University of Baghdad – College of Engineering
Aeronautical Engineering Department
Scientific Committee

Course Folio

Module Title:	Aircraft Structures / II
Code Number:	AE406
Credit Hours:	2 Hours
Contact Hours:	2Hours (1 hr. Theoretical and 1 hr. Tutorial)
Pre-requisite(s):	Aircraft Structures / I, Mechanics of Machines and Vibrations
Co-requisite(s):	Aerodynamics, Jet Propulsion Engines and Design of Machines
Module Instructor:	Assist. Prof. Dr.Ahmed Hameed Kaleel Lecturer of Aeronautical Engineering Dept. / / College of Engineering / University of Baghdad Tel: +00964-7806573513 Email: a.h.alobaidi@coeng.uobaghdad.edu.iq
Teaching Assistant:	-----

Module Description (or Catalog Data)

The components of aircraft structures are subjected to forces and deformed elastically during the life of service.

1. This course covers the general information of Airworthiness and Airframe loads, Tapered wing spar beams having variable stringer areas. The focus is to deliver the fundamental knowledge for stresses, deflection, and buckling analysis of idealized sections and multi-cel ribs under various static loading conditions including torsion, bending and shear.
2. There are two main activities in this course. The first is lectures which emphasize the fundamentals of structural mechanics and analytical approaches for analysis of idealized aircraft structures. The students will learn to derive the theory of linear elasticity and apply it to analyze the components subjected to typical aircraft loading conditions and design requirements.
3. The second is tutorials which provide a set of lessons and exercises teaching the concepts and methodology in analysis of aircraft structures.

Textbook and References

1. Aircraft Structures for engineering students, 4th edition T.H.G. Megson
2. Aircraft structures , G. Lakshmi Narasaiah
3. Introduction to Aircraft Structural Analysis, 3rd Edition, T.H.G. Megson
4. Analysis of Aircraft Structures, Second Edition BRUCE K. DONALDSON
5. Lecture notes

Module Goals and Objectives

1. To know the idealized sections are used in aircraft and aerospace.
2. To understand the loads and forces that applied in tapered spar in aircraft structures.
3. To be familiar with stress analysis of various idealized structures elements using elasticity theory under different static loading conditions.
4. To understand stability of thin-walled structures for idealized sections.
5. To understand the principles of complex structure elements.

Module Learning Outcomes

At the end of the class, the student will be able to:

a. Able to visualize the complexity of structural components and materials of the aircraft and understand their functions.
b. Able to visualize how external aerodynamic loads give rise to internal stresses and deformations.
c. Able to apply the theories to analyze various aircraft structural components subject to different loading conditions.
d. Able to apply energy methods for deformation analysis.
e. Have the capability to assess whether aircraft structural components are able to withstand the applied loads and meet specified performance

Program Student Outcomes

The ***Aeronautical Engineering Program*** at the Aeronautical Engineering Department / College of Engineering – University of Baghdad adapts the **ABET** seven student outcomes as the main student outcomes of the program. These are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Mapping between Module Learning Outcomes and Program Student Outcomes

The following table shows how the ***Module Learning Outcomes*** can achieve and fulfill the ***Program Student Outcomes***:

Module Learning Outcomes	Program Student Outcomes						
	1	2	3	4	5	6	7
a	x						x
b	x						x
c	x						x
d	x						x
e	x						x
f			x		x	x	
g					x		
h	x	x					
i				X			
j			x				
k						x	
l							

Assessments

Academic System	√ Modular System		Annual
Module Assessment for Modular System 100%	Quest	Laboratory Work	Final Examination
	Presentations, and Extracurricular Activities) 30 % (Mid-Term Test, Quizzes, Homework and assignments, Seminars, Oral and ppt. Presentations, and Extracurricular Activities)	\	70 %
Additional Information	1. The laboratory experiments are included in the general module (AE309 Aeronautical Engineering Labs./III). One Mid-Term test, and (4) Quizzes are usually made.		

Grading System

1. Quizzes:
   - There will be (4) closed books and notes quizzes during the semester.
   - The quizzes will count 10% of the total module grade.
2. Mid-Term Test, and will count 10% of the total module grade.
3. Homework and assignments, and will count 5% of the total module grade.
4. Seminars and oral & ppt. presentations, and will count 5% of the total module grade.
5. Extracurricular Activities, this is optional and will count extra marks (1–5%) for the student, depending on the type of activity.
6. Final Exam:
   - The final exam will be comprehensive, closed books and notes.
   - The final exam will count 70% of the total module grade

Typical Grading

Excellent	90-100%
Very Good	80-89%
Good	70-79%
Fair	60-69%
Pass	50-59%
Poor	<50%

Module Academic Calender

Week	Covered Material	H.W. and Assignments	Exams
1 2	**Airworthiness** - Factors of safety-flight envelope - Load factor determination - Fatigue		
3 4 5	**Airframe loads** - Aircraft inertia loads - Symmetric manoeuvre loads - Normal accelerations - Gust loads - Flight envelope - Gust envelope - Flight - gust envelope	H.W. 1	Quiz 1
6 7	**Wing spars and box beams** - Tapered wing spar - Beams having variable stringer areas	H.W. 2	Quiz 2
8 9 01	**Fuselages** - The skin/stringer arrangement - bending - shear - torsion - Cut-outs in fuselages		Mid-Term Exam
02 03 04	**Multi cell Wings** - bending, - shear - torsion - Tapered wings - Cut-outs in wings - Loads and forces in aircraft structures	H.W. 3	Quiz 3
05 06 07	**Fuselage frames and wing ribs** - Principles of stiffener/web construction - Fuselage frames - Wing ribs	H.W. 4	
08 09 10	**Laminated composite structures** - Elastic constants of a simple lamina - Stress–strain relationships for an orthotropic ply - Thin-walled composite beams (open and closed) - bending, - shear - torsion	Seminar Assignment	Quiz 4
11	Overall Review and Tutorial		Final Exam

Module Policies

1. Ministry, College, and University regulations apply to this module regarding class attendance,

punctuality, exams, late submissions, absence with permission, penalties for cheating, and policies for assignments and home works.

2. Home works should be submitted one week after assignment, no late homework is accepted.

Assessment Plan

1. Reinforcement is done through tests, quizzes, homework and assignments, seminars, oral and ppt. presentations, extracurricular activities and student engagement during lectures as shown in the table below.
2. Listing the responses obtained from student survey conducted at the end of academic semester. A students' opinion questionnaire is made for a selected specimen of the students.
3. Students rating performance is made through the results of quizzes and exams related to some of the module outcomes.

Strategies for Achieving Outcomes and Assessment Methods

Module Outcomes	Strategies/Actions	Assessment Methods
a) Study the idealized aircraft structure elements and stress analysis and distinguish between open section beams and closed section Beams calculations, and understand the theory of thin-walled for idealized beams	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to Participate in the lecture.	• In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations. • Lab. Experiments.
b) Calculate; bending stresses, deflection and shear flow, on open and close section beams also shear Centre position for idealized and tapered sections	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	• In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations. • Lab. Experiments.
c) Be familiar with thin-walled beams theory, and analysis of idealized aircraft structures, shear flow distribution, on structural elements.	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	• In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations. • Lab. Experiments.

d) Understand and apply the principles of stress analysis and similitude to modified aircraft structure problems.	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to Participate in the lecture.	• In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations. • Lab. Experiments.