### Proposed Syllabus and and Mode of Delivery of Department Introductory Course

**Department Introductory Course** 

## Requirements & Concerns

#### Requirements

- Current course aerodynamics intensive
- "Catch-em-young"
  - Generate student interest in Aero
  - Satisfy general queries
- Should have lots of "hands-on" content
- Concerns
  - Should not be <u>only</u> descriptive

But can have some descriptive elements
Many of us should be able to run it

## **Proposed Course Outline**

Structure LTPC

3028

- Weekly Schedule
  - Teaching
    - ► 3 contact hours
  - One "Hands-On" sessions
    - 2 contact hours
- Total Contact hours = 35 + 24
  - Assuming 12 weeks per semester
- Evaluation Scheme & Weightage
  - Quiz-1 + MidSem + Quiz-2 + EndSem
  - 15% + 35% + 15% + 35%

#### Topics to be covered (35) Figures in brackets = no. of weekly contact hours

- Historical Developments in Aviation
- Types and components of aircraft
- Fluid Mechanics & Aerodynamics
- Intro. to Aerospace Propulsion
- Intro. to Aircraft Structures
- Aircraft Performance
- Aircraft Operations
- Introduction to Space flight

(2)(2)(7)(4)(4)(11)(3)(2)

# Historical Developments (3)

- Aviation milestones
  - Balloon flight, Imitating Birds, Gliders
  - De-linking of lift and thrust producing units
  - Powered Flight, Higher Speeds, Sonic Barrier
  - Super and -hypersonic flight
  - Effect of Fuel crisis

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Components of an aircraft
Types of aerial vehicles

## Fluid Mechanics & Aerodynamics (7)

- Basic Fluid dynamic equations & their basis
   Ideal fluid, viscous flows
- Flow past a body, Flow Separation
- Generation of Lift, Drag & Moment
- Non-dimensional coefficients
- Airfoils & Wings, Aerofoil families
  - Case Study of an aerofoil & wing
- Supersonic flight, Wave Drag
- Aircraft Drag Polar
- Properties of atmosphere
  - ISA, IRA
  - Variation with atmosphere (upto 100 km)
- Aircraft Speeds
   IAS, TAS, CAS, EAS

**Department Introductory Course** 

# Propulsion (4)

Types of Powerplant Air-breathing Turboprop - Pistonprop ▶Turbojet-Turbofan Ramjet - Pulsejet Thrust (Power) and fuel flow variation with H & V Non-air breathing Rockets Principles Solid, Liquid, Hybrid

# Aircraft Structures (4)

#### Role & Layout of structural members

# Lifting surfaces - wings & stabilizers

- Spanwise beam concepts
- Wing Fuel Tanks
- Chordwise location of spars
- Rib location & direction
- Fixed secondary structure
- ► H & VT
- Auxiliary surfaces
  - Hinged Control surfaces
  - Pivoted control surfaces
  - High Lift systems

- Fuselage
  - Cross-section shape
  - Basic Layout- Outer shell
  - Frames
  - Doors windows, windscreen, canopies
  - ► Floors
- Attachment of lifting surfaces
  - Continuous carry-through structure
  - Wing lods passed around fuselage
- Buried powerplants in combat a/c
  - Wing location
  - Engine removal
- Landing Gear
  - Mechanical layout
  - Retraction

#### **Department Introductory Course**

# Aircraft Operations (3)

#### Airports

- Airside and Landside areas
- Runway, Taxiway, Apron, Stopway, Clearway
- Airport environs
- Avionics Equipment
  - Cockpit, Ground
  - Precision aids (e.g., ILS system)
- Air Traffic Management
  - Separation minima, Air Route structure
- Navigation and Guidance

# Aerospace Component (2)

- Types of trajectories
- Types of missiles
- Launch vehicles
- Satellites

## The 12 "Hand-On" Sessions

#### Pre-Midsem

- 1. Aerospace Movie Show
- 2. Activity on Aviation History
- 3. Paper Aircraft Flying
- 4. Quiz- (History + Aerody.)
- 5. Movies on Fluid Mechanics
- 6. Tutorial on Prop./Structures

#### Pre-Midsem

- 1. Balsa a/c expt.
- 2. Tutorial-Perf.
- 3. Tutorial Perf.
- 4. Quiz-Performance
- 5. Balsa a/c re-visit
- 6. Tutorial- Operations

Note: Some tutorials could also be conducted during lecture hours, if we assume 14 weeks available per semester

# Recommended Books

- Anderson, J. D., The Aeroplane, a History of its Technology, AIAA Education Series, 2002
- Anderson, J. D., Introduction to Flight, McGraw-Hill Professional, 2005
- Howe, D., Aircraft Loading and Structural Layout, AIAA Education Series, 2004
- Ojha, S.K., Flight Performance of Aircraft, AIAA Education Series, 1995
- Horonjeff, R and McKelvey, F., Planning and Design of Airports, McGraw-Hill Professional, 1994