COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P+L Hour*	*Credits*	*ECTS*
WIND ENERGY	CE 571	1-2	3+0+0	3	10

Prerequisites	-

Language of Instruction	English
Course Level	Master's Degree (Second Cycle Programmes)
Course Type	Departmental Elective
Course Coordinator	-
Instructors	Asst. Prof. M. Adil AKGÜL
Assistants	-
Goals	This course aims to provide the attendants with knowledge on wind, its properties as an energy source and harvestment of wind power with emphasis kept on wind energy potential, wind turbines and their structural design, environmental impacts and future projections.
Content	Wind as a renewable energy source, history of wind energy in civilization, national and global status of wind energy. Mechanism and physical expression of wind, its measurement and data analysis. Physical expression of wind, velocity profile, effect of topography on wind, wind power. Calculation and assessment of wind energy potential. Conversion systems: Short history, horizontal and vertical axis turbines. Structural members. Rotor aerodynamics. Safety and reliability in wind turbines, control systems. Vibration and noise in turbines. Simplified calculations. Numerical modeling methods. Deployment of wind farms. Offshore wind farms.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to define types and members of wind turbines and select suitable member types.	2,9	1,2	A,C
2) Ability to use computational and experimental tools for the design and analysis of wind turbines and related members.	2,4,7,9	1,2	A,C
3) Ability to conduct a preliminary design and efficiency analysis for a planned wind farm.	4,7,9,11	1,2	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Laboratory, 4: Case-study
Assessment Methods:	A: Exams, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction: Wind and its role in history of civilization, its effects and utilization as an energy source.	Lecture Notes and Textbook
2	Fundamental definitions on wind. Measurement and data acquisition of wind. Gust winds. Data sources and statistical analysis.	Lecture Notes and Textbook
3	Physical expression of wind. Application of fundamental fluid mechanics equations to wind. Effect of topography on wind speed.	Lecture Notes and Textbook
4	Wind power and wind energy. Turbulence. Calculation of wind energy potential and its assessment.	Lecture Notes and Textbook
5	Wind turbines. Horizontal and vertical axis turbines. Structural members of wind turbines: Rotor, transmission, generator, hub, tower, foundation.	Lecture Notes and Textbook
6	Rotor aerodynamics. Activator disc concept. Betz limit. Rotor disc theory. Power output calculation.	Lecture Notes and Textbook
7	Blade theory. Flow around blades, effect of blade geometry and number of blades. Vortex shedding and stall. Simplified calculations. Numerical modeling.	Lecture Notes and Textbook
8	Midterm Exam	Lecture Notes and Textbook
9	Design of hub, tower and foundations. Design loads, related design codes and guidelines. Construction methods.	Lecture Notes and Textbook
10	Vibration and noise problems in wind turbines. Performance of wind turbines.	Lecture Notes and Textbook
11	Turbine control mechanisms. Brake systems. Pitch, yaw and stall control mechanisms. Vibration control. Safety devices.	Lecture Notes and Textbook
12	Design of wind farms. Site selection, feasibility. Micrositing. Deployment of wind turbines.	Lecture Notes and Textbook
13	Offshore wind farms 1	Lecture Notes and Textbook
14	Offshore wind farms 2	Lecture Notes and Textbook
15	Environmental impacts of wind turbines	Lecture Notes and Textbook

RECOMMENDED SOURCES	
Lecture Notes	Notes prepared by the instructor

Textbooks	1) Burton, T., Sharpe, D., Jenkins, N. ve Bossanyi, E. (2001). "Wind Energy Handbook". John Wiley & Sons. 2) Hau, E. (2006). "Wind Turbines - Fundamentals, Technologies, Application, Economics", Springer-Verlag. 3) Manwell, J.F., McGowan, J.G., Rogers, A.L. (2002). "Wind Energy Explained - Theory, Design and Application", John Wiley & Sons.

MATERIAL SHARING	
Documents	Lecture notes and additional documents, guidelines and codes shall be submitted by the instructor
Assignments	Homeworks are returned to students after they are graded
Exams	Exams questions are solved if demanded

ASSESSMENT

IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	40
Quizzes	-	-
Assignment	4	60
Lab Work	-	-
Term Project	-	-
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Attains knowledge through wide and in-depth investigations his/her field and surveys, evaluates, interprets, and applies the knowledge thus acquired.					
2	Has a critical and comprehensive knowledge of contemporary engineering techniques and methods of application.		√			

3	By using unfamiliar, ambiguous, or incompletely defined data, completes and utilizes the required knowledge by scientific methods; is able to fuse and make use of knowledge from different disciplines.					
4	Has the awareness of new and emerging technologies in his/her branch of engineering profession, studies and learns these when needed.		√			
5	Defines and formulates problems in his/her branch of engineering, develops methods of solution, and applies innovative methods of solution.					
6	Devises new and/or original ideas and methods; designs complex systems and processes and proposes innovative/alternative solutions for their design.					
7	Has the ability to design and conduct theoretical, experimental, and model-based investigations; is able to use judgment to solve complex problems that may be faced in this process.					√
8	Functions effectively as a member or as a leader in teams that may be interdisciplinary, devises approaches of solving complex situations, can work independently and can assume responsibility.					
9	Has the oral and written communication skills in one foreign language at the B2 general level of European Language Portfolio.			√		
10	Can present the progress and the results of his investigations clearly and systematically in national or international contexts both orally and in writing.			√		
11	Knows social, environmental, health, safety, and legal dimensions of engineering applications as well as project management and business practices; and is aware of the limitations and the responsibilities these impose on engineering practices.			√		
12	Commits to social, scientific, and professional ethics during data acquisition, interpretation, and publication as well as in all professional activities					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	7.5	105
Midterm examination	1	3	10
Homework	4	20	80
Project	-	-	-
Final examination	1	3	3
Total Work Load			240
Total Work Load / 25 (h)			9.6
CTS Credit of the Course			10