Cairo University
Faculty of Engineering

Aerospace Engineering Department

Course Specifications

Program(s) on which this course is given:	Aerospace Engineering
Department offering the program:	Aerospace Department
Department offering the course:	Aerospace Department
Academic Level:	3rd year / Undergraduate
Date	
Semester (based on final exam timing)	■ Fall ☐ Spring

A- Basic Information

1. Title:	Incompressible Aerodynamics			**Code:**	AER301			
2. Units/Credit hours per week:	Lectures	4	Tutorial	2	Practical	3	Total	6

B- Professional Information

1. Course description:	This course Educational/training application is designed to teach the principles of incompressible Potential Flow and their applications to solve flow problems. The course assumes familiarity with basic fluid mechanics concepts and with linear algebra and differentials calculus.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding** Upon completion of this course the student should be able to:
	▪ use superposition of the solutions to Laplace's equation for some simple, fundamental flows to model more complicated ones.
	▪ explain the concept of circulation and its relationship to the lift on an airfoil
	▪ use a source/vortex sheet and vortex filament to model non-lifting and lifting flows past 2D airfoil and wings of finite span
	▪ explain the concept of lift-induced drag
	b) Intellectual Skills Upon completion of this course the student should be able to:
	▪ Design a 3D wing and compute the steady aerodynamic lift and moment
	▪ Design 2D airfoil sections to compute the steady aerodynamic lift and moment
	c) Professional and Practical Skills Upon completion of this course the student should be able to:
	▪ Calculate the imposed pressures induced by inviscid flows
	▪ Write their own simple computer programs to model flow problems introduced in the course, carry out a computational project, and write a detailed report about procedure and results in teams of two students.
	d) General and Transferable Skills
	1. Computing skills 2. Working in a group 3. Use of technological tool

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
Chapter 1: Introduction	4	3	1
Chapter 2: The Governing Equations of Fluid Motion	7	5	2
Chapter 3: Some Closed Form	2	2	

Solutions and Limiting Cases			
Chapter 4: Alternative Formulations of the Governing Equations	3	2	1
Chapter 5: The Two Dimensional Incompressible Potential Flow	11	8	3
Chapter 6: Complex Variables and Conformal Transformations	6	4	2
Chapter 7: Introduction to Theory of Thin Airfoils	4	3	1
Chapter 8: Introduction to Theory of Flow Over Finite Wings	8	6	2
4. Teaching and Learning Methods	Lectures (√)	Practical Training/ Computer Laboratory (√)	Seminar/Workshop ()
	Class Activity (√)	Case Study (√)	Projects (√)
	E-learning ()	Assignments /Homework (√)	Other:

5. Student Assessment Methods

• **Assessment Schedule**	**Week**
-Assessment 1;Class tests	Every lecture
-Assessment 2; Project Assignment	Weekly
-Assessment 3; Presentations	Week 6 and 13
-Assessment 3; Midterm Exam	Week 7
-Assessment 4; Final Exam	Finals week

• **Weighting of Assessments**	
-Mid-Term Examination	20 %
-Final-term Examination	60 %
-Project	10 %
-Class Tests	10 %
-Presentation	0 %
-Total	100 %

6. List of References

Schilichting, H., “Boundary Layer Theory”, 7th. Edition, McGraw-Hill, New York, 1979.

Anderson, J. D., “Fundamentals of Aerodynamics”, , McGraw-Hill, New York, 1984.

Bertin, J.J. and Smith, M. L., ”Aerodynamics for Engineers”, Prentice Hall, Englewood Cliffs, N. J., 1979.

Batchelor, G. K., “Introduction to Fluid Dynamics”, Cambridge University Press, 1967

Katz, J. and Allen Plotkin, “Low Speed Aerodynamics from Wing Theory to Panel Methods”, McGraw Hill, New York, 1991.

7. Facilities Required for Teaching and Learning

- Board
- Exercise sheets
- Computer laboratory
- Library

Course Coordinator:	**Prof. Dr. Mohamed Madbuli Abdelrahman**

Head of Department:	**Prof. Dr. Ayman Hamdy Kasem**