

Course Layout

Introduction to Aircraft Design

AE-332 Minor / AE-714

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Background

- ❑ New Course, First Delivery in 2013 !
 - Instructor has > 2½ decades of teaching experience
- ❑ Key Features
 - Tailor made for non-Aero background Students
 - Coupling of UG Minor and PG Elective students
 - Mostly Descriptive
 - Very little Maths, simple equations !
 - Many Videos and Pictures
 - Smaller Class size
 - Better interaction (Classroom + Moodle)
 - Case Studies
 - Lots of discussions

Who am I ??

MY BACKGROUND

Academic

□ Three degrees in Aeronautical Engineering

- Bachelors'

- Punjab Engineering College Chandigarh, 1979-83

- Masters'

- IIT Madras (sponsored by HAL), 1984-86

- Doctoral

- College of Aeronautics, Cranfield University, UK, 1993-97

- Commonwealth Scholarship Commission in UK

Work Experience

□ Five years' industrial experience

- HAL Kanpur (1984-88)
 - Do-228 and HS-748 structural modifications
- HAL Nashik (1988-89)
 - MiG 27-M and -21 Aerodynamics & Flight Testing

□ ~25 years' teaching & research @ IIT Bombay

- Lecturer (1989-90)
- Asst. Prof. (1990-01)
- Associate Prof. (2001-12)
- Prof. (2012→ ?)

Aircraft I have mainly worked on



AE-332M / 714 Aircraft Design



Other aircraft I worked on



Aircraft I have flown (in the cockpit !)



Basic aerospace engineering concepts focusing on aircraft design

COURSE DESCRIPTION

Six Capsules

1. Introduction to Engineering Design
2. Introduction to Aircraft Design
3. Configuration & Layout & Initial Sizing

MID SEMESTER EXAMINATION

1. Estimation Methodologies
2. Constraint Analysis
3. Operational & Environmental Issues

1: Introduction to Engg. Design

- ❑ What is Engineering Design?
- ❑ Requirements Capture & QFD

2: Introduction to A/C Design

- ❑ What is Aircraft Design?
- ❑ Design Considerations in Civil Aircraft
- ❑ Design Considerations in Military aircraft

3: Configuration & Layout

- ❑ Wing & Powerplant
- ❑ Tailplane
- ❑ LG Layout & Sizing

4: Initial Sizing & Constraint Analysis

- ❑ Estimation of Design Gross Weight
- ❑ Empty Weight Fraction, Fuel Fraction & L/D
- ❑ Constraint Analysis

5: Refined Sizing & Lift + Drag Estimation

- ❑ Refined Sizing
- ❑ Estimation of Drag Coefficient
- ❑ Estimation of Lift Coefficient
- ❑ Aircraft Weight Breakdown

6: Operational & Environmental Issues

- ❑ Range-Payload Diagram
- ❑ V-n Diagram
- ❑ Aviation Noise
- ❑ Cost Estimation

Anticipated Outcomes

- ❑ At the end of the course, you should be able to
 - Define, discuss, and apply the concepts of Aircraft Design
 - Express all design parameters in their appropriate dimensions
 - Calculate lift and drag using standard approaches
 - Estimate performance requirements and specifications
 - Solve a specific aerospace design problem with defined specifications
 - Communicate key aspects of your design, including the role of trade-offs and external concerns such as cost, noise, emissions, and fuel use

Evaluation Scheme

❑ In-Semester: 60%

- Attendance 10%
- Class Participation: 10%
- Quizzes: 20%
- Assignments: 20%

❑ Examinations: 40%

- Mid-Sem examination: 20%
- End-Sem examination: 20%

Course Policies

- ❑ Course Material on Moodle after class
 - Most communication by e-mail from Moodle
- ❑ No attendance to Latecomers beyond 17:10
 - Unless they have a genuine reason !
- ❑ Mobile Phones to be switched off (not mute)
 - Or else I get to answer !
- ❑ Audit requirements
 - $\geq 80\%$ attendance
 - Submission of all Assignments
- ❑ Questions and Interruptions Welcome !

My Contact Details

- ❑ *rkpant@aero.iitb.ac.in*
- ❑ Extn: 7127
- ❑ Room No 208F
- ❑ Last Room near CASDE backdoor
- ❑ LTA Systems Laboratory
- ❑ Meetings by prior appointments
 - Open Door policy for quick doubts

Teaching Assistants

□ Jay Prakash

- jayjaiswal1991@gmail.com
- Extn: 4141, Mobile: [9167798467](tel:9167798467)
- Aircraft Design & Computing Lab (ADCL)
- Ground Floor, Aerospace Engg. Deptt.
- # 59, H2



□ Mohd. Irfan Alam

- irfannoble@gmail.com
- Extn: 4131, Mobile:
- Ph.D. Scholar's Room, Ground Floor,
Aero Annex Building



Recommended Books

- ❑ **Brandt, S. A., Stiles, R. J., Bertin, J. J., Whitford, R.,** Introduction to Aeronautics: A Design Perspective, AIAA Education Series, 3rd Ed., 2015, ISBN: 978-1-62410-327-8, DOI: 10.2514/4.103278
- ❑ **Raymer, D. P.,** Aircraft Design - A Conceptual Approach, AIAA Education Series, 5th Ed., 2012, ISBN: 978-1-60086-921-1, DOI: 10.2514/4.869211
- ❑ **Nicolai, L. M., Carichner, G. E.,** Fundamentals of Aircraft and Airship Design, Volume 1 – Aircraft Design, 2010, ISBN: 978-1-60086-751-4, DOI: 10.2514/4.867538
- ❑ **Kundu, A. K.,** Aircraft Design, Cambridge Aerospace Series, Cambridge University Press, 2010, ISBN 978-0-521-88516-4.
- ❑ **Fielding, J.,** Introduction to Aircraft Design, Cambridge Aerospace Series, Cambridge University Press, 1999, ISBN 978-0-521-65722-8

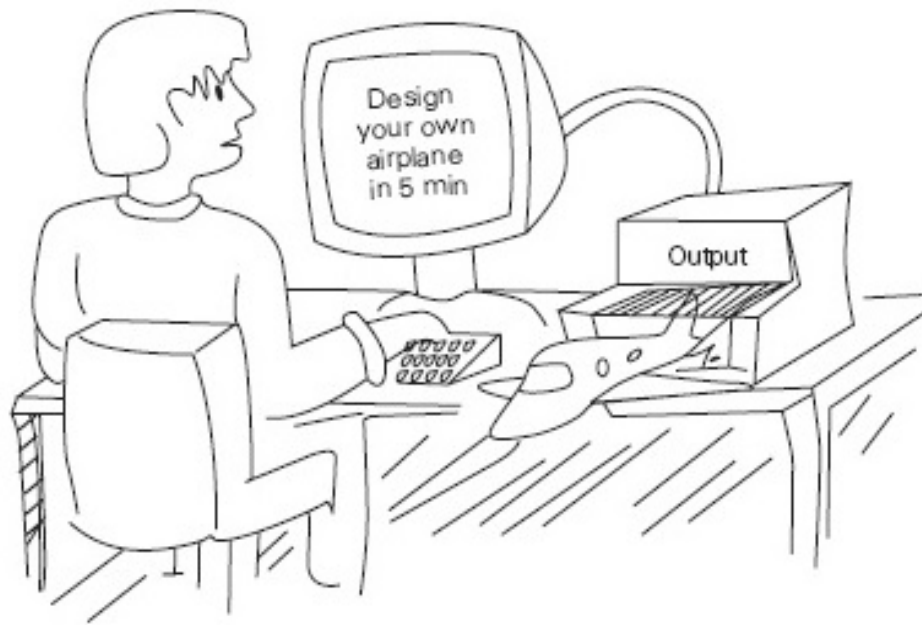
Recommended Books—Contd.

- ❑ **Howe, D.,** Aircraft Conceptual Design Synthesis, Professional Engineering Publishing, Suffolk, UK, 2000, ISBN 1-86058-301-6
- ❑ **Jenkinson, L. R., Simpkin, P. and Rhodes, D.,** Civil Jet Aircraft Design, Arnold Publishers, London, 1999, ISBN: 978-1-56347-350-0, DOI: 10.2514/4.473500
- ❑ **Küchemann, D.,** The Aerodynamic Design of Aircraft, 2012, ISBN: 978-1-60086-922-8, DOI: 10.2514/4.869228
- ❑ **Torenbeek, E.,**
 - Synthesis of Subsonic Airplane Design, Delft University Press, 1977

Free Online E-Books

- ❑ <http://www.freeengineeringbooks.com/AeroSpace/Aircraft-Design-Books.php>
- ❑ Komerath, N. M., Design Centered Introduction To Aerospace Engineering

What is Aircraft Design?....



Student view of design



The 'real' design process

Source: Slides of AE 403- Aircraft Design by T. Rajesh Senthil Kumar, AVV, Ettimadai, Coimbatore, 2012.

Engineering Design: An Overview