RENG 420 – Residential Wind Systems

2013 Spring Semester
3 Credits (2 50-minute lectures, 3-hour laboratory)
Pre-requisites: MATH 141, RENG 320

INSTRUCTOR:

Dr. Philip V. Hofmeyer, 108 Shannon Hall
On-campus mailbox: Marshall Hall
Office phone: 315- 684-6515
E-mail: 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:

RENG 420 is a 3-credit hour class (2 hours of lecture and 3 hours of laboratory) that that builds on RENG 320. The focus is on siting small wind systems, plotting and analyzing Weibull and Rayleigh wind distribution functions, analyzing wind shear and turbulence data, tip-speed ratios, optimizing turbine-inverter interactions for maximum energy production, rotor design, electrical system design, and system troubleshooting. Paperwork necessary for grant funding and New York State ordinances are also covered. This course will heavily emphasis the NABCEP requirements for small wind site assessment. Spring semester.

EXPECTED COURSE OUTCOMES:

The overall objective of this course is to provide the student with a thorough understanding of the wind resource and system components to adequately design and site residential wind systems. Upon completion of this course, the student will be able to:

1. Collect and analyze anemometer data
2. Analyze the impact of wind turbulence on energy production
3. Create 1-line and 3-line wind system diagrams
4. Collect and analyze inverter data to optimize system efficiency
5. Critique various residential small wind turbines and inverters to select the proper equipment for a given site
6. Assess and augment small wind ordinances for towns in New York State
7. Scrutinize technical journal articles through a process of identifying article strengths, insights, and areas for improvement (SII methodology)
8. Employ safe work habits at heights, with high voltage, and high electrical current

INSTRUCTIONAL METHODS:

1. Lecture/laboratory/problem solving sessions.
2. Reading assignments.
3. Homework and laboratory exercises.
4. 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).

Hart, G.V., and S. Hart. 2009. Ugly's Electrical References, Revised 2008 Edition. Jones and Bartlett Publishers. 186 p. (ISBN: 978-0-7637-7126-3). ($13)

Additionally, a course manual will be prepared for the students based upon the references listed below and readings from technical journals (e.g. Homepower).

REFERENCES:

Ackermann, T. Wind Power in Power Systems. 2005. Wiley Publishing, 742 p. (ISBN: 978-0470855089)

Ahrens, C.D. Meteorology Today. 9th Ed. Brooks Cole Publishing, 624 p. (ISBN: 0495555738)

Manwell, J.F., J.G. McGowan, and A.L. Rogers. 2009. Wind Energy Explained, second edition. Wiley Press, 577 p. (ISBN: 978-0-470-01500-1).

National Electric Code. 2011. National Fire Protection Association. 840 p. (ISBN: 0877657904).

STUDENT REQUIRED EQUIPMENT:

Notebook, scientific calculator, work boots, laptop, 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) 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 class 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 twenty percent (20%) of the total course score. It is important that students 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.

Three lab projects will be given throughout the semester. Each of these lab projects will be full site assessments ranging from fairly simple to complex. Students are expected to show continual growth throughout the semester ending with an excellent wind site assessment. Each site assessment will be worth 20% of the total course score.

A final written exam will follow the North American Board of Certified Energy Practitioners (NABCEP) Small Wind Site Assessor Job Task Analysis (uploaded onto Blackboard). This will prepare students to take the exam once they graduate. Like the NABCEP exam, the final exam will be multiple choice and will be worth 20% of the final grade in the course.

The breakdown of grading is as follows:

Homework	20%
Three site assessments	60%
Final Exam	20%
TOTAL	100%

Grading Scale:

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*:

Week	Topics (Lecture and Lab)
1	Syllabus, NABCEP, Entry Quiz, Review of Entry Quiz
Lab	Mini turbines – Review of basic wind theory
2	Basic statistics with wind data
Lab	Dairy Complex site evaluation – be prepared for cold weather
3	Wind meteorology (playing with bubbles, frequency distributions)
Lab	Cleaning data, plotting wind speeds, MYSTAT
4	Wind quantity (monitoring, power and energy, ground drag)
Lab	creating frequency distributions , Create wind rose, estimate wind shear
5	Wind quantity (wind shear, seasonality, wind maps, wind rose, visual cues)
Lab	Estimate TI, Dairy Complex site assessment report
6	Wind quality (turbulence, siting rules, displacement)
Lab	Tax maps, airports, Google/Bing maps (Remote residential)
7	Wind quality (wind maps, trip lines, orography, wind windows)
Lab	Estimate the wind resource (AWS Truewind report) , topo maps, soils maps
8	Towers and foundations
Lab	Wire runs, voltage drop, ampacity, wire gauges (three turbine/controller setups)

9	Turbines (solidity, lift vs. drag, imperfect VAWT airfoils, alternators)
Lab	Tower layout
10	Turbines (Governing)
Lab	Site assessment report for residential client
11	Run-through of turbines up to 100 kW
Lab	Site evaluation for Equine (remote)
12	Zoning, on-the-ground assessment
Lab	Site Evaluation for Equine (in-field)
13	Interconnection and Economics and Incentives
Lab	Wind speed maps, applying derating metrics, wind shear, displacement, etc.
14	NEC Article 694
Lab	Basic Tree ID (top 15 in NYS)
15	NEC article 705
Lab	Equine Rehabilitation Center Site Assessment Report
Final	Final Exam - TBA

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