RENG 435 – Advanced Topics in Solar Photovoltaics Systems
Spring Semester, every other year
3 Credits (3 hours of lecture weekly)
Pre-requisites: RENG 430

INSTRUCTOR:
Dr. Philip V. Hofmeyer, 103 Shannon Hall
On-campus mailbox: Marshall Hall
Office phone: 315- 684-6515
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OFFICE HOURS:
TBA. If necessary, students are also encouraged to make appointments to see the instructor at other times.

ACCOMODATIONS:
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. Students are highly encouraged to make arrangements with the Academic Support Center.

COURSE DESCRIPTION:
Solar Photovoltaics systems are rapidly changing in scope, scale, and development. Advanced Topics is a flexible, leading edge course that mirrors the changes in industry to meet the high demands of this renewable energy job sector. Examples of semester topics include commercial/industrial systems, high voltage DC systems, transformers, utility interconnection, and storage-based micro grids. National Electrical Code, AutoCAD, and the NABCEP examination are integral components of this high-level, project-based course.
Prerequisites: RENG 430 minimum grade of C.
3 Credits (3 hours lecture)

EXPECTED COURSE OUTCOMES:
The goal of this course is to engage students with innovative assessment, design, and implementation of advanced solar PV systems. Upon successful completion of this course, students will be expected to:

1. Assess potential sites for commercial solar PV development
2. Design Code-compliant mechanical and electrical layouts for commercial systems
3. Design Code-compliant electrical layouts for battery-based systems, including fully standalone and grid-connected (AC- and DC-coupled)
4. Predict annual kWh production from all scales of solar PV systems
5. Interpret utility CESIR grid study reports and mitigate insufficient site characteristics
6. Draft technical reports to summarize designs
7. Work competently in a consulting/team role
8. Employ safe work habits around solar energy systems.

INSTRUCTIONAL METHODS:

1. Project-based problem solving sessions (individual and group).
2. Reading assignments.
3. In-class demonstrations, short student-peer presentations, and discussions.
4. Homework exercises.

REQUIRED TEXTS:

Current version of the National Electrical Code (downloaded from the Morrisville Sate College Library NFPA collection).

Ugly's Electrical References. 2017. Jones and Bartlet Publishing. 199 p. ISBN-13: 978-1284119367

STUDENT REQUIRED EQUIPMENT:
Notebook, texts, scientific calculator, laptop, 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) 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.

Civility:
My classroom revolves around professional civility – we will treat one another with respect and carry ourselves with integrity at all times. We come from different backgrounds, ethnicities, genders, and life experiences. Use this rich background as a means for expanding your personal boundaries rather than searching for differences to demean another person. I have a zero tolerance policy for crass behavior and you will be referred to the Dean if you cannot comply with this policy.

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: This advanced course is project-based. Each project is designed to allow for continual progression in design and implementation of your unique photovoltaic system knowledge. Each project will range from 1-2 weeks in length, based on expectations and complexity. Successful completion of these projects will include short technical reports covering site analysis, mechanical design, electrical design, and/or electricity production estimates. While most projects will be completed individually, there will be at least 1 group project where your team will act as a consulting firm. Assessment and grading rubrics will be distributed to students when a project is assigned.

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 for Spring 2018*:

Week	Topics	Assessed
1	Review of residential PV systems (shade assessment, kWh production, essential electrical configurations, essential mechanical configurations)	RENG 430 finals reviewed
2	AC-coupled, grid interactive systems (Conceptual overview, general awareness)	CAD 1- line electrical diagram
3	AC-coupled, grid interactive systems (AC and DC system sizing, transfer switchgear, and standby generators)	CAD 1-line electrical diagram
4	DC-coupled, grid-interactive systems (Component analysis, power panels, DC optimization)	CAD 1-line electrical diagram
5	Roof-mounted commercial system (ca. 200 kW) mechanical layout and kWh production estimate	Helioscope and Aurora layouts
6	Roof-mounted commercial system (ca. 200 kW) existing electrical system analysis (3-phase grid review, riser diagrams, 3-phase power and current)	CAD Riser diagram
7	Roof-mounted commercial system (ca. 200 kW) solar PV design (kWh estimates, string sizing, voltage drop, ampacity, system sizing)	CAD 1-line diagram
8	Commercial site assessment (1+ MW) (plot size, SEQR forms, transmission lines, utility CESIR study report analysis, commercial utility bills)	SEQR Short form completion
9	Commercial mechanical layout (1+ MW) initial site utilization and kWh estimate	Helioscope output
10	Commercial mechanical layout (1+ MW) initial site utilization and kWh estimate	Aurora output
11	Commercial electrical layout (1+ MW) (electrical BOS, ampacity, voltage drop, switchgear, transformers)	CAD 1-line diagram
12	Commercial finalization (clean up drawings, sizing modifications) Final project introduction (new commercial system, 1+ MW, groups)	CAD 1-line diagram
13	Commercial system metering options (remote net metering, community net metering, monetized credits)	Helioscope/Aurora and CAD group project
14	Commercial system financing options (volumetric, monetary, leasing, power purchasing agreements)	Helioscope/Aurora and CAD group project
Finals week	Final project group presentations	Written and oral presentations

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