



## **RENG 221 – Introduction to Small Wind Systems**

**3 Credits (2 hrs lecture, 3-hour laboratory)**

**Pre-requisites: ELEC 190 or AGEN 125 or DTEC 125, and PHYS 107**

### **INSTRUCTOR:**

Dr. Philip V. Hofmeyer, 108 Shannon Hall  
On-campus mailbox: Marshall Hall  
Office phone: 315-684-6515  
E-mail: [hofmeypv@morrisville.edu](mailto:hofmeypv@morrisville.edu)

### **OFFICE HOURS:**

TBA. If necessary, students are also encouraged to make appointments to see the instructor at other times.

Students with disabilities who require accommodations to fully-participate in the course activities are requested to contact the instructor within the first two weeks of the semester.

### **COURSE DESCRIPTION:**

This course provides students with an introduction to wind energy and the impacts of turbulence, frequency distributions, and tower height on the wind resource. Students are engaged with installation, maintenance, and troubleshooting small wind system (those <100 kW in size). This course covers the Job Task Analysis for the North American Board of Certified Energy Practitioners (NABCEP) Small Wind Installer examination.

Prerequisites: ELEC 190 or DTEC 125 or AGEN 125, and PHYS 107 minimum grade of C.

3 Credits (2 hours lecture, 2 hours laboratory).

### **Course Learning Outcomes:**

The overall objective of this course is to provide the student with a technical understanding of residential and small commercial wind energy systems. Upon completion of this course, the student will be able to:

1. Measure and map wind resources.
2. Define and describe system components of wind turbines, towers, and electricity connections.
3. Evaluate potential small wind turbine sites (<100 kW).
4. Assemble conductors, battery banks, inverters, charge controllers, and diversion loads correctly.
5. Identify cost sharing and incentives for small wind systems.
6. Employ safe work habits around wind turbines, towers, and electrical systems.
7. Critique and troubleshoot residential wind systems.

### **INSTRUCTIONAL METHODS:**

1. Lecture/laboratory/problem solving sessions.
2. Reading assignments.
3. Homework and laboratory exercises.
4. A renewable energy system project shall be undertaken (group project).
5. Reading current literature related to energy systems.

**REQUIRED TEXTS:**

Gipe, P. Wind Power: Renewable Energy for Home, Farm, and Business. Chelsea Green Publishing Company, 496 p. (ISBN: 1-931498-14-8).

North American Board of Certified Energy Practitioners Small Wind Installer Certification Task Analysis. Available on Blackboard.

Other handouts and course material will be available on-line via Blackboard, accessible only by those students who are enrolled in the course.

**REFERENCES:**

Manwell, J.F., J.G. McGowan, and A.L. Rogers. 2002. Wind Energy Explained. Wiley Press, 577 p. (ISBN: 978-0-471-49972-5)

Woofenden, I. 2009. Wind Power for Dummies. Wiley Press. 364 p.

**STUDENT REQUIRED EQUIPMENT:**

Notebook, texts, scientific calculator, work boots, and appropriate dress for scheduled laboratory operations and field trips.

**CLASS POLICIES:**

**Student Behavior:** *As students in a technical program are preparing for a professional career, all students are expected to conduct themselves, in both manner and dress, as professionals.*

Eating, drinking, or the consumption of *any* tobacco products is prohibited during class meetings (lecture hall, classroom, laboratory, or field). Doing so may result in the student's dismissal from that class period and will count as an unexcused absence.

Cell phones, pagers, and similar devices must be turned **off** during the instruction time. Use of or disruption of class by these devices **will** result in the confiscation of the device by the instructor, and may result in the student's dismissal from that class period which will count as an unexcused absence. The confiscated device may be retrieved at University Police.

**Attendance:** Students are required to attend scheduled lectures, labs, and field trips; and to work on class and lab/field assignments as scheduled by the professor. Students are required to attend their scheduled sections for labs, lectures, and examinations (unless authorized by the professor). Since class sessions start on the hour, students are expected to be punctual. *There will be no late entries once a class has begun.* In this case, student's absence will be counted as *unexcused* and will receive a zero for any assignments due.

If a student must leave class early during a regularly scheduled meeting, he/she must discuss reasons with the professor. If a student must miss a scheduled class meeting due to an acceptable, verifiable time conflict, he/she must resolve the time conflict *prior to* class.

If a student is unable to attend class because of an emergency, the professor or School of Agriculture and Natural Resources office must be contacted *prior to* the scheduled class meeting. The telephone number is 684-6515 (Dr. Hofmeyer) or 684-6083 (School office). Use of e-mail ([hofmeypv@morrisville.edu](mailto:hofmeypv@morrisville.edu)) is highly recommended.

Students failing to call ahead or discuss absences prior to the class will be unexcused. If a student accumulates four *unexcused* absences, he/she will be given the option of dropping the course or receiving a failing grade for the semester.

**Honesty Policy & Discipline (Due Process):** Honesty and integrity are major elements in professional behavior and are expected of each student. Any assignment (including those in electronic media) submitted by a student must be of the student's original authorship. Representation of another's work as his/her own shall constitute plagiarism. Cheating, in any form, is considered unacceptable behavior within all University courses. Students having academic problems should consult with their advisor or a college counselor. Instances of cheating will be dealt with in accordance to University policy. Standards of academic honesty and due process procedures for Morrisville College are located in the Rules, Regulations & Expectations section of the student handbook.

**Safety Guidelines:** Certain class assignments may require the student to be absent from the professor's immediate supervision. Whether the student is under immediate supervision or not, safe conduct and safe use of equipment shall be the ultimate rule. Failure to comply with prudent safety practice and/or willful disregard for class participants and/or equipment may be cause for immediate dismissal from that particular class session by the professor. Subsequent similar activity may be cause for dismissal from the course by the School Dean.

#### **GRADING/EVALUATION OF THE STUDENT:**

Evaluation is a shared responsibility between the teacher and the student. The purpose of the evaluation is to demonstrate how well the professor has taught and the student has learned specific course materials, the principles, concepts and terms relevant to the renewable energy field, and to determine the students' ability to apply that knowledge to specific situations.

**Grade Method:** Many laboratory periods will have a graded component or exercise. These may be written assignments, in-lab assignments, homework, or the evaluation of the student's participation and attitude. These components will total sixty percent (60%) of the total course score. It is important that students come to class, be actively engaged in laboratory exercises, complete their assignments accurately, neatly, and submit them on time. Assignments received past the due date will be devalued 50% for each day that the item is late. No class assignment of any student will be graded (for credit) once the same assignment is corrected and returned to the class.

Two exams will be given in lab. The first exam will be a unit test on wind energy system components and wiring, and the second exam will be a comprehensive exam on wind energy systems (including site assessment). Each exam will be worth 20% of the total course score. No make-up examination will be given without a written medical excuse, family emergency, or prior permission from the instructor. Students are responsible for all material covered in the class whether presented orally during the lectures and laboratory or assigned (homework and reading).

The breakdown of grading is as follows:

|                                 |            |
|---------------------------------|------------|
| Midterm exam                    | 20%        |
| Final exam                      | 20%        |
| Homework/laboratory assignments | 40%        |
| <u>Lab participation</u>        | <u>20%</u> |
| TOTAL                           | 100%       |

|                       |               |               |               |               |
|-----------------------|---------------|---------------|---------------|---------------|
| <b>Grading Scale:</b> | 100 - 94% = A | 89 - 87% = B+ | 79 - 77% = C+ | 69 - 65% = D+ |
|                       | 93 - 90% = A- | 86 - 83% = B  | 76 - 73% = C  | 64 - 60% = D  |
|                       |               | 82 - 80% = B- | 72 - 70% = C- | Below 60% = F |

**TENTATIVE OUTLINE OF TOPICS\*:**

| <b>Week</b> | <b>Topics (Lecture and Lab)</b>   |
|-------------|---|
| 1           | Introduction, NABCEP JTA, Entry Quiz  |
| lab         | Lab safety, lab setup, Mini turbines (I)  |
| 2           | Wind system overview, history and development   |
| lab         | Mini Turbines (part II)   |
| 3           | Wind power and wind shear   |
| lab         | Wind tunnel   |
| 4           | Wind energy and frequency distributions   |
| lab         | Excel Exercise, basic stats... (e.g. Bergey Wind CAD)   |
| 5           | Site Assessment (analyzing client's needs)  |
| lab         | Bergey Site data – measuring the wind   |
| 6           | Site assessment - Wind Shear (wind quantity) vs. turbulence (wind quality)                            |
| lab         | Site Plans and site assessment  |
| 7           | Turbine overview (components, orientation, HAWTs, VAWTs)  |
| Lab         | System build I  |
| 8           | Component operation (drive trains and rotors)   |
| <b>lab</b>  | <b>Midterm Exam</b>   |
| 9           | Mechanical integration (towers and foundations)   |
| lab         | System Build II   |
| 10          | Electrical Integration  |
| lab         | Turbine wiring I  |
| 11          | Wind Code I   |
| lab         | Turbine Wiring II   |
| 12          | Wind Code II  |
| lab         | Skystream functioning and troubleshooting   |
| 13          | Tower layout (guyed lattices, SSV, Monopole, TUT)   |
| lab         | Bergey Site visit (system components, setup, inspection, soils chart, foundation, guy tension, bolts) |
| 14          | Ordinances and wind explorer  |
| lab         | Equine site assessment, tree height, soils  |
| 15          | Wind system economics (including economics and wind characteristic impacts)                           |
| <b>lab</b>  | <b>Comprehensive Final Exam</b>   |

*\*The topics and corresponding schedule listed in the table above are tentative and may be subject to change during the semester.*