positioning of Centre of Pressure for Static Stability

Week 7: Revision, Stability and Control: Designer's Perspective, Stability and Control: Designer's Perspective (Continued), Longitudinal Control: Elevator, Stability: Wing and Tail Contribution, Stability: Wing and Tail Contribution (Continued)

Week 8**:** Control: Elevator, Control: del_E Required, Control: del_E Required (continued), Design Basics: Wing Loading & Thrust Loading, Design Basics: Sweep & Dihedral, Revision