DEPARTMENT OF AERONAUTICAL ENGINEERING
COURSE SYLLABUS

AE 432: Aerospace Structures II

COURSE TITLE	ENGLISH CODE/NO	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	Total
Aerospace Structures II	AE 432	432 هـ ط	٣	١		٣
Pre-requisites:	AE 331, AE 333					
Course Role in Curriculum	Required Course					

Catalogue Description:
Introduction to the Theory of Elasticity. Structural instability of columns and thin plates. Analysis methods (Virtual work and energy and matrix methods including FEM) for stress and deflection calculations in determinant and indeterminate structures. Thin plate theory. Composite materials analysis and design. FEA using ABAQUS. Lab experiments. Light aircraft design and build project.

***Textbooks*:** Megson, T.H.G, Aircraft Structures for Engineering Students, Fifth Edition, Butterworth-Heinemann, 2012.
(Author, Title, Pub., year)
***Supplemental Materials*:** Course Notes: Composite materials design professors' notes

***Course Learning Outcomes*:**

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

1. Determine the components of the stress and strain tensors for plane stress or plane strain scenarios
2. Determine the effect of a variety of loading and support conditions on the small deflection of columns and rectangular plates
3. Calculate the buckling and crippling strength of thin-walled columns
4. Calculate deflections and stresses in statically determinate or indeterminate beam, truss and frame structures using unit load method
5. Perform basic finite element idealization of structures
6. Carry out finite element matrix analysis for simple bar and beam structures by hand
7. Describe fiber reinforced plastics composite constituents and composite manufacturing methods
8. Determine composite laminates strength and estimate composite sections properties
9. Use either Solidworks or abaqus or Catia or Nastran/Patran or ANSYS FEA packages to redesign a metal aircraft component to a composite one
10. Experimentally determine buckling strength of struts and deflection of beam, truss and frame structures

***Topics to be Covered*:**	***Duration in Weeks***
1. Theory of elasticity and plasticity	1
2. Structural instability of columns and thin plates	1.5
3. Virtual work and energy methods of structural analysis in beams, frames and trusses	1

4.	Matrix and finite element methods for structural analysis in beams, frames and trusses	1.5
5.	Introduction to composite materials	1
6.	Composite laminates analysis using 10% rule, netting analysis and carpets plots	1.5
7.	Composite sections analysis	1.5
8.	Composite manufacturing using vacuum bagging method	1.5
9.	Laboratory experiments	1.5
10.	Metal and composite aircraft components analysis group project using one of the available FEA software packages	2

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: (a) and (k)

Instructor or course coordinator: Dr. Mostefa Bourchak
Last updated: May 2015