Navajo Technical University http://navajotech.edu
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ERS 102-01 Photovoltaic Theory

3-Hour Credit
Spring Semester 2018
Cap: 20

Faculty: Raymond Griego
Office: Mod-3
Office Hours: Wed/Thurs 10:00-11:30
Class Location: Mod-3
Class Meeting Times: M-W 12:30-1:50

E-mail: rgriego@navajotech.edu
Office Phone: 505 786-4308

Required Materials: Calculator**,** Notebook

Textbooks: Photovoltaic Design and Installation;
The Electrician's Guide to Photovoltaic System Installations
Tools: Electrical Hand Tools
Lab Fee: **$125.00**

Mission Statement

Navajo Technical University's mission is to provide University readiness programs, certificates, associate, baccalaureate, and graduate degrees. Students, faculty, and staff will provide value to the Diné community through research, community engagement, service learning, and activities designed to foster cultural and environmental preservation and sustainable economic development. The University is committed to a high quality, student-oriented, hands-on-learning environment based on the Diné cultural principles: *Nitsáhákees, Nahátá, Íína, Siihasin.*

Course Description

An overview of theory and manipulation or arrangement of photovoltaic modules, mounting, controllers, batteries, inverters, load calculations and water pumping will be covered. How solar cells generate electricity will be emphasized. Students will be introduced to the proper and safe use of tools and equipment for installations of photovoltaic systems. Students will be required to install a photovoltaic systems and its hardware. Solar site analysis will include orientation of azimuth angle, magnetic declination, tilt angle, and magnetic declination. Understanding safe installations, which include conductor size, over current protection and grounding procedures will be stressed. A research paper or poster will be required from all students; the research paper or poster may be a group effort.

Week	Date	Chapters	Assignments	Quizzes
1		Development of Photovoltaic	Write a two report	
	1-19	**Last day to add/drop**		
2		Electric Principles	Homework/Lab	
3		Solar Resources	Homework/Lab	Chap 1-3
4		Load Analysis	Homework/Lab	
5		PV Modules	Homework/Lab	
	3-2	**Graduation Petition is due**		
6		**Batteries**	Homework/Lab	Chap 4-6
7		**Controllers**	Homework/Lab	
8	March 5-9	Midterm; grades are due		**Exam**
9		Inverters	Homework/Lab	
	March 29	**Last day to withdraw with a "W"**		
10		Systems Wiring	Homework/Lab	
11		Stand Alone Systems	Homework/Lab	Chap 9-11
12		Grid-tied Systems	Homework/Lab	
13		Mounting Modules	Homework/Lab	
14		Maintenance	Homework/Lab	**Chap 12-13**
15		Applications	Homework/Lab	
16		**Project Presentation**		
17	May 7-10	Final Exam		Finals
17	**May 10**	**Grades are due to the Registrar**		
17	**May 11**	**Graduation**		

Course Objectives

1. Solar Site Analysis and the required skills to determine magnetic declination
2. Relate how module orientation will affect conductor sizing and related components
3. Recognize codes to safely install a complete photovoltaic system
4. Relate how the connecting of modules and batteries are manipulated
5. Evaluate loads and load requirements
6. Develop awareness of stand only, hybrid , and grid tied systems
7. Develop skills to document the efficiency of a photovoltaic system

COURSE OUTCOMES	COURSE MEASUREMENTS
A strong understanding of how and explain how electrons move when sunlight strikes the surface of a photovoltaic module	Complete reading assignments, homework assignments, exams, projects, and quizzes.
A strong understanding of how to interpret and design a schematic to connect modules, inverters, controllers and batteries	
A strong understanding of the safety and understanding of overcurrent protection	
A strong understanding of energy storage and load analysis	
A strong ability to determine module and battery arrangement; series, parallel and series parallel circuits	
A strong ability to wire AC/DC circuits	
A strong ability to follow a plan of operation	
A strong ability to determine correct magnetic declination as it relates to siting a system	
A strong knowledge of to evaluate loads/requirements	
An ability to communicate with and program equipment	

Grading Plan

Homework	20%	A = 100 - 90%
Mid-term	20%	
Final Exam	25%	B = 89 - 80%
Project	10%	
Quizzes	20%	C = 79 - 70%
Class Participation	3%	D = 69 - 60%
Portfolio:	2%	F < 60%

Grading Policy

Each student must do his or her own homework and case studies. Discussion among students on homework and cases is encouraged for clarification of assignments, technical details of using software, and structuring major steps of solutions - especially on the course's Web site.

Students must do their own work on the homework and exam. Cheating and Plagiarism are strictly forbidden. Cheating includes but is not limited to: plagiarism, submission of work that is not the student's own, submission or use of falsified data, unauthorized access to exam or assignment, use of unauthorized material during an exam, supplying or communicating unauthorized information for an assignment or exam.

Participation

Students are expected to attend and participate in all class activities- as listed above, as it **is 3% of the grade**. Points will be given to students who actively participate in class activities including field trips, laboratories, and ask questions of guest speakers and other presenters.

Cell phone and head phone use

Please turn cell phones off or place them on silence or vibrate mode **before** coming to class. Also, answer cell phones **outside of class** (not in the classroom). Exercising cell phone use courtesy is appreciated by both the instructor and classmates. Headphones are to be removed before coming to class.

Attendance Policy

Students are expected to regularly attend all classes for which they are registered. A percentage of the student's grade will be based on class attendance and participation. Absence from class, regardless of the reason, does not relieve the student of his/her responsibility to complete all course work by the required deadlines. Furthermore, it is the student's responsibility to obtain notes, handouts, and any other information covered when absent from class and to arrange to make up any in-class assignments or tests if permitted by the instructor. Incomplete or missing assignments will necessarily affect the student's grades. Instructors will report excessive and/or unexplained absences to the Counseling Department for investigation and potential intervention. **Instructors may drop students from the class after three (3) absences unless prior arrangements are made with the instructor to make up work and the instructor deems any excuse acceptable.**

Study Time Outside of Class for Face-to-Face Courses

For every credit hour spent in a class, a student is expected to spend two hours (2) outside of class studying the course materials.

Study Time for Hybrid or Blended Courses

For a hybrid or blended course of one (1) credit hour, a student is expected to spend three (3) hours per week studying the course materials.

Study Time for Online Courses

For an online course of one (1) credit hour, a student is expected to spend four hours (4) per week studying the course materials.

Academic Integrity

Integrity (honesty) is expected of every student in all academic work. The guiding principle of academic integrity is that a student's submitted work must be the student's own. Students who engage in academic dishonesty diminish their education and bring discredit to the University community. Avoid situations likely to compromise academic integrity such as: cheating, facilitating academic dishonesty, and plagiarism; modifying academic work to obtain additional credit in the same class unless approved in advance by the instructor, failure to observe rules of academic integrity established by the instructor.

Diné Philosophy of Education

The Diné Philosophy of Education (DPE) is incorporated into every class for students to become aware of and to understand the significance of the four Diné philosophical elements, including its affiliation with the four directions, four sacred mountains, the four set of thought processes and so forth: Nitsáhákees, Nahát'á, Íína and Siih Hasin which are essential and relevant to self-identity, respect and wisdom to achieve career goals successfully.

Students with Disabilities

The Navajo Technical University and the Energy Systems Program are committed to serving all enrolled students in a non-discriminatory and accommodating manner. Any student who feels he/she may need an accommodation based on the impact of disability, or needs special accommodations should inform NTU in accordance with the procedures of the subsection entitled "Students with Disabilities" under Section 7: Student Support Programs, NTU Student Handbook.