

ME408 – Aircraft Performance and Design

Fall 2016 Course Outline

1) Instructor Information

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2) Course Objectives

- a) Expose students to the **key elements** of conceptual, fixed-wing aircraft design: Requirements, Sizing, Performance, Wing-Fuselage-Empennage Design, Enhanced Lift, Structural Design, Stability & Control and Cost Estimation.
- b) Demonstrate the fundamental, **iterative nature** of design through complete aircraft design projects that run parallel to the course material.
- c) Students learn to design **multiple types** of fixed wing aircraft and gain appreciation for what drives the three basic types: Commercial Transport, General Aviation and Military.
- d) Establish a foundation for the **fundamental principles** of aircraft design, especially for Aero-Concentrators who, on successful completion of ME408, may select an aircraft design related project for ME461 (Spring 2016).

3) References

a) Required Texts:

Primary Text Book: "Design of Aircraft", Corke, Thomas C., Prentice Hall, 2003

Reference: "Theory of Wing Sections", Abbott, Ira Herbert and von Doenhoff, Albert Edward, Dover Publications, 1949

Reference: Jane's All the Worlds Aircraft in four (4) separate volumes published yearly. Note: The BU Library has begun to purchase new volumes. Here is the latest

Jane's All the Worlds Aircraft-Dev & Prod	2013/2014
Jane's All the Worlds Aircraft-In Service	2014/2015 (On Order)
Jane's All the Worlds Aircraft-Unmanned	2014/2015
Jane's All the Worlds Aircraft -Aero Engines	NONE

Also, the MIT Library has a good selection of volumes.

b) Other Texts

“Aircraft Design”, Sadraey, Mohammad H., Wiley, 2013

4) Class Attendance

Class attendance is highly encouraged, but will not be tracked so technically it is optional. Often time's students will be asked to bring their laptops to class for hands-on exercises. Students are also encouraged to bring their texts to class.

5) Grades

The individual course grades for this course will be based on the BU point system.

<u>Points</u>	<u>Letter Grade</u>	<u>Honor Points</u>
95+	A	4.0
90-94	A-	3.7
85-89	B+	3.3
80-84	B	3.0
75-79	B-	2.7
70-74	C+	2.3
65-69	C	2.0
60-64	C-	1.7
55-59	D	1.0
<55	F	0.0

Points will be awarded on the following basis:

<u>Course Item</u>	<u>Content</u>	<u>Max Possible Points</u>	<u>Due</u>
Presentation 1	Chapters 1-3	20	9/22/16, 6PM
Presentation 2	Chapters 1-6	20	10/13/16, 6PM
Presentation 3	Chapters 1-9	20	11/8/16, 6PM
Presentation 4	Chapters 1-13	20	12/8/16, 6PM
Jane's Style Report	Final Design	20	12/8/16, 6PM
BONUS	Best Design In Class	<u>5</u>	n/a
Total		105	

6) Team Projects (80% of Grade)

a) Projects.

There are ten (12) projects to choose from, details of which will be defined in a separate document.

<u>Description</u>	<u>Regulatory Certification</u>
1) Single Seat Ultralight	General Aviation FAR Part 103
2) US Light Sport Aircraft (LSA)	Special Light Sport (S-LSA)
3) Single Seat, Kit-Built Sport Plane	Multiple Cert: Military + FAR Part 23? + S-LSA?
4) Four Seat Light Plane	General Aviation FAR Part 23
5) Agricultural Sprayer / Aerial Firefighter	General Aviation FAR Part 23
6) Maritime Surveillance Aircraft (MSA)	Military
7) Business Jet	General Aviation FAR Part 23
8) NASA High Altitude Long Endurance (HALE) UAV	General Aviation FAR Part 23
9) Narrow-Body Airliner	Commercial FAR Part 25
10) Air Superiority Fighter	Military
11) MOM Airliner	Commercial FAR Part 25
12) Long Range Strike Bomber	Military

Each team will be expected to work the entire design project throughout the Semester.

b) Teams

Members

Each student will be placed on a team of approximately 4 students. The first assignment is to review the design projects and submit to the Instructor (jgeiger@bu.edu) your top three or four choices. All efforts will be made to form teams with each student's top choices.

Trades

Each team will have the option of one (1) "trade" during the semester. The trade option is voluntary, not required and intended to give teams the option of improving upon team chemistry, in the event that personalities are getting in the way of team progress and morale. The trade must be one-for-one and both teams involved in the trade must be in full concurrence that the trade is approved. If a trade cannot be worked out to the satisfaction of all concerned, then the team seeking a trade must find a way to "soldier on". Once the details of the trade have been determined, all parties should consult with the Instructor to finalize the trade.

c) Team Presentations

Each Team will present the status of their designs to the class on four (4) occasions during the semester, tentatively on the following dates;

Thursday, 9/22/16	Chapters 1-3
Thursday, 10/13/16	Chapters 1-6
Tuesday, 11/8/16	Chapters 1-9
Thursday, 12/8/16	Final Project Presentation, Chapters 1-13

Each presentation will be graded. Each member of the team will receive the same grade for a given presentation.

d) Mid-Term Peer Evaluations

Each team member will have a chance to anonymously rate his or her team mates on overall contribution to the team. If the evaluations show clear evidence that a team member is not contributing to the team in a fair and equitable way, based on the other team members input, then a meeting with the Instructor will be arranged and a plan outlined to improve performance. If the behavior persists throughout the semester, then the final grade of the underperforming student(s) will be adjusted.

e) Presentation Content

Details of the expected content for each presentation will be given during the semester prior to each presentation. Templates to use for the presentations will be supplied.

7) Jane's Style Report (20% of Grade)

Jane's is a yearly publication widely used by the aerospace industry for reference. The BU Library should have recent versions that can be used. Also the MIT Library has been used regularly for Jane's resources. Jane's style technical reports must be obtained and studied for competitor aircraft. From these reports comes invaluable information on the design of current aircraft.

Each team will be expected to deliver a final report on their aircraft design in the style of a Jane's technical report. Teams are expected to study Jane's technical reports of their competitors and create a similar style report that documents their final design.

8) ME408 Class Calendar and Homework, Fall 2015

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ME408 - Aircraft Performance and Design				
Fall 2016 Class Schedule				
<u>Week</u>	<u>Class</u>	<u>Date</u>	<u>Day</u>	<u>Lecture Topic</u>
1	1	9/6/2016	Tu	Intro, Syllabus, Class Projects, Chapter 1 - Introduction
1	2	9/8/2016	Thu	Chapter 2 - Preliminary Estimate of Takeoff Weight
2	3	9/13/2016	Tu	Chapter 2 - Preliminary Estimate of Takeoff Weight
2	4	9/15/2016	Thu	Chapter 3 - Wing Loading Selection
3	5	9/20/2016	Tu	Chapter 3 - Wing Loading Selection
3	6	9/22/2016	Thu	Team Presentations - Chapters 1-3
4	7	9/27/2016	Tu	Chapter 4 - Main Wing Design
4	8	9/29/2016	Thu	Chapter 5 - Fuselage Design
5	9	10/4/2016	Tu	Chapter 6 - Horizontal and Vertical Tail Design
5	10	10/6/2016	Thu	Chapter 4-6 Review
6		10/11/2016	Tu	NO CLASS (Holiday, Substitute Monday Schedule)
6	11	10/13/2016	Thu	Team Presentations - Chapters 1-6
7	12	10/18/2016	Tu	Chapter 7 - Engine Selection
7	13	10/20/2016	Thu	Chapter 7 - Engine Selection
8	14	10/25/2016	Tu	Chapter 8 - Take-Off and Landing
8	15	10/27/2016	Thu	Chapter 8 - Take-Off and Landing
9	16	11/1/2016	Tu	Chapter 9 - Enhanced Lift Design
9	17	11/3/2016	Thu	Chapter 9 - Enhanced Lift Design
10	18	11/8/2016	Tu	Team Presentations - Chapters 1-9
10	19	11/10/2016	Thu	Chapter 10 - Structural Design and Material Selection
11	20	11/15/2016	Tu	Chapter 10 - Structural Design and Material Selection
11	21	11/17/2016	Thu	Chapter 11 - Static Stability and Control
12	22	11/22/2016	Tu	Chapter 11 - Static Stability and Control
12		11/24/2016	Thu	NO CLASS (Holiday)
13	23	11/29/2016	Tu	Chapter 12 - Cost Estimate
13	24	12/1/2016	Thu	Chapter 13 - Design Summary and Trade Study
14	25	12/6/2016	Tu	Prep for Final Project Presentations
14	26	12/8/2016	Thu	Team Presentations - FINAL
15		12/13/2016	Tu	NO CLASS (No Final Exam)
15		12/15/2016	Thu	NO CLASS (No Final Exam)