DEPARTMENT OF AERONAUTICAL ENGINEERING
COURSE SYLLABUS

AE 436: Aircraft Structural Design

COURSE TITLE	ENGLISH CODE/NO	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	Total
Aircraft Structural Design	AE 436	436 هط	3		3	6
Pre-requisites:	AE 432					
Course Role in Curriculum *(Required/Elective):*	Required Course					
Catalogue Description: Structural design of wing, fuselage, tail-plane, fin, and landing gear. Design of ribs, frames, stiffeners, webs, and skins. Spar design. Diagonal semi tension field beams. Optimum design. Computer applications.						

***Textbooks*:**
(Author, Title, Pub., year)

1. Michael Chun-Yung Niu., Airframe Stress Analysis and Sizing, 4th edition,. Adaso/Adastra Engineering Center, 2011
2. Moaveni S., Finite Element Analysis, Theory and Application with ANSYS, 2nd Edition, Pearson Education, Inc., 2003
3. Bruhn, Analysis and Design of Flight Vehicle Structures, © Copyright 1974

Supplemental Materials:

Course Learning Outcomes:

By the completion of the course the students should be able to:

1. Describe aircraft structural design process, design criteria, and sizing approaches.
2. Identify, collect, and analyze aircraft operational parameters, including load paths (flight loads, ground loads, local and internal loads, dynamic loads, and miscellaneous loads) and flight envelopes (V-N diagram and altitude-Mach number envelopes), for preliminary design with specified purpose of conventional airplanes.
3. Practice computer analysis and work out Finite Element Modeling (FEM) of aircraft structural problems.
4. Develop and implement solutions to aircraft structural problems using engineering structures such as trusses, beams, frames, membranes, plates, and shells (use FEM for numerical analysis).
6. Recognize structural functions and configurations of aircraft components and assess structural integrity of these components using practical engineering methods and techniques (i.e. shock energy concept, beam-box method, and diagonal-web technique).
7. Apply parametric design and optimization concepts to suggest good initial designs of aircraft components and subsystems.
8. Perform detailed stress analysis of the main aircraft components via more computer work and using different software engineering tools.
9. Investigate special structural design considerations such as cutout, damage tolerance, and

fail-safe design.

10. Develop a multi-model analysis using knowledge-based engineering to support aircraft multidisciplinary design.
11. Address issues of relevance to the realities of aviation such as technology applications, safety, and environment.
12. Undertake, within a team, a successful aircraft structural design project and write a concise design report that addresses all assigned aspects of the design project.

Topics to be Covered:		***Duration in Weeks***
1.	Aircraft Sizing and Stress Analysis Process	1.5
2.	Computer-aided Aircraft Analysis and software packages	1.5
3.	Engineering Structures Models for Aircraft Stress Analysis (Trusses, Beams and Frames)	2
4.	Engineering Structures Models for Aircraft Stress Analysis (Membranes, Plates and Shells)	2
5.	Aircraft Components Design and Structural Analysis: Landing Gear	1.5
6.	Aircraft Components Design and Structural Analysis: Wing	1.5
7.	Aircraft Components Design and Structural Analysis: Fuselage, Empennage, and cockpit	2
8.	Aircraft Structural Design Considerations and Aviation Contemporary Issues	1
9.	Knowledge-based Engineering and Multidisciplinary Aircraft Design	1

Key Student Outcomes addressed by the course: (Put a ✓ sign)

(a)	an ability to apply knowledge of mathematics, science, and engineering	✓
(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	
(c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	✓
(d)	an ability to function on multidisciplinary teams	✓
(e)	an ability to identify, formulate, and solve engineering problems	✓
(f)	an understanding of professional and ethical responsibility	
(g)	an ability to communicate effectively	
(h)	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i)	a recognition of the need for, and an ability to engage in life-long learning	
(j)	a knowledge of contemporary issues	✓
(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	✓

Key Student Outcomes assessed in the course: (c), (d) and (j)

Instructor or course coordinator: Dr. Belkacem Kada
Last updated: May 2015