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:	Postgraduate
Date	March 25 2015
Semester (based on final exam timing)	■ Fall ☐ Spring

A- Basic Information

1. Title:	Aerodynamics of Turbo-machines			**Code:**		AER 616		
2. Units/Credit hours per week:	Lectures	27	Tutorial	15	Practical	3	Total	45

B- Professional Information

1. Course description:	This course introduces the aerodynamics of the flows associated with the different types of turbo-machines like axial compressors and turbines, centrifugal compressors, and radial turbines. This course is looking at the different aerodynamics theories behind working of these different types of turbo-machines. The course covers different aspects associated with the aerodynamics of the most important components which constitute an aircraft engine.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	To know the various aerodynamic parameters affecting the performance of the compressors and turbines
	To understand basic techniques to predict the performance of these types of turbo-machines
	b) Intellectual Skills
	To learn the method for predicting the aerodynamic performance of the various types of turbo-machines.
	To learn the methods to predict the aerodynamic performance at both design and off-design operations of the various types of turbo-machines.
	c) Professional and Practical Skills
	Calculations of fundamental aspects of turbo-machine blade design from the experimental airfoil data and using two-dimensional and three dimensions analysis.
	Design of compressors and turbines blades and construct the turbo-machine map in design and off-design operations.
	Design of compressor and turbine blades and construct the performance map and detect the surge line.
	d) General and Transferable Skills
	Solve problems of the aerodynamics design of various turbo-machines.
	Analyze the results and reach conclusions for problems of the aerodynamics design of various turbo-machines.
	Write reports for problems of the aerodynamics design of various turbo-machines.

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
Introduction to aero-thermodynamics of flow through turbo-machines.	3	3	

Introduction to axial type of turbo-machine, losses in axial flow compressor stage, secondary flows tip leakage and estimation of three dimensional losses.	6	6	
Design of axial compressor blades, two dimensional blade design, airfoil data, axial flow track design, multi-staging of compressor characteristics	7	6	1
Introduction to centrifugal compressors, inlet duct, impeller flow, concept of rothalpy, centrifugal compressor characteristics, surging and rotating stall.	7	6	1
Introduction to radial turbine, radial turbine characteristics, losses and efficiency, design of radial turbine.	7	6	1
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	4,5,6
-Assessment 2; Project Assignment	7
-Assessment 3; Presentations	10
-Assessment 3; Midterm Exam	9
-Assessment 4; Final Exam	16
• **Weighting of Assessments**	
-Mid-Term Examination	20
-Final-term Examination	40
-Project	20
-Class Test	15
-Presentation	5
-Total	100

6. List of References

Fluid Mechanics and Heat Transfer in Turbomachineries, by: B. Laksminarayana, 1995, USA

Compressor Aerodynamics, by Nicholas Cumpsty, Kreiger Publications, 2004, USA.

Axial flow compressors, by J.H. Horlock, Butterworths, 1958, UK

Axial flow turbines, by J.H. Horlock, Butterworths, 1965, UK

7. Facilities Required for Teaching and Learning

Advanced propulsion lab

Course Coordinator:	**Prof. Dr. Mohamed Madbouli Abdelrahman**
Head of Department:	**Pro. Dr. Ayman H. Kassem**