

Course Outline

Energy, Environment, and Utilities

REVISED: August/2017

Job Title

PV Technician

72-65-50

Career Pathway:

Energy and Power Technology

Photovoltaics/1

Industry Sector:

Energy, Environment, and Utilities

Credits: 5

Hours: 90

O*NET-SOC CODE:

47-2231.00

Course Description:

This competency-based course is the first in a sequence of three designed for alternative and renewable energy technology. It provides students with project-based experiences in photovoltaics (PV). Technical instruction includes workplace safety policies and procedures, resource management, trade mathematics, and employability skills. Emphasis is placed on photovoltaic energy as a viable source of alternative energy, basic electrical theories, electrical wiring principles and procedures, solar energy, and the operational fundamentals of PV modules. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

CBEDS Title:

Energy and Environmental Technology

Prerequisites:

Enrollment requires a reading level of 6.0 as measured by the TABE D 9/10.

CBEDS No.:

5691

NOTE: For Perkins purposes this course has been designated as an **introductory** course.

Tasks designated by an asterisk (*) meet the North American Board of Certified Energy Practitioners (NABCEP) 10 Learning Objectives for the PV Entry Level exam. The competencies of this course are aligned with the knowledge requirements set by the NABCEP's Entry Level 10 Learning Objectives.

This course cannot be repeated once a student receives a Certificate of Completion.



COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS

LOCATION

GOALS AND PURPOSES

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

PERFORMANCE OBJECTIVES OR COMPETENCIES

pp. 7-13

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

COURSE OUTLINE COMPETENCY-BASED COMPONENTS
(continued)

COURSE OUTLINE COMPONENTS

LOCATION

INSTRUCTIONAL STRATEGIES

p. 16

Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT

Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.

pp. 7-13

Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

EVALUATION PROCEDURES

p. 16

The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT

Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

ACKNOWLEDGMENTS

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CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS
Energy, Environment and Utilities Industry Sector
Knowledge and Performance Anchor Standards

1.0 Academics

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Energy, Environment, and Utilities academic alignment matrix for identification of standards.

2.0 Communications

Acquire, and accurately use Energy, Environment, and Utilities sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Energy, Environment, and Utilities sector workplace environment.

5.0 Problem Solving and Critical Thinking

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Energy, Environment, and Utilities sector using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Energy, Environment, and Utilities sector workplace environment.

7.0 Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Energy, Environment, and Utilities sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization.

10.0 Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Energy, Environment, and Utilities sector.

11.0 Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Energy, Environment, and Utilities anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

Energy, Environment, and Utilities Sector Pathway Standards

B. Energy and Power Technology Pathway

The Energy and Power Technology pathway provides learning opportunities for students interested in preparing for careers in the energy and power industries.

Sample occupations associated with this pathway:

- ◆ Energy Efficiency Evaluation Specialist
- ◆ Energy Engineer
- ◆ Energy Generation/Power Distribution, Maintenance, Inspection, and Repair Technicians
- ◆ Energy/Building Retrofit Specialist
- ◆ Plant/Field Weatherization Installer

- B1.0 Explore the basic conventional and emerging principles and concepts of the energy industry, including energy production, energy transmission, and alternative energy technologies.
- B2.0 Identify various conventional electric power generation fuel sources and the cost and efficiency issues associated with each.
- B3.0 Investigate emerging and alternative electric power generation technologies and fuel sources.
- B4.0 Understand nonnuclear power generation plant operations (coal, oil, natural gas, solar, wind, geothermal power, hydroelectric, or biofuel).
- B5.0 Understand and apply basic knowledge and skills necessary for nuclear power generation and nuclear power plant personnel.
- B6.0 Research methods of energy procurement, transmission, distribution, and storage.
- B7.0 Understand the interrelationships among components of systems.

CBE
Competency-Based Education

COMPETENCY-BASED COMPONENTS
for the Photovoltaics /1 Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. ORIENTATION AND SAFETY</p> <p>Understand and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p>	<ol style="list-style-type: none"> 1. Describe the scope and purpose of the course. 2. Describe the overall course content as a part of the Linked Learning Initiative. 3. Describe classroom policies and procedures. 4. Describe the different occupations in the Energy and Utilities Industry Sector which have an impact on the role of photovoltaic installers. 5. Describe the opportunities available for promoting gender equity and the representation of non-traditional populations in computer technology. 6. Explain the impact of Environmental Protection Agency (EPA) legislation on Engineering and Design Industry Sector practices in protecting and preserving the environment. * 7. Describe and demonstrate the procedures for contacting proper authorities for the removal of hazardous materials based on the EPA standards. * 8. Describe the National Electrical Code (NEC) and its role in safeguarding the work conditions of photovoltaic installers/craftsmen. * 9. Describe and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the photovoltaic field.* 10. Describe the role of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ in increasing the use of clean and renewable technology in California.* 11. Describe the City of Los Angeles Building and Safety Codes and their applications to the photovoltaic field.* 12. Describe the provisions of the California Title 24 Energy Efficiency Standards (a.k.a. 2008 California Green building Standards Code) as they relate to the Energy and Utilities Industry Sector.* 14. Identify classroom and workplace first aid and emergency procedures based on the American Red Cross (ARC) standards. 15. Describe the California Occupational Safety and Health Administration (Cal/OSHA) and its electrical safety standards governing photovoltaic installers/craftsmen.* 	<p>Career Ready Practice: 1, 2, 3, 5, 6, 7, 9, 11, 12</p> <p>CTE Anchor: Communications: 2.5 Career Planning and Management: 3.4 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.11, 6.12, 6.15 Ethics and Legal Responsibility: 8.2 Leadership and Teamwork: 9.6 Technical Knowledge and Skills: 10.2</p> <p>CTE Pathway: B1.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(8 hours)	16. Describe how each of the following insures a safe workplace: <ol style="list-style-type: none"> employees' rights as they apply to job safety employees' obligations as they apply to safety employees' training on how to accurately test high voltages* employees' training on how to identify potential electrical/non-electrical hazards* employees' training on how to use safety equipment* 17. Pass the safety exam with 100% accuracy.	
B. RESOURCE MANAGEMENT Understand resource management principles and techniques applied in the photovoltaic field.	<ol style="list-style-type: none"> Define the following: <ol style="list-style-type: none"> resources management sustainability Describe the management of the following resources in the photovoltaic field: <ol style="list-style-type: none"> time materials (including sustainable and green) personnel List specific examples of effective management of the following resources in the photovoltaic field: <ol style="list-style-type: none"> time materials (including sustainable and green) personnel Describe the benefits of effective resource management in the photovoltaic field: <ol style="list-style-type: none"> profitability sustainability company growth Describe the economic benefits and liabilities of managing resources in an environmentally responsible way. 	Career Ready Practice: 1, 2, 3, 5, 7, 8, 9 CTE Anchor: Career Planning and Management: 3.5 Responsibility and Flexibility: 7.1, 7.2, 7.4, 7.6 CTE Pathway: B2.4
C. TRADE MATHEMATICS Understand and apply the mathematical requirements in the photovoltaic field.	<ol style="list-style-type: none"> Describe the practical applications of math in the photovoltaic field. Describe and demonstrate problem-solving techniques involving whole number problems using arithmetic operations (addition, subtraction, multiplication, and division). Describe and demonstrate problem-solving techniques involving various fraction problems using arithmetic operations. Describe and demonstrate problem-solving techniques involving various decimal problems using addition, subtraction, multiplication, and division. Describe and demonstrate techniques for changing fractions to decimals. Describe and demonstrate techniques for changing decimals to fractions. 	Career Ready Practice: 1, 3, 5 CTE Anchor: Problem Solving and Critical Thinking: 5.2 CTE Pathway: B2.4, B3.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(12 hours)	<ol style="list-style-type: none"> 7. Describe the English and metric systems of measuring length. 8. Describe the English and metric systems of measuring weight. 9. Describe the English and metric systems of measuring volume or capacity. 10. Describe and demonstrate English and metric problem-solving techniques for various measuring problems using arithmetic operations. 11. Describe and demonstrate English and metric measuring techniques of objects by using tools common to the trade. 12. Express units in ascending and descending powers of ten. 13. Convert the English numbering system to metric system. 14. Convert metric system to English numbering system. 15. Calculate square roots of English numbers. 16. Describe and demonstrate problem-solving techniques for geometric problems. 17. Describe and demonstrate problem-solving techniques for algebraic problems. 18. Describe and demonstrate problem-solving techniques using percentages. 19. Describe and demonstrate techniques for reading and interpreting graphs. 20. Describe and demonstrate techniques for using a calculator. 	
<p>D. SOLAR ENERGY</p> <p>Understand the fundamentals of solar energy.</p> <p>(8 hours)</p>	<ol style="list-style-type: none"> 1. Define the following: <ol style="list-style-type: none"> a. true solar south b. magnetic south c. irradiance d. irradiation e. insolation f. array azimuth g. angle of inclination h. solar azimuth angle i. solar altitude angle 2. Describe the effects of the following on seasonal sunlight exposure: <ol style="list-style-type: none"> a. solar path b. earth orbit c. earth tilt 3. Describe the following: <ol style="list-style-type: none"> a. difference between true solar south and magnetic south b. factors that reduce/enhance solar irradiation c. angular effects of irradiance on an array d. average solar irradiation on various surfaces e. conversion of solar irradiation into a variety of units f. effect of horizon on solar irradiation g. effects of weather on solar irradiation h. use of the Solar Pathfinder 	<p>Career Ready Practice: 1, 3, 4, 5, 10</p> <p>CTE Anchor: Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4</p> <p>CTE Pathway: B4.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>E. PHOTOVOLTAIC ENERGY: ALTERNATIVE ENERGY</p> <p>Understand photovoltaic energy as a viable source of alternative energy.</p> <p>(4 hours)</p>	<ol style="list-style-type: none"> 1. Define and describe the following sources of energy: <ol style="list-style-type: none"> a. renewable energy <ol style="list-style-type: none"> i. solar/photovoltaics (PV) ii. biofuels iii. geothermal iv. wind v. water b. non-renewable energy <ol style="list-style-type: none"> i. fossil fuels – oil, natural gas, coal ii. nuclear fuel 2. Describe the need for alternative energy in today’s economy based on the following: <ol style="list-style-type: none"> a. economic security b. environmental impact c. accessibility d. reliability e. cost effectiveness 3. Describe the history of PV. 4. Describe the basic operational aspects of PV in terms of: <ol style="list-style-type: none"> a. durability b. maintenance requirements c. efficiency d. cost effectiveness e. variety in application 	<p>Career Ready Practice: 1, 3, 4, 5, 10</p> <p>CTE Anchor: Technology: 4.5 Problem Solving and Critical Thinking: 5.3 Leadership and Teamwork: 9.5 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: B1.2, B1.3, B1.4, B2.1, B2.2, B2.3, B2.4, B3.3, B3.4, B3.5, B4.2, B4.3, B4.4, B5.3, B5.5, B5.7</p>
<p>F. PV FUNDAMENTALS</p> <p>Understand the operational fundamentals of PV modules.</p>	<ol style="list-style-type: none"> 1. Define and describe the features and functions of the following: <ol style="list-style-type: none"> a. crystallinity b. single crystalline thin films c. polycrystalline thin films d. absorption coefficient e. bandgap f. complexity of manufacturing g. PV cell h. PV module i. PV array j. PV system <ol style="list-style-type: none"> i. flat-plate systems ii. concentrator systems k. balance of system (BOS) components <ol style="list-style-type: none"> i. mounting systems ii. inverters iii. electricity storage component l. energy payback times (EPBT) 	<p>Career Ready Practice: 1, 3, 4, 5, 10, 11</p> <p>CTE Anchor: Technology: 4.1 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: B2.1, B4.6, B7.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(18 hours)	<ol style="list-style-type: none"> 2. Describe the structure and characteristics of the following PV electricity-producing devices: <ol style="list-style-type: none"> a. PV cells b. PV modules (a.k.a. solar modules) c. PV arrays d. PV system 3. Describe the characteristics of the following solar cell materials: <ol style="list-style-type: none"> a. monocrystalline silicon b. polycrystalline silicon c. amorphous thin films 	
<p>G. BASIC ELECTRICAL THEORIES</p> <p>Understand and apply basic electrical theories.</p> <p>(10 hours)</p>	<ol style="list-style-type: none"> 1. Define the following: <ol style="list-style-type: none"> a. matter b. atoms c. electrons d. molecules e. conductors f. insulators g. electricity h. energy i. work j. magnetism k. magnetic polarity l. semiconductors 2. Define and describe the following: <ol style="list-style-type: none"> a. current <ol style="list-style-type: none"> i. direct current (DC) ii. alternating current (AC) b. voltage c. power (a.k.a. watts) d. resistance (a.k.a. ohms) e. current (a.k.a. amperage) f. Watts Law g. Ohms Law h. simple circuit i. series circuits j. parallel circuits 3. Describe the operation of a simple battery or cell. 4. Describe and demonstrate the following: <ol style="list-style-type: none"> a. calculation of the values of a simple light circuit using Watts Law b. proper use of a multimeter 	<p>Career Ready Practice: 1, 3, 5, 10</p> <p>CTE Anchor: Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: B1.4, B7.3, B7.4, B7.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>H. BASIC ELECTRICAL WIRING</p> <p>Understand, apply, and evaluate wiring principles and procedures approved by the National Electrical Code (NEC).</p> <p>(25 hours)</p>	<ol style="list-style-type: none"> 1. Define the terms common to electrical service installations: <ol style="list-style-type: none"> a. transformer b. service drop c. weather head d. mast e. meter base f. disconnect g. panel h. ground 2. Identify the following: <ol style="list-style-type: none"> a. tools and components common to the wiring trade b. commonly used wire sizes in the electrical trade and the amperage rating of each c. proper arrangement of electrical components and hardware in a typical utility-connected installation d. breaker panel components 3. Describe the differences between: <ol style="list-style-type: none"> a. step-up and step-down transformers b. primary and secondary ground c. single-phase and three-phase service installations d. 20v and 240v circuits 4. Describe and demonstrate the operation of the following main electrical components: <ol style="list-style-type: none"> a. inverter b. charge controller c. combiner d. Ground Fault Circuit Interrupter (GFCI) 5. Describe and demonstrate the following: <ol style="list-style-type: none"> a. electrical service wiring techniques b. wiring techniques for typical 120v and 240v residential circuits c. wiring techniques for a sub-fed panel 	<p>Career Ready Practice: 1, 3, 5, 10</p> <p>CTE Anchor: Problem Solving and Critical Thinking: 5.1 Health and Safety: 6.6, 6.7, 6.11, 6.15, 6.16 Technical Knowledge and Skills: 10.1, 10.2 Demonstration and Application: 11.1</p> <p>CTE Pathway: B1.4, B6.1, B6.2, B6.4, B7.1, B7.4, B7.6</p>
<p>I. EMPLOYABILITY SKILLS</p> <p>Understand, apply, and evaluate the employability skills required in the photovoltaic field.</p>	<ol style="list-style-type: none"> 1. Describe employer requirements for the following: <ol style="list-style-type: none"> a. punctuality b. attendance c. attitude toward work d. quality of work e. teamwork f. timeliness g. communication skills h. computer skills and software applications 2. Identify potential employers through traditional and internet sources. 3. Describe the role of electronic social media in job search. 4. Design sample résumés and cover letters. 	<p>Career Ready Practice: 1, 2, 3, 5, 6, 7, 10</p> <p>CTE Anchor: Communications: 2.1, 2.6 Career Planning and Management: 3.1, 3.2, 3.3, 3.4, 3.8, 3.9 Technology: 4.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(4 hours)	<ol style="list-style-type: none"> 5. Describe the importance of filling out a job application legibly, with accurate and complete information. 6. Complete sample job application forms correctly. 7. Describe the importance of enthusiasm on a job. 8. Describe the importance of appropriate appearance on a job. 9. Describe the importance of the continuous upgrading of job skills. 10. Describe customer service as a method of building permanent relationships between the organization and the customer. 11. Describe and demonstrate appropriate interviewing techniques. 12. Identify the informational materials and resources needed to be successful in an interview. 13. Design sample follow-up letters. 14. Describe and demonstrate appropriate follow-up procedures. 	<p>Ethics and Legal Responsibility: 8.4, 8.5</p> <p>Demonstration and Application: 11.5</p> <p>CTE Pathway: B1.1</p>

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTS AND SUPPLEMENTAL BOOKS

TEXTBOOKS

Kemp, William H. The Renewable Energy Handbook Revised Edition, 3rd edition. Aztex Press, 2009.

Schaeffer, John. Real Goods Solar Living Source Book – Special 30th Anniversary Edition. Gaiam Real Goods, 2007.

Strong, Steven J. The Solar Electric House. Sustainability Press, 1994.

Williams, Neville. Chasing the Sun. New Society Publishers, 2005.

RESOURCES

Employer Advisory Board members

CTE Model Curriculum Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/energyutilities.pdf>

Barnett, Dave and Kirk Bjornsgaard. Electrical Power Generation: A Nontechnical Guide. Pennwell Books, 2000.

International Association of Plumbing and Mechanical Officials. Uniform Solar Energy Code. International Association of Plumbing and Mechanical Officials, 2009.

Michael Casey, Douglas Hansen, and Redwood Kardon. Code Check: Electrical: An Illustrated Guide to Wiring a Safe House. 4th edition, Taunton Press, 2006.

National Fire Protection Association. National Electrical Code 2011. National Fire Protection Association, 2011.

www.americangreenjobs.net

www.ases.org

www.careers.pennenergyjobs.com

www.cleantechrecruits.com

www.irecusa.org

www.renewableenergyjobs.com

www.solarenergy.org

www.solarelectricpower.org

www.seia.org

www1.eere.energy.gov

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

- A. Lecture and discussion
- B. Multimedia presentations
- C. Demonstrations and participations
- D. Individualized instruction
- E. Peer teaching
- F. Role-playing
- G. Guest speakers
- H. Field trips and field study experiences
- I. Projects

EVALUATION

SECTION A – Orientation and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management – Pass all assignments and exams on resource management with a minimum score of 80% or higher.

SECTION C – Trade Mathematics – Pass all assignments and exams on trade mathematics with a minimum score of 80% or higher.

SECTION D – Solar Energy – Pass all assignments and exams on solar energy with a minimum score of 80% or higher.

SECTION E – Photovoltaic Energy: Alternative Energy – Pass all assignments and exams on photovoltaic energy: alternative energy with a minimum score of 80% or higher.

SECTION F – PV Fundamentals – Pass all assignments and exams on PV fundamentals with a minimum score of 80% or higher.

SECTION G – Basic Electrical Theories – Pass all assignments and exams on basic electrical theories with a minimum score of 80% or higher.

SECTION H – Basic Electrical Wiring – Pass all assignments and exams on basic electrical wiring with a minimum score of 80% or higher.

SECTION I – Employability Skills – Pass all assignments and exams on employability skills with a minimum score of 80% or higher.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.
