



Course Specification

DIPLOMA

Course Title: **Wind Energy**

Course Code: **APRT2206**

Program: **Renewable energy technologies**

Department: **Diploma Department**

College: **The Applied College**

Institution: **Umm Al-Qura University**

Version: **1**

Last Revision Date: **10 February 2025**



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A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (3rd Level / 2nd Year)

4. Course General Description:

1. Course Description

- The course aims to introduce concepts and techniques of energy production from wind energy. Wind machine types, classification, parameters - Wind and its structure, statistics, measurements, data presentation, and power in the wind - Wind turbine aerodynamics, momentum theories, basic aerodynamics, airfoils and their characteristics - Horizontal Axis Wind Turbine (HAWT); Blade Element Theory, wake analysis, Vertical Axis Wind Turbine (VAWT) aerodynamics - HAWT rotor design considerations; power regulation, yaw system, tower - Wind turbine loads, aerodynamic loads in steady operation, wind turbulence, static - dynamic - fatigue analysis, yawed operation and tower shadow, WECS control system, requirements and strategies. Wind Energy Conversion System (WECS) siting, rotor selection, Annual Energy Output (AEO).

5. Pre-requirements for this course (if any):

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

Course Main Objective

The main goal of this course is to understand wind turbine design.

The course aims also to introduce concepts and techniques of energy production from wind:

- 1-Overview of wind engineering: benefits of wind energy; assessment of wind resources; assessment of means of energy production, consumption, and cost; green credit; and wind turbine terminology and definitions.
2. Conversion of mechanical energy into electricity: basic AC power generators.
3. Impact of wind turbines on the environment.

2. Teaching mode (mark all that apply)





No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	5	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> Traditional classroom E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	45
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Figure out a comprehensive knowledge and critical understanding of the main subjects of the wind energy or specialization, including the main concepts, principles, theories and their current applications in the field of academic research specializing in Energy management and energy efficiency.	K1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Understand deeply one or more areas of specific specialization in relation to the latest theories, research and professional practice in wind Energy	K2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.0	Skills			
2.1	Apply continuously theoretical and practical knowledge in dealing with a variety of contexts, new and unexpected scientific, and provide authentic and innovative responses to problems and issues. Make convincing and informed judgments in situations where complete or consistent information is not available.	S1	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.2	Extracts from published research or professional reports in wind Energy and can apply them, develops important new ideas and integrates them into their knowledge or experiences. Applies specialized and general research methods in the creative analysis of complex issues and in the development of results and proposals related to its academic field.	S2	Lectures, tutorials and independent study assignments	Homework, Quizzes, Midterm and Exam
2.3	Plan and execute large projects or part of scientific research independently,	S3	Lectures, tutorials and independent study assignments	Homework, Quizzes,



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	applying his theoretical and practical knowledge and using research methods to arrive at valuable conclusions that lead to important additions to current knowledge or professional practices in certain field of wind Energy.			Midterm and Exam
3.0	Values, autonomy, and responsibility			
3.1	Practice knowledge and skills to identify, independently and responsibly, the real problem by realizing a given problem statement in real selection of different wind turbine, perform Literature Review to establish the need to solve the problem, define the real problem and develop technical objectives and a mission statement based on assumptions and realistic constraints to guide him to solve the problem.	V1	Study presentation and report preparation	Oral presentation and minor projects.
3.2	Communicate individual work well in written / oral form for diversified audience.	V2	Study presentation and report preparation	Oral presentation and minor projects.
3.3	Conduct professionally and perform research in his engineering discipline to write / publish a scholarly article.	V3	Study presentation and report preparation	Oral presentation and minor projects.

C. Course Content

No	List of Topics	Contact Hours
1. 1	<i>Overview of wind engineering: Benefits of wind energy; assessment of wind resources; assessment of means of energy production, consumption and wind turbine terminology and definitions</i>	6
2. 2	<i>Blade element theory: Inflow models based on combined blade element theory; incorporation of swirl losses in inflow; root and tip losses and stall delay models; and assessment of publicly available wind turbine modeling tools</i>	6
3	<i>Horizontal Axis Wind Turbine (HAWT) design: Using blade element theory, wake analysis, HAWT rotor design considerations; power regulation, yaw system</i>	6
4	<i>Vertical Axis Wind Turbine (VAWT) design: Using blade element theory</i>	6
5	<i>Wind turbine loads: Aerodynamic loads in steady operation, wind turbulence, static- dynamic - fatigue analysis, yawed operation and tower shadow</i>	6
6	<i>Conversion of mechanical energy into electricity: basic AC power generators; hybrid power systems; and hybrid system modeling and simulation</i>	6
7	<i>Lab Work</i>	45
Total		75

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1. 1	Quizzes and Exercise	3-8	%10
2. 2	Report & Presentation	3-8	%20
3. 3	Mid-term	9	%20
4	Final exam	17/18	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources





Essential References	<i>James Manwell, Jon McGowan, Anthony Rogers, "Wind Energy Explained: Theory, Design and Application, 2nd Edition", John Wiley & Sons, 2010, ISBN: 978-0-470- 01500-1.</i>
Supportive References	<ul style="list-style-type: none"> • <i>Burton, Sharpe, Jenkins and Bossanyi, Wind Energy Handbook; Wiley, 2001, ISBN 0 471 48997 2</i> • <i>Freris & Infield, Renewable Energy in Power Systems; Wiley, 2008, ISBN 978 0 471 01749 4</i> • <i>L Freris; Wind Energy Conversion Systems, Prentice Hall, 1900, ISBN 013 960527 4</i> • <i>Dr. John Wagner, Fundamentals of Wind Power, Lecture Notes and Homework Problems, V8.0, May 2017.</i> <i>M. Hansen, Aerodynamics of Wind Turbines, Routledge, 2007.</i>
Electronic Materials	<ul style="list-style-type: none"> • All the lecture notes
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty	Direct (project, HW, Quiz, midterm and final exam)
Effectiveness of Students assessment	Students	Indirect (Student Survey)





Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Program Coordinator	Direct analysis
The extent to which CLOs have been achieved	Program Coordinator	Direct analysis
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Umm Al-Qura University Council
REFERENCE NO.	851141114462/190394
DATE	22/11/1446

