# RENG 101 – Basic Electricity for Renewable Energy

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

**Co-requisites: MATH 102**

**INSTRUCTOR:**

Dr. Philip V. Hofmeyer, 103A Shannon Hall
On-campus mailbox: Marshall Hall
Office phone: 315-684-6515
E-mail: hofmeypv@morrisville.edu

**OFFICE HOURS:**

I have an open door policy when I am not teaching a class. If my door is not closed tight, please knock and come in. If necessary, students are encouraged to make an appointment to ensure I am there at a specific time.

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 101 – Basic Electricity for Renewable Energy
Introductory course covering DC and AC electrical circuits as applied to renewable energy fields, including solar photovoltaics, small wind, micro hydroelectricity, biofuel generators, and standalone power systems (batteries and generators). Fundamental theoretical concepts will be intimately linked to hands-on laboratory exercises that form the basis for subsequent renewable energy courses. Power conditioning components will also be emphasized, including charge controllers, inverters, and diversion loads.

Co-requisite: MATH 102
4 credits (3 lecture hours and 2 lab hours), Fall semester

**Course Learning Outcomes:**

Upon successful completion of RENG 101, students will be able to:

1. Apply Ohm's Law and Power Law to simple renewable energy systems.
2. Describe and measure the common supply phasing and voltage to residential and commercial electricity customers.
3. Use a digital multimeter to test circuit components.
4. Analyze common DC and AC renewable energy power supplies (e.g. wind turbines and solar PV modules).
5. Describe essential functioning and interaction between renewable energy balance-of-system components (controllers, inverters, batteries, switchgear, combiners, and diversion loads).
6. Work safely in small, supervised groups with electrical components.

**INSTRUCTIONAL METHODS:**

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

**REQUIRED TEXTS:**

Goodstal, Gary. 2013. Electrical Theory for Renewable Energy. Cengage Learning. 352 p. ISBN-13: 9781133127550 (approx cost: $20 - $40 in both paper and e-text format)

UGLY's Electrical References. 2017. Jones and Bartlett Learning. 199 p. ISBN: 978-1-284-11936-7 (approx cost $20).

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

**STUDENT REQUIRED EQUIPMENT:**

Multimeter, scientific caluclator, safety glasses, laptop.

**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 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.

**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.

**Attendance:** Students are required to attend scheduled lectures, and labs; and to work on class and lab 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 must be contacted *prior to* the scheduled class meeting. The telephone number is 684-6515 (Dr. Hofmeyer). 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 (4) *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 laboratory 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 lecture periods will have a graded exercise. These may be written 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 class. The first exam will be a unit test on DC circuits, and the second exam will be a comprehensive exam on both AC and DC circuits. These exams will be worth 40% 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 during the lectures or assigned (homework and reading).

The breakdown of grading is as follows:

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|---|---|
| Homework/in-class assignments | 60% |
| Exams | 40% |
| TOTAL | 100% |

**Grading Scale:**

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|---|---|---|---|
| 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) |
|---|---|
| 1 | Course introduction, use of Blackboard. Atoms, charges, and electricity |
| 2 | Overview of electrical circuits, Ohm's Law, Power Law |
| 3 | Power Law, Efficiency, Resistors |
| 4 | DC series circuits, DC parallel circuits, basic troubleshooting |
| 5 | Complex DC circuits, Complex DC power sources |
| 6 | PV I-V curves and cell temperature corrections |
| 7 | **Midterm Exam on Thursday (no class on Tuesday)** |
| 8 | Electromagnetism, DC motors, AC alternators |
| 9 | AC resistance, capacitance, inductance |
| 10 | R-C, R-L, and R-L-C series circuits |
| 11 | R-L-C parallel circuits, Rectangular and polar coordinates |
| 12 | Power factor corrections, introduction to 3-phase systems, phasor diagrams |
| 13 | Final exam overview (**no class on Thursday)** |
| 14 | Split-phase and three-phase grids, phasor analysis |
| 15 | Current analysis on split-phase and 3-ph grids |
| | **Final Exam during exam week** |