Course Specifications

Program(s) on which this course is given:	Master of Science Program
Department offering the program:	Department of Aerospace Engineering
Department offering the course:	Department of Aerospace Engineering
Academic Level:	Post Graduate
Date	March 2015
Semester (based on final exam timing)	☐ Fall ■ Spring

A- Basic Information

1. Title:	Computational methods in Aerodynamics			**Code:**		AER 614		
2. Units/Credit hours per week:	Lectures		Tutorial		Practical		Total	

B- Professional Information

1. Course description:	**The aim of this course is** to review differential form of the governing equations of fluid flows and their mathematical characteristics. The method of Finite difference is then reviewed and applied to linear and nonlinear terms and to Initial and Boundary conditions. Concepts of consistency, convergence and stability are introduced and limits for stability derived for the different types of PDEs. Methods for solving the resulting systems of algebraic equations using Direct and Iterative methods and solver characteristics are established. The weak form of the governing equations are introduce and the methods of Finite Volume. Structured / Unstructured Grid generation methods are outlined. Selected 1-D and 2-D applications for external and internal flows are solved and analyzed**.**
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	Understand and recognize the relative roles of theoretical results of the Theory of PDE's, Discrete Modeling, and Numerical computations and simulations in analyzing Aerodynamic applications.
	Appreciate the roles of modeling, computing, simulation and visualization in Aerodynamic applications.
	Understand the relations between continuous Analysis and Discrete Modeling.
	Reviewed and understand the basic concepts of linear algebra such as vector spaces, measures (norms), solution of linear and nonlinear systems of equations, Eigen values and eigenvectors, Matrix decomposition and singular value decomposition.
	Identify and evaluate the roles played by each in the modeling process and the analysis of outcomes.
	b) Intellectual Skills
	Model Simple Internal/External Aerodynamic applications in Finite Difference Form.
	Apply a consistent framework to formulate models, computationally solve and simulate the behaviors of simple Aerodynamic (Practice, formulate, Analyze, Compute, visualize).
	c) Professional and Practical Skills
	Practice and perform computing and simulating using their choice of programming environments (C, C++, Matlab, Mathematica,) (Compute, Visualize and IT Skills).
	Computationally solve and simulating the resulting flows.
	d) General and Transferable Skills
	Visualize the results statically (Charts, Graphs and contour maps) and dynamically

	(Computed Animations).
	Assess the outcomes and Evaluate their usefulness and relevance.
	Students should be able to achieve alone and by working in groups.

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours

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	
-Assessment 2; Project Assignment	
-Assessment 3; Presentations	
-Assessment 3; Midterm Exam	
-Assessment 4; Final Exam	

• **Weighting of Assessments**	
-Mid-Term Examination	
-Final-term Examination	
-Project	
-Class Test	
-Presentation	
-Total	

6. List of References

7. Facilities Required for Teaching and Learning

.

Course Coordinator:	**Prof. Dr. Atef O. Sherif**
Head of Department:	**Prof. Dr. Ayman H. Kasem**