AIRCRAFT DESIGN

**Prof. A.K. Ghosh**  
Department of Aerospace Engineering  
IIT Kanpur

**TYPE OF COURSE**: Rerun | Core | UG/PG  
**COURSE DURATION**: 12 Weeks (18 Jan’ 21 - 09 Apr’ 21)  
**EXAM DATE**: 24 Apr 2021

**PRE-REQUISITES**: Introduction to Airplane Performance

**INTENDED AUDIENCE**: Btech, Mtech, PhD

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

**COURSE OUTLINE**:  
This course will present the entire process of aircraft conceptual design- from requirements definition to initial sizing, configuration layout, analysis, sizing, optimization, and trade studies.

**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 the Design Process, Airfoil and Geometry Selection, Thrust-to-Weight Ratio and Wing Loading  
**Week 2**: Initial Sizing, Control-Surface Sizing, Configuration Layout  
**Week 3**: Aerodynamic Considerations, Structural Considerations, Vulnerability Considerations  
**Week 4**: Crew Station, Passengers, and Payload  
**Week 5**: Propulsion and Fuel System Integration, Fuel System, Landing Gear Arrangements  
**Week 6**: Step-by-Step Development of a New Design, Aerodynamics, Propulsion  
**Week 7**: Structures and Loads, Weights, Group Weights Method  
**Week 8**: Stability, Control, and Handling Qualities, Longitudinal Static Stability and Control, Lateral-Directional Static Stability and Control  
**Week 9**: Performance and Flight Mechanics, Equations of Motion, Operating Envelope  
**Week 10**: Cost Analysis, Operations and Maintenance Costs, Aircraft and Airline Economics  
**Week 11**: Sizing and Trade Studies, Vertical Flight--Jet and Prop, Extremes of Flight  
**Week 12**: Design of Unique Aircraft Concepts, Flying Wing, Tailless, Lifting Fuselage, and Blended Wing-Body, Conceptual Design Examples