Cairo University
Faculty of Engineering

Department of Aerospace Engineering

Course Specifications

Program(s) on which this course is given:	Aerospace Engineering
Department offering the program:	Aerospace Engineering Department
Department offering the course:	Aerospace Engineering Department
Academic Level:	Doctor of Philosophy
Date	
Semester (based on final exam timing)	☐ Fall ☐ Spring

A- Basic Information

1. Title:	Acoustics and Structures			**Code:**	AER 736			
2. Units/Credit hours per week:	Lectures	2	Tutorial	0	Practical	0	Total	2

B- Professional Information

1. Course description:

This course explains the physical process of interaction and introduces the student to various mathematical models and theoretical analyses of the behaviour of coupled fluid–structural systems. This is known as "vibroacoustics" or "structural acoustics". This is accomplished by studying the propagation of acoustic vibrations throughout fluids and solid structures. Doing so, the following topics are studied:
Waves in Fluids and Solids, mobility, impedance, vibrational Energy, sound radiation, fluid loading of vibrating structures, sound transmission, acoustic induced vibration, structure-fluid acoustic coupling, numerical methods for fluid-structure interaction: Finite Element Method, Boundary Element Method, Statistical Energy Analysis, Control of sound radiation and transmission.

2. Intended Learning Outcomes of Course (ILOs):

a) Knowledge and Understanding

1) Understand the advanced structures of Aerospace vehicles
2) Understand sound radiation from vibrating structures
3) Understand sound transmission between adjacent regions of fluid media separated by an intervening solid partition
4) Understand the response of structures to excitation by incident sound fields.

b) Intellectual Skills

5) Modeling physical process mathematically and numerically
6) Calculate sound radiation from vibrating structures
7) Calculate sound transmission between adjacent regions of fluid media
8) Calculate the response of structures to excitation by incident sound fields

c) Professional and Practical Skills

9) Structural synthesize and/or design of a complete aerospace vehicle
10)

d) General and Transferable Skills

11) Solve problems
12) Analyze results and reach conclusion

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
Waves in Fluids and Solid Structures	2	2	
Structural Mobility, Impedance, Vibrational Energy and Power	2	1	1
Sound Radiation by Vibrating Structures	4	3	1

Fluid Loading of Vibrating Structures	4	3	1
Transmission of Sound through Partitions	3	2	1
Acoustically Induced Vibration of Structures	3	2	1
Acoustic Coupling between Structures and Enclosed Volumes of Fluid	3	2	1
Waves in Fluids and Solid Structures	3	2	1

4. Teaching and Learning Methods	Lectures (√)	Practical Training/ Laboratory (√)	Seminar/Workshop ( )
	Class Activity (√)	Case Study (√)	Projects ( )
	E-learning (√)	Assignments /Homework (√)	Other:

5. Student Assessment Methods

• **Assessment Schedule**	**Week**
-Assessment 1; Class Activity	2
-Assessment 2; Class Activity	3
-Assessment 3; Class Activity	4
-Assessment 4; Class Activity	5
-Assessment 5; Midterm Exam	7
-Assessment 6; Class Activity	8
-Assessment 7; Class Activity	10
-Assessment 8; Class Activity	12
-Assessment 9; Final Exam	15
• **Weighting of Assessments**	
-Mid-Term Examination	7
-Final-term Examination	70
-Class Activity	20
-Class Attendance	3
-Total	100

6. List of References

1) Frank Fahy and Paolo Gardonio, Sound and Structural Vibration; Radiation, Transmission and Response, 2nd ed., Academic Press, 2007

7. Facilities Required for Teaching and Learning

Projector, white board, Modal analysis laboratory (Signal analyzer, multichannel dynamic data acquisition, vibration sensors (accelerometers), force transducers, programmable function generators, shakers, impact hummer, test structure, data acquisition/analysis software, experimental modal analysis software)

Course Coordinator:	**Dr. Ahmed Mohamed Rashed Desoki**

Head of Department:	**Prof. Ayman Hamdy Kassem**