Course Specifications

Program(s) on which this course is given:	PhD. 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:	High Performance Computing for Aerospace applications		**Code:**		AER 710			
2. Units/Credit hours per week:	Lectures		Tutorial		Practical		Total	

B- Professional Information

1. Course description:	The aim of this course is to introduce High Performance Computing methods and techniques for modeling, computationally solving, simulating and visualizing results for different engineering applications in the area of Aerospace.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	Understand and recognize the relative roles of single core, multicore cluster based and GPU based processing on discrete modeling and numerical computations and simulations in analyzing aerospace engineering applications.
	Understand and recognize the different Parallel Computers Architectures, SIMD (array processors), MIMD/SPMD and supercomputers.
	Understand and recognize the different types of memory access, Symmetric multiprocessor uniform memory access, Non uniform memory access, logically and physically distributed memory.
	Understand and recognize the meanings of Parallel Programming, Thread Parallelism, Distributed memory & MPI, Hyprid Shared/Distributed Memory computing, Bulk Synchronous Parallel model BSP, Parallel Languages (Parallel C, HP Fortran, …)
	Understand and recognize requirements for program Design for Parallelism. Thread parallelism, Open MP, Parallel Data Structures and Latency Hiding
	Appreciate Quantifying parallelism using Asymptotics, Amdahl's Law, Scalability, and simulation scaling.
	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 and 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
	Study their Selection of GPU hardware (NVIDIA/AMD) and their Parallel programming related issues as a low cost hardware.
	Apply a unified framework to formulate models, computationally solve and simulate the behaviors of simple aerospace engineering applications selected from different disciplines. (Practice, formulate, Analyze, Compute, visualize).

	Practice performing parallel computing and simulating using their choice of GPU and parallel programming environments (C, C++, Matlab, Mathematica,) and parallel techniques for solving PDEs and High Performance Linear Algebra Libraries.(Compute, Visualize and IT Skills).
	c) Professional and Practical Skills
	Utilize a low cost parallel computing infrastructure to Model Simple Aerospace Engineering applications in discrete form.
	d) General and Transferable Skills
	Visualize the results statically (Charts, Graphs and contour maps) and dynamically (Computed Animations) using parallel architecture.
	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

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Course Coordinator:	**Prof. Dr. Atef O. Sherif**

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