Course Specifications

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

A- Basic Information

1. Title:	**Aerodynamic Design & Performance of Wind Turbines**			**Code:**	**AER618**			
2. Units/Credit hours per week:	Lectures	3	Tutorial	NA	Practical	**NA**	Total	3

B- Professional Information

1. Course description:	This course focuses on the analysis and analytical modeling of the aerodynamics of wind turbines and includes a blend of aerodynamic theory used for the design of state-of-the-art wind turbines. The main objective of this course is to provide students with the knowledge and skills in aerodynamics required for a detailed understanding of the turbine design issues that impact siting and project development. Some of the control techniques effects on the design and performance will be discussed and applied in this course.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	• Derive the governing equations for the performance of the Horizontal axis wind turbine. • Understand the different aspects which reflect on the design and the performance
	b) Intellectual Skills
	• To be capable of designing and study the performance of horizontal axis wind turbines using simple low order methods. • To apply simple control techniques and produce the effect on the performance using open source codes especially made for these purposes.
	c) Professional and Practical Skills
	• Apply course material to examine a relevant research project, such as small horizontal axis wind turbines
	d) General and Transferable Skills
	• The capability of Designing and control a Horizontal Axis Wind Turbine with taking into consideration the parameters affecting the performance.

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
Introduction: History , Wind characteristics and Resources	3	3	
Aerodynamics of Horizontal-Axis Wind Turbines	6	6	
Airfoils for Horizontal-Axis Wind Turbines	6	6	
Blade Element Momentum (BEM)	12	12	

Theory (Strip Theory)			
Modelling and design Horizontal Axis wind turbine	6	6	
Aerodynamic control strategies for wind turbines (apply basic control algorithms to investigate wind turbine control)	6	6	
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

- J.F. Manwell , J. G. McGowan and A.L. Rogers, ”Wind Energy Explained : Theory, Design and Application ”John Wiley & Sons Ltd, 2002.
- Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi, ” Wind Energy Handbook “ John Wiley & Sons Ltd., 2001 .
- Martin O. L. Hansen , Aerodynamics of Wind Turbines “, Earthscan, London. Sterling, VA, 2008.

7. Facilities Required for Teaching and Learning

.White board, projector, computer

Course Coordinator:	**Prof. Galal Bahgat Salem**
Head of Department:	**Dr. Ayman Kassem**