AIRCRAFT STABILITY AND CONTROL

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IIT Kanpur

INTENDED AUDIENCE : Core course for UG students

INDUSTRIES APPLICABLE TO : NAL Bangalore, ARDE Pune, ADE Bangalore, ADA Bangalore

COURSE OUTLINE :

This course is designed to understand stability and control aspects of an airplane. This course will also help in creating a background to design an airplane from stability and control aspects

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.

COURSE PLAN :

Week 1: Overview of aerodynamics and atmosphere, Wing stall and maximum lift coefficient,Wing aerodynamic center & pitching moment, Introduction to static and dynamic stability.
Week 2: Introduction to static and dynamic stability, Wing contribution, Tail contribution, Canard and fuselage contribution.
Week 3: Power plant contribution & its effect on NP, Stick fixed neutral point, Static margin, Stick fixed : maneuvering point.
Week 4: Elevator effectiveness, Elevator angle of trim, Flight measurement of Xnp, Elevator hinge moment, Stick forces (trim tab & stick force gradient),
Week 5: Stick free neutral point, Stick free : maneuvering point, Roll stability and roll control, Yaw stability and yaw control.
Week 6: Newton's second law of rigid dynamics, Axes system and relevant transforms, Angular motion equations.
Week 7: Aerodynamic forces, Gravitational and thrust forces, Linearized equations of motion,
Week 8: Force and moment derivatives, Force and moment derivatives, Contribution of aircraft components to aerodynamic derivatives, Linear model.
Week 9: Short period approximation,Long period approximation, Pure pitching motion, Flying and handling qualities.
Week 10: Linearized lateral dynamics.Lateral motion :Linearized coupled motion, Roll approximation, Spiral approximation.
Week 11: Dutch roll approximation. Pure rolling. Pure yawing, Inertia coupling.
Week 12: Stability augmentation system: Longitudinal, Stability augmentation system: Lateral.