RENG 231 – Introduction to Solar Photovoltaics

3 Credits (2 50-minute lectures, 2-hour laboratory)
Pre-requisites: ELEC 190 or DTEC 125 or AGEN 125, MATH 102

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:

This course provides students with an introduction to solar energy and the impacts of seasonality, aspect, and latitude on solar resources. Students are engaged with system components and design of solar photovoltaic electricity generation in both grid-tied and off-grid systems. This course covers the Job Task Analysis for the North American Board of Certified Energy Practitioners (NABCEP) Solar PV Entry Level examination.
Prerequisites: ELEC 190 or DTEC 125 or AGEN 125, MATH 102 minimum grade of C.
3 Credits (2 hours lecture, 2 hours laboratory).

EXPECTED COURSE OUTCOMES:

The overall objective of this course is to provide the student with a technical understanding of solar electric systems. Upon completion of this course, the student will be able to:

1. Measure and map solar resources.
2. Define and describe solar photovoltaic system components.
3. Evaluate potential solar PV system sites.
4. Assemble conductors, battery banks, inverters, and charge controllers correctly.
5. Identify cost sharing and incentives for solar PV systems.
6. Critique and troubleshoot solar photovoltaic systems.
7. Employ safe work habits around solar energy 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).

REQUIRED TEXT:

Dunlop, J.P. 2010. Photovoltaic Systems, 2nd Ed. American Technical Publishers, 469 p. (ISBN: 978-0-8269-1308-1).

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

REFERENCES:

Solar Energy International. 2004. Photovoltaics: Design and Installation Manual. New Society Publishers, 326 p. (ISBN: 978-0-86571-520-2).

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.

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 fifty percent (50%) 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.

Two exams will be given over the course of the semester. A midterm exam and final comprehensive exam. 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 labratory or assigned (homework and reading). All exams will be multiple choice, just as the NABCEP exams are structured.

The breakdown of grading is as follows:

PV exams (midterm and final)	40%
Homework/laboratory assignments	50%
Class participation	10%
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	Photovoltaics Overview, solar PV industry
lab	NABCEP COK JTA, Lab Safety, Course overview, MDP review
2	Solar power and energy
lab	NREL data
3	Mounting and Racking
lab	Roof penetrations, flashing and racking system
4	Balance of Systems
lab	Wiring diagrams, PVP wiring, multimeters
5	System sizing (I-V and string sizing)
lab	Wiring diagrams, Enphase wiring, conduit, IV curves
6	Commissioning and interconnection
lab	Commissioning, decommissioning PVP and Enphase
7	Wire sizing (voltage drop and ampacity)
lab	**Midterm Examination**
8	Grounding I
lab	Grounding exercise
9	Grounding II
lab	Complete wire sizing exercise
10	Off-grid – charge controllers and batteries
lab	Off-grid battery and charge controller configurations
11	Off-grid system sizing
lab	Battery bank sizing
12	Site analysis
	Solar Pathfinder and Sun Eye
13	PV system economics (incentives and tax credits)
lab	PV economics
14	PV system design project
	Site plans and disconnect plans
15	PV review
lab	Technical hands-on assessment (multimeters, wiring diagrams, connections)
	Comprehensive Final Exam

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