**Cairo University**
**Faculty of Engineering**

**Department of Aerospace**

# Course Specifications

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|---|---|
| **Program(s) on which this course is given:** | Doctorate Program |
| **Department offering the program:** | **Department of Aerospace** |
| **Department offering the course:** | **Department of Aerospace** |
| **Academic Level:** | Doctorate |
| **Date** | |
| **Semester (based on final exam timing)** | ■ Fall ■ Spring |

## A- Basic Information

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|---|---|---|---|---|---|---|---|---|
| **1. Title:** | **Unsteady Aerodynamics** | | | **Code:** | | **AER711** | | |
| **2. Units/Credit hours per week:** | Lectures | 3 | Tutorial | NA | Practical | **NA** | Total | 3 |

## B- Professional Information

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|---|---|
| **1. Course description:** | This course introduces theoretical formulation of unsteady airfoil theory and techniques used for determining airloads on oscillating lift surfaces; exact solutions and various approximations presented and evaluated; application to problems of unsteady incompressible flow about airfoils and wings. |
| **2. Intended Learning Outcomes of Course (ILOs):** | **a) Knowledge and Understanding** |
| | • To understand effects of unsteady aerodynamics and relevant assumptions<br>• Derive the governing equations for unsteady aerodynamics for inviscid flow<br>• Derive the relevant boundary conditions for unsteady flow |
| | **b) Intellectual Skills** |
| | • To solve unsteady flow over an oscillating, pitching and plunging, and plate<br>• To solve unsteady flow around two dimensional airfoils for incoming gusts<br>• To solve three dimensional unsteady aerodynamic problems |
| | **c) Professional and Practical Skills** |
| | • Apply course material to examine a relevant research project, such as flapping wing, dynamic stall and so on. |
| | **d) General and Transferable Skills** |
| | • Solving complex unsteady aerodynamics problems |

**3. Contents**

| Topic | Total hours | Lectures hours | Tutorial/ Practical hours |
|---|---|---|---|
| Introduction | 3 | 3 | |
| Fundamental Equations | 6 | 6 | |
| Impulsive Motion of Airfoil | 3 | 3 | |
| Simple Harmonic Motion of Airfoil | 3 | 3 | |
| Arbitrary Motion of Airfoil | 3 | 3 | |
| Gust Problem | 3 | 3 | |
| Panel Methods for Unsteady Flow | 6 | 6 | |
| Dynamic Stall (viscous flow) | 3 | 3 | |
| | | | |

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| **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 test | NA |
| -Assessment 2; Project Assignment | During the last week of the course |
| -Assessment 3; Presentations | NA |
| -Assessment 3; Midterm Exam | NA |
| -Assessment 4; Final Exam | 15 |
| • **Weighting of Assessments** | |
| -Mid-Term Examination | NA |
| -Final-term Examination | 70% |
| -Project | 30% |
| -Class Test | NA |
| -Presentation | NA |
| -Total | 100% |

**6. List of References**

- Fundamentals of Modern Unsteady Aerodynamics, Ülgen Gülçat, Springer; 2011 edition

**7. Facilities Required for Teaching and Learning**

.White board, projector, computer

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|---|---|
| **Course Coordinator:** | **Dr. Basman Elhadidi** |
| **Head of Department:** | **Dr. Ayman Kassem** |