Reedley College

CREDIT COURSE OUTLINE

I. COVER PAGE

(1) MFGT 94	(2) Introduction to Solar Technology	(3) 2
Number	Title	Units

(4)	Lecture / Lab Hours:			
	Course Hours			
		Weekly Lec hours:		36.00
		Weekly Lab hours:		9.00
		Total Contact hours:		45.00
	Lec will generate __ hour(s) outside work.			
	Lab will generate __ hour(s) outside work.			
(5)	Grading Basis:	Grading Scale Only		
		Pass/No Pass option		X
		Pass/No Pass only		
(6)	Advisories:			
(7)	Pre-requisites (requires C grade or better): • Manufacturing Technology 93			
	Corequisites: •			

(8)Classification:		
	Degree applicable:	
	Non-degree applicable:	
	Basic skills:	
(9)RC	Fulfills AS/AA degree requirement: (area)	
	General education category:	
	Major:	Maintenance Mechanic
	Certificate of:	Maintenance Mechanic
	Certificate in:	
(10)CSU	Baccalaureate:	X
(11)Repeatable: (A course may be repeated three times)		0
(12)C-ID:		
Proposed Start Date:		Fall 2012

(12) Catalog Description:
Basic concepts in solar technology including solar system layout and components, tools and techniques used with solar technology and safe practices to use around solar installations.

II. COURSE OUTCOMES:

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

Upon completion of this course, students will be able to:

I. Practice safe techniques when installing and troubleshooting solar installations.
II. Estimate the correct size and location to optimize a solar installation.

III. COURSE OBJECTIVES:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

I. Select and properly use tools necessary for a safe solar installation.
II. Use the correct electric measuring instrument to accurately assess function of a solar system.
III. Use correct tools and techniques to install a solar system on a roof or at ground level.
IV. Identify potential hazards in a solar installation and take the proper corrective action.

IV. COURSE OUTLINE:

Lecture Content:

I. Solar System Safety
- A. Electrical Safety
  1. Voltage danger
  2. Amperage danger
  3. Grounding concepts
  4. Safe Practices around high voltage and amperage
- B. Thermal Safety
  1. Where is heat generated?
  2. Causes of heat in solar systems
  3. Safe practices around hot solar components
- C. Building Safety

1. Safe scaffold and rigging techniques
2. Building design with regard to electrical components

II. Fundamentals of Solar electricity
- A. Basic electricity review
  - 1. Volts
  - 2. Amps
    - a. AC
    - b. DC
  - 3. Resistance
  - 4. Circuit basics
- B. Solar cell technology
  - 1. Semiconductor basics
    - a. Silicon cells
    - b. Foil solar cells
    - c. Carbon solar cells
    - d. Polymer solar cells
- C. Measuring solar energy
  - 1. Solar insolation
    - a. Defined
    - b. Charts and resources
  - 2. Solar cell efficiency
    - a. Wavelength and energy content
    - b. Measurement tools to check cell efficiency
    - c. Mounting, orientation and maintenance for efficiency
  - 3. Solar steam system efficiency
    - a. Heat generated

III. Photovoltaic Systems
- A. Solar cell panels
  - 1. Types
  - 2. Brands
- B. Inverters
  - 1. Types
  - 2. Brands
- C. Wiring
- D. Mounting components
  - 1. Types
  - 2. Brands
- E. Schematics of Photovoltaic Systems
  - 1. Component symbols
  - 2. Wiring basics
  - 3. Code information required

IV. Solar Thermal Systems
- A. Thermal System Components
- B. Solar thermal system design concepts
  - 1. Pumps
  - 2. Pipes
  - 3. Reflectors
  - 4. Turbines
- C. Solar thermal installation concepts

IV. Construction and Solar Systems
- A. Building Codes
  - 1. How building codes administered
  - 2. Why building codes are required
  - 3. How building codes are applied to the job
    - 4. Special building code areas for solar installations

a. Roofing
b. Structural
c. Environmental
d. Electrical

B. Electrical Codes

V. Photovoltaic Estimating
A. Energy audits
1. Home
2. Industrial
B. Site assessment
1. Solar potential quantity
2. Shade and yearly variations
3. Size and scale of installation
4. Environmental
C. Cost Estimating

VI. Solar Installation Techniques
A. Structural
1. Panel mounting device assembly
2. Mounting device erection
3. Roof safety
B. Electrical
1. Where to locate system components
2. Correct wiring methods
3. Methods of connecting panels together

Lab Content:

I. Mounting Panels
A. Mounting Brackets
B. Mounting Hardware
C. Connecting Panels
D. Handling Panels
E. Mounting Panels
F. Roof
1. Sealing
2. Rigging
3. Safety

II. Mounting Inverters
A. Methods
B. Location
C. Connections to grid and panel

III. Testing Solar components
A. Test Equipment
1. Types of test units
2. Connections
3. How to read
B. Troubleshooting systems
1. Methodology
2. Systematic approach
3. Panels
4. Inverter

IV. Estimating solar installations
A. Test equipment to measure solar potential
B. Site assessment
1. Calculations
a. Solar potential on site

b. Electrical load / panel requirement

2. Measurements
   a. Lot measuring tools
   b. System measuring tools

V. APPROPRIATE READINGS

Reading assignments may include but are not limited to the following:

I. Sample Text Title:
   1. Recommended - Dunlop, J, P *Photovotaic Systems,* ed. 2 American Technical Publishers, 2009,

II. Other Readings

___ Global or international materials or concepts are appropriately included in this course
___ Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

A. Writing Check either 1 or 2 below			
	1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.		
X	***2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.***		
	a) essay exam(s)		d) written homework
	b) term or other paper(s)		e) reading reports
	c) laboratory report(s)		f) other (specify)

Required assignments may include but are not limited to the following:

B. Problem Solving Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)	X	d) laboratory reports
X	b) quizzes		e) field work
X	c) homework problems		f) other (specify):

Required assignments may include but are not limited to the following:
Troubleshoot a basic photovoltaic system.

C. Skill demonstrations, including:			
	a) class performance(s)		c) performance exams(s)
	b) field work		d) other (specify)

Required assignments may include but are not limited to the following:

D. Objective examinations including:			
X	a) multiple choice	X	d) completion
X	b) true/false		e) other (specify):
X	c) matching items		

COURSE GRADE DETERMINATION:
Description/explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.

Problem Solving 40 - 60% Skill Demonstration 20 - 40% Objective Examination 20 - 40%

VII. EDUCATIONAL MATERIALS

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):	College-Level Criteria Met YES	NO
Textbook		X
Reference materials		X
Instructor-prepared materials		X
Audio-visual materials		X

Indicate Method of evaluation:

- Used readability formulae (grade level 10 or higher) _____
- Text is used in a college-level course _____
- Used grading provided by publisher _____
- Other: (please explain; relate to Skills Levels) _____

Computation Level (Eligible for MATH 101 level or higher where applicable)		X
Content		
Breadth of ideas covered clearly meets college-level learning objectives of this course		X
Presentation of content and/or exercises/projects:		
Requires a variety of problem-solving strategies including inductive and deductive reasoning.		X
Requires independent thought and study		X
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.		X

List of Reading/Educational Materials

Recommended - Dunlop, J, P *Photovotaic Systems,* ed. 2 American Technical Publishers, 2009,

Comments:

_____ This course requires special or additional library materials (list attached).

_____ This course requires special facilities:

Attached Files:

Manufacturing Pathways

BASIC SKILLS ADVISORIES PAGE The skills listed are those needed for eligibility for English 125, 126, and Math 201. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

Check the appropriate spaces.

_____ Eligibility for Math 201 is advisory for the target course.

_____ Eligibility for English 126 is advisory for the target course.

_____ Eligibility for English 125 is advisory for the target course.

If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.

REQUISITES

Prerequisite -- MFGT 92 Motor Controls 2

- Identify intermediate and advanced motor and control systems within a manufacturing environment.
- Design and diagram the integration of motor and control system components.
- Organize and assemble motor and control system components into working control systems.
- Select and properly use tools necessary for a safe solar installation.
- Use the correct electric measuring instrument to accurately assess function of a solar system.
- Use correct tools and techniques to install a solar system on a roof or at ground level.
- Identify potential hazards in a solar installation and take the proper corrective action.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

_____Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.
Justification: Indicate how this is so.
_____The health or safety of the students in this course requires the prerequisite.
Justification: Indicate how this is so.
__X__The prerequisite course is part of a sequence of courses within or across a discipline.
_____The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.
Justification: Indicate how this is so.
_____The prerequisite/corequisite is required by law or government regulations.
Explain or cite regulation numbers:
_____The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.
Justification: Indicate how this is so.
_____The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.
Justification: Indicate how this is so.
_____Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

Justification:

JUSTIFICATION OF LIMITATION ON ENROLLMENT

Enrollment in courses or blocks of courses may be limited based on performance, honors, or other performance based criteria. Be mindful of the disproportionate impact the limitation will have on specific groups of students. It is important to determine if the limitation will disproportionately keep under-represented students from enrolling in the course or block of courses.

Describe the reasons for limiting the enrollment.

Course Designator: MFGT 94

Course Title(s): Introduction to Solar Technology

Rationale for Limiting Enrollment:
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