RC204

Introduction to Wind Energy

3 Credits

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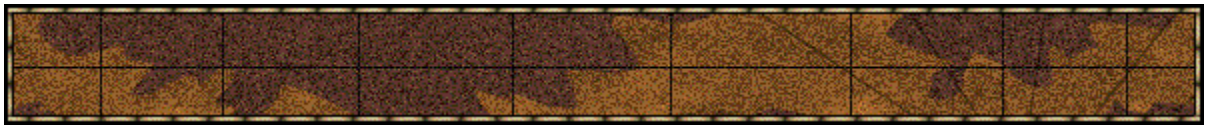

Introduction to Wind Energy

Calendar Description

This is an introductory course that examines the development of wind power as an alternative renewable energy source. Topics of discussion include the need to assess wind energy potential, types of wind turbines, global development of wind power and environmental aspects. Both large commercial and small wind power applications are introduced.

Rationale

This is a required course for the Renewable Energy and Conservation program. There are several benefits to increasing the world's use of renewable energy. One of the benefits is the reduced greenhouse gas emissions from renewable energy sources relative to fossil fuel energy sources. There is a general consensus among scientists that emissions of greenhouse gases from fossil fuels are a major contributor to climate change on Earth. If renewable energy sources can be used to replace existing or fossil fuel energy use, then the global impacts of climate change could be reduced.

Wind is a key component of renewable energy power generation. Wind power is becoming an increasingly significant energy producer in both large and smaller scale projects and is increasing in new online operations each year.

This course provides the background of key factors and concepts required to understand electrical generation from wind turbines. This will enhance the opportunity for course participants to participate in the wind energy business.

Prerequisites

RC200 or equivalent or can be taken as a co-requisite

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. list the names, uses, sizes, designs, and parts of wind turbines, ending with a discussion on the advantages/disadvantages of wind turbine installations.

2. define concepts involved with electrical components, using examples and calculations.
3. discover wind fundamentals by reviewing what creates weather, the four levels of the atmosphere, atmospheric pressure systems, causes of wind, wind shear, and calculating wind measurements.
4. compute swept areas.
5. interpret graphs of power density and compute power density.
6. discuss wind speed and turbine properties, including interpretations of turbine power and energy output graphs.
7. describe the technologies and systems involved in limiting rotor speed.
8. summarize tower requirements and types, turbine mountings, giving examples of installation considerations.
9. explain components of a wind turbine electrical system, including the production of alternating and direct current, and wind turbine connection configurations.

Resource Materials

Required Texts:
This textbook will be mailed out to registered students:

Gipe, P. 2016. Wind power for the rest of us: A comprehensive guide on wind energy

and how to use it. Chelsea Green, White River Junction, VT.

Conduct of Course

This course consists of the equivalent of 45 hours of lecture delivered through the Internet using an on-line learning manager program. Course content modules and links to some assigned readings will be available on-line. A course facilitator will be available to guide the student through the course, answer any questions, and grade assignments. Students are expected to participate in on-line discussion forums with other classmates and the course facilitator. Assignments include on-line discussions, assessments (on-line quizzes) and assignment papers. Assignments will be submitted through the learning manager program. Exams will be taken on-line. In order to complete the course on time, deadlines for assignments and exams will be enforced.

Evaluation Procedures

Grades will be assigned with the following weightings:

Evaluation Tool	Weighting
19 Assignments	60%
Midterm Exam	10%
Final Exam	30%
Total	100%

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Active participation is required in all courses within the Renewable Energy and Conservation certificate and diploma programs. Each facilitator designates these requirements through the use of tools within the management system and personal contact with learners.

These expectations can be given marks as part of the assessment process. Each course outlines these expectations within the course structure.

For example, learners can be asked to demonstrate their participation/attendance through discussion forums, sharing research results, contributing relevant information, submitting assignments, communicating with colleagues and the facilitator, and participating in synchronous meetings or asynchronous activities.

Attendance is considered vital to the learning process. Absenteeism is recorded. For example, if a discussion forum is organized; the learner is expected to attend as per the guidelines set by the facilitator.

Students can request for an excused absence. An excused absence is one that is verified with your facilitator.

NOTE: Any exceptions to the above attendance policy (e.g. family or work-related issues) **must** be approved in writing by the Department Chair **prior** to the beginning of the course.

It is the student's responsibility to know their own absentee record.

Course Units/Topics

1. Introduction
1.1 The Beginning
1.2 History of Wind Power
1.3 Current Uses of Wind Turbines
1.4 Wind Turbine Nomenclature
1.5 Environmental and Other Considerations

2. Electrical Components and Theory
2.1 Electrical Components and Theory

3. Wind Fundamentals
3.1 Sources of Wind
3.2 Other Wind Factors
3.3 Wind Speed Measurement, Wind Speed Units, Assessing Wind Availability

4. Swept Area
4.1 Swept Area

5. Power in the Wind
5.1 Power in the Wind

6. Wind Speed and Turbine Properties
6.1. Blade Aerodynamics
6.2 Wind Turbine Relationship
6.3 Sizing the Turbine

7. Blade Speed Control
7.1 Blade Speed Control

8. Towers
8.1 Tower Types and Considerations

9. Wind Turbine Connection Configurations
9.1 Wind Turbine Connection Configurations

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