University: Cairo **Faculty:** Engineering **Department:** Aerospace Engineering

Course Specifications

Program: Aerospace Engineering
Major Field: Aerodynamics
Department: Aerospace Engineering Department
Academic Year Level: Fourth Year Undergraduate
Term: Second Term
Year of Approval: March, 2015.

A- Basic Information

Title: Computational Aerodynamics
Code: AER402
Credit Hours: 3
Weekly Hours: Lectures 3, Tutorials 1, Total 4
Prerequisite Courses: AER112, AER201a, AER201b, AER301a, AER301b

B-Professional Information

1-Overall Aims of Course

Introduce the student to computational aerodynamics to obtain the forces and moments about an aircraft.

2-Intended Learning Outcomes

A-Knowledge and Understanding

Upon completion of this course the student should be able to:

- Understand the basic elements of numerical analysis for parabolic, elliptic and hyperbolic equations
- Understand the basic elements of grid generation
- Understand the basic elements of the solution of a coupled system of equations governing the flow problems.

B-Intellectual Skills

Upon completion of this course the student should be able to:

- Discretize any governing equation
- Determine the equation type of any governing equation
- Solve initial and boundary value problems
- Generate simple algebraic and elliptic grids
- Solve the Laplace equation in a generalized coordinate system

- Solve the unsteady one-dimensional compressible flow through a convergent-divergent nozzle.
- Obtain the numerical solution for flow around aircrafts

3-Course Contents

Topic	Lecture Hour	Tutorial Hour
Classification of partial differential equations	4	1
Finite difference formulation	4	2
Parabolic partial differential equations	6	2
Stability analysis	6	2
Elliptic equations	9	3
Hyperbolic equations	6	2
Scalar representation of Navier Stokes Equations	4	1
Grid generation	6	2

4-Teaching and Learning Methods

- Board instructions
- Student discussions
- Homework problems
- Discussion of exercise problems
- Computers and softwares

5-Student Assessment Methods

- Reports of exercise problems to assess understanding of solution methods
- Mid-term exam to assess material comprehension
- Take home exam to assess computer skills
- Final exam to assess overall material comprehension

Assessment Schedule

Assessment 1	At the end of every chapter
Assessment 2	Midterm Exam
Assessment 3	At the end of the term
Assessment 4	At the end of the term

Weighting of Assessments

Reports	5%
Mid-Term exam	15%
Take home exam	10%
Final exam	70%

6-List of References

Essential Textbooks

K. Hoffmann, and S. Chiang, “Computational Fluid Dynamics”, Fourth Edition, 2000, Engineering Education System

7-Facilities Required for Teaching and Learning

- Board
- Course notes
- Computer lab
- College library

Course Coordinator: Prof. Mohamed Madbouli Abdelrahman, Professor of Aerodynamics

Head of Department: Prof. Ayman H. Kassem

Date: March, 2015.