

Imperial Valley College Course Syllabus –Solar Energy Systems PV1

Basic Course Information

Semester	Spring 2016	Instructor's Name	
Course Title & #	Solar Energy Systems PV 1 RNEW 150	Arturo Juarez Rodelo	
CRN #	20935	Webpage (optional)	arturo.juarez@imperial.edu
Room	3119	Office (PT Faculty:809)	
Class Dates	16 Feb-10 Jun, 2016	Office Hours (n/a for PT Faculty)	
Class Days	Tues-Thurs	Office Phone # (PT may use dept. number)	760 355 6361
Class Times	8:00- 11:00 am 8:00-10:15	Who students should contact if emergency or other absence	Dept Secretary is an option Cell 760 222 5704
Units	3		

Course Description

This course provides students with instruction in the principles of photovoltaic (PV) technology that meets NSF and NABCEP guidelines, and qualifies the students to take the NABCEP Solar PV Entry Level Exam, instruction includes an overview of electric principles, the solar resource, electrical load analysis, PV modules, controllers, batteries, inverters, PV systems utility, interactive systems, integrating (PV) into buildings and systems applications. Basic installation, maintenance, troubleshooting and safety.
(Formerly EWIR 150)(Non transferable AA/AS degree only)

Student Learning Outcomes

Upon course completion, the successful student will have acquired new skill, knowledge and or attitudes as demonstrated by being able to

1. Identify the laws of solar energy, its effects and understand electrical power generation from solar energy. (ILO2, ILO3)
2. Explain the photovoltaic systems principles, applications, configurations, components, functions and Sizing (ILO1, ILO2)
3. Understand photovoltaic systems protection, disconnects, grounding, installation, maintenance and troubleshooting utilizing National Electrical Code. (ILO2, ILO3)

Course Objectives

Upon satisfactory completion of the course, students will be able to:

1. Explain and apply OSHA safety and health standards, policies and procedures for general industry.
2. Locate orientation and declination of the sun for different seasons of the year using national geophysical data center maps.
3. Compare the advantages and disadvantages of photovoltaic technology.
4. Explore the advantages of passive solar home design.
5. Perform load estimates using electrical load requirements use national electrical code.
6. Explain series and parallel circuits in power sources and electric loads.
7. Explain the photovoltaic principles of photovoltaic arrays.
8. Describe battery specifications, types, operations and sizing.
9. Identify controller types, features and sizing.
10. Investigate inverters operating principles, features, efficiency, types and sizing.

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11. Explain Grid-tied, net-metering of a utility interactive-photovoltaic system.
12. Describe the operation of a hybrid system with generators.
13. Explore photovoltaic system installation, protection, disconnects, and grounding utilizing NEC .
14. Troubleshoot photovoltaic wiring problems using a multimeter and OHM's law.

Textbooks & Other Resources or Links

Solar Energy International (2012). *Solar Electric Handbook: Photovoltaic Fundamentals and Applications* New Society Publishers. ISBN: 13: 978-1-256-91816-5

Boxwell, Michael (2012). *Solar Electricity Handbook - 2012 Edition: A Simple Practical Guide to Solar Energy - Designing and Installing Photovoltaic Solar Electric Systems* (2012/e). Greenstream Publishing. ISBN: 978-1907670183

Photovoltaic Systems Jim Dunlop PE ISBN 978-0-8269-1287-9 NJATC Staff

National Fire Protection Association (2014). *NEC - National Electrical Code Handbook* (1st/e). NFPA

Course Requirements and Instructional Methods

Below is the Instructional Scale :

Breakdown (100 points)

Reviews:	20%
Shop practices:	30%
Midterm:	25%
Final:	<u>25%</u>
	100%

Teaching Methods: Discussion of assignments and instructional methods will be a combination of all methods of instruction, which can be classified as telling, lecturing, or discussing; showing or demonstrating.

Out of Class Assignments: The Department of Education policy states that one (1) credit hour is the amount of student work that reasonably approximates not less than one hour of class time and two (2) hours of out-of-class time per week over the span of a semester. WASC has adopted a similar requirement.

Course Grading Based on Course Objectives

The course grade is based on total points accumulated during the semester. There is a maximum of 100 points. Very limited extra credit points may be available, either through some class participation activity, group work or perfect attendance. Failing to turn in regular assignments will stop you from being able to earn extra credit points and late assignments will have points subtracted.

Final Grades are calculated as follows:

Grade	Points
<u>A</u>	90-100
<u>B</u>	80-89
<u>C</u>	70-79
<u>D</u>	60-69
<u>F</u>	Below 60

Grading Rubrics: In addition to the percentages and points listed above the following grading rubric (standards expected) will be used when grading student assignments. The description that best fits your work will be the

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assigned grade.

Grade	Rubric or Standard Expected
<u>A</u>	Focused and clearly organized. Contains advanced critical thinking and analysis. Convincing evidence is provided to support conclusions. Clearly meets or exceeds assignment requirements.
<u>B</u>	Generally focused with some development of ideas, but may be simplistic or repetitive. Evidence is provided to support conclusions. Occasional grammatical errors. Meets assignment requirements, but does not exceed.
<u>C</u>	Unfocused, underdeveloped, or rambling, but has some coherence. Minimal evidence is provided to support conclusions. Several grammatical errors. Meets
<u>D</u>	Unfocused, underdeveloped, and/or rambling. Limited evidence is used to support conclusions. Serious grammatical errors that impede overall understanding. Does not address the assignment requirements
<u>F</u>	Unfocused, underdeveloped, and/or rambling. Incomplete or too brief. No evidence is used to support conclusions. Serious grammatical errors that block overall understanding. Does not meet assignment requirements. Minimal to no student effort.

Attendance

- A student who fails to attend the first meeting of a class or does not complete the first mandatory activity of an online class will be dropped by the instructor as of the first official meeting of that class. Should readmission be desired, the student's status will be the same as that of any other student who desires to add a class. It is the student's responsibility to drop or officially withdraw from the class. See General Catalog for details.
- Regular attendance in all classes is expected of all students. A student whose continuous, unexcused absences exceed the number of hours the class is scheduled to meet per week may be dropped. For online courses, students who fail to complete required activities for two consecutive weeks may be considered to have excessive absences and may be dropped.
- Absences attributed to the representation of the college at officially approved events (conferences, contests, and field trips) will be counted as 'excused' absences.

Classroom Etiquette

- Electronic Devices: Cell phones and electronic devices must be turned off and put away during class unless otherwise directed by the instructor. **Consider**: specifics for your class/program
- Food and Drink are prohibited in all classrooms. Water bottles with lids/caps are the only exception. Additional restrictions will apply in labs. Please comply as directed.
- Disruptive Students: Students who disrupt or interfere with a class may be sent out of the room and told to meet with the Campus Disciplinary Officer before returning to continue with coursework. Disciplinary procedures will be followed as outlined in the General Catalog.
- Children in the classroom: Due to college rules and state laws, no one who is not enrolled in the class may attend, including children.

Academic Honesty

- Plagiarism is to take and present as one's own the writings or ideas of others, without citing the source. You should understand the concept of plagiarism and keep it in mind when taking exams and preparing written materials. If you do not understand how to correctly 'cite a source', you must ask for help.
- Cheating is defined as fraud, deceit, or dishonesty in an academic assignment or using or attempting to use materials, or assisting others in using materials, or assisting others in using materials, which are prohibited

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or inappropriate in the context of the academic assignment in question.

Anyone caught cheating or will receive a zero (0) on the exam or assignment, and the instructor may report the incident to the Campus Disciplinary Officer, who may place related documentation in a file. Repeated acts of cheating may result in an F in the course and/or disciplinary action. Please refer to the General School Catalog for more information on academic dishonesty or other misconduct. Acts of cheating include, but are not limited to the following: (a) plagiarism; (b) copying or attempting to copy from others during an examination or on an assignment ;(c) communicating test information with another person during an examination; (d) allowing others to do an assignment or portion of an assignment, (e) use of a commercial term paper service

Additional Help – Discretionary Section and Language

- Blackboard support center: <http://bbcrm.edusupportcenter.com/ics/support/default.asp?deptID=8543>
- Learning Labs: There are several ‘labs’ on campus to assist you through the use of computers, tutors, or a combination. Please consult your college map for the Math Lab, Reading & Writing Lab, and Learning Services (library). Please speak to the instructor about labs unique to your specific program
- Library Services: There is more to our library than just books. You have access to tutors in the learning center, study rooms for small groups, and online access to a wealth of resources.

Disabled Student Programs and Services (DSPS)

Any student with a documented disability who may need educational accommodations should notify the instructor or the Disabled Student Programs and Services (DSP&S) office as soon as possible. If you feel you need to be evaluated for educational accommodations, the DSP&S office is located in Building 2100, telephone 760-355-6313.

Student Counseling and Health Services

Students have counseling and health services available, provided by the pre-paid Student Health Fee. We now also have a fulltime mental health counselor. For information see <http://www.imperial.edu/students/student-health-center/>. The IVC Student Health Center is located in the Health Science building in Room 2109, telephone 760-355-6310.

Student Rights and Responsibilities

Students have the right to experience a positive learning environment and due process. For further information regarding student rights and responsibilities please refer to the IVC General Catalog available online at http://www.imperial.edu/index.php?option=com_docman&task=doc_download&gid=4516&Itemid=762

Information Literacy

Imperial Valley College is dedicated to help students skillfully discover, evaluate, and use information from all sources. Students can access tutorials at <http://www.imperial.edu/courses-and-programs/divisions/arts-and-letters/library-department/info-lit-tutorials/>

Anticipated Class Schedule / Calendar

The instructor will provide a tentative, provisional overview of the reading, assignments, tests, or other activity for the duration of the course. The faculty may find a table format useful for this purpose.

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CORE CONTENT	APPROX. % OF COURSE
A. Electrical safety and safety for construction.	5.00%
B. The suns position and orientation	5.00%
C. Overview of Photovoltaic technology development and system types.	10.00%
D. Series and parallel circuits in power sources.	10.00%
E. Advantages of passive solar home design	5.00%
F. Load analysis, electrical load requirements and calculating load estimates use National Electrical Code.	10.00%
G. Principles of photovoltaic arrays and modules performance factors.	10.00%
H. Battery specification, types, safety, operations and sizing.	10.00%
I. Photovoltaic Controllers specifications, types, features and sizing.	10.00%
J. Inverters operating principles, types, efficiency, features, grid-tied, and standalone sizing.	10.00%
K. Overview of Photovoltaic system applications, installation, troubleshooting and maintenance.	15.00%
TOTAL	100%