College of San Mateo
Official Course Outline

1. **COURSE ID:** ELEC 144 **TITLE:** Solar Energy Fundamentals
   Semester Units/Hours: 4.0 units; a minimum of 48.0 lecture hours/semester; a minimum of 48.0 lab hours/semester
   Method of Grading: Letter Grade Only

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   This course covers the fundamentals of solar energy production, including both thermal and photovoltaic technologies. Included will be an overview of applicable electrical principles, load analysis, evaluation of the solar resource, system sizing principles, and coverage of the components included in off-grid and grid interactive systems. The lab section provides hands-on experience in building and testing solar based systems. Information will also be provided on the California rebate process and installer certification requirements for residential-based solar energy systems.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. describe the basics of electricity and electrical generation systems as applies to home and business applications
   2. complete an electrical load analysis of a home or business location and determine the average electrical power usage on a daily, weekly and monthly basis
   3. evaluate and analyze the solar resource available at a given site, including the prediction of solar energy available in both shaded and unshaded portions, the number of sun hours available at the site and the expected electrical generation potential of the site.
   4. identify and describe the function of all components necessary to design both off-grid and grid-intertie photovoltaic and thermal solar energy systems.
   5. prepare a solar photovoltaic or thermal system plan for an intended site, that will satisfy the energy needs of the site, including the incorporation of component inefficiencies and derating factors.
   6. describe the California rebate process and provisions as they apply to solar grid-interactive systems, either as a thermal or photovoltaic system.
   7. describe installer certification requirements as part of the California rebate process.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. describe the basics of electricity and electrical generation systems as applies to home and business applications
   2. complete an electrical load analysis of a home or business location and determine the average electrical power usage on a daily, weekly and monthly basis
   3. evaluate and analyze the solar resource available at a given site, including the prediction of solar energy available in both shaded and unshaded portions, the number of sun hours available at the site and the expected electrical generation potential of the site.
   4. identify and describe the function of all components necessary to design both off-grid and grid-intertie photovoltalc and thermal solar energy systems.
   5. prepare a solar photovoltaic or thermal system plan for an intended site, that will satisfy the energy needs of the site, including the incorporation of component inefficiencies and derating factors.
   6. describe the California rebate process and provisions as they apply to solar grid-interactive systems, either as a thermal or photovoltaic system.
   7. describe installer certification requirements as part of the California rebate process.

6. **COURSE CONTENT:**
   Lecture Content:
   1. Doing an Electrical Load Analysis
   2. Improving Electrical Efficiency

3. Review of Electricity & Electrical Concepts
4. Series & Parallel Sources/Loads
5. System Diagrams & Photos
6. The Electrical Grid & Electrical Generation Systems
7. AC Fundamentals & Generators
8. Evaluating the Solar Resource
9. Photovoltafc modules, panels & arrays
10. Batteries and Battery Systems
11. Solar Controllers Power Centers
12. Maximum Peak Power Transfer
13. Inverters
14. System Wiring
15. DC & AC Disconnects
16. Sizing Solar Energy Systems & Derating Factors
17. Rebates and the California Solar Initiative
18. NABCEP Installer certification requirements

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**
Typical methods of instruction may include:
A. Lecture
B. Lab
C. Activity
D. Discussion
E. Other (Specify): The course is in a lecture·demonstration mode for lectures and with instructor·guided hands-on activities for the lab portion of the course. In addition, students will do considerable review of current topics in renewable energy, and evaluation of currently available products on the market, as well as new industry trends. Reading assignments and homework comes from the course textbook and instructor-prepared laboratory activities. Critical thinking skills are accomplished through research of currently available products on the market and application to the design of real world thermal and photovoltaic solar energy systems.

8. **REPRESENTATIVE ASSIGNMENTS**
Representative assignments in this course may include, but are not limited to the following:
Writing Assignments:
1. Students may have a small group project centered on the uses/applications of solar energy principles.
2. Students may be assigned a short publication-based research paper on new developments in the industry.
3. Students may be assigned a research topic tied to various industries adopting solar power in innovative ways.
4. Students will have other similar activites appropriate for the course.

Reading Assignments:
1. Students will have regular reading assignments from the textbook.
2. Students will read current articles from a variety of publications with a concomitant discussion or writing assignment.

9. **REPRESENTATIVE METHODS OF EVALUATION**
Representative methods of evaluation may include:
A. Learning will be accomplished by evaluating homework assignments, completion of laboratory activies and evaluation of a completed solar energy system design. The evaluation process will include instructor as well as peer review of the system design project at the end of the course.

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
A. Dulop, J, NJATC. *Photovoltaic Systems*, 3rd ed. NJATC, 2012
Other:
A. Photovoltaic Systems. By Jim Dunlop, in partnership with National Joint Apprenticeship and Training Committee. Published by American Technical Pu lishers, Inc. Copyright 2007. (ISBN 978-0-8269-1287 -9)

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