

CNST A161: SOLAR WATER AND POOL HEATING INSTALLATION

Item	Value
Curriculum Committee Approval Date	12/02/2020
Top Code	095200 - Construction Crafts Technology
Units	4 Total Units
Hours	108 Total Hours (Lecture Hours 36; Lab Hours 72)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)

Course Description

Technologies for Solar Water Heating and Solar Swimming Pool Heating for residential, commercial and agricultural applications. Solar concepts, system types and system components. Solar collector mounting, component installation, checkout and start-up procedures. Pool systems components, installation, operation, and economics. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Identify and implement appropriate codes and standards concerning installation, operation and maintenance of a solar thermal system.
2. Specify components for a solar thermal system, optimal location, system layout and configuration.

Course Objectives

- 1. Identify plumbing, electrical and other hazards associated with solar thermal installations and implement preventative and remedial measures to ensure personnel safety.
- 2. Determine active direct system components? location, system layout and configuration.
- 3. Estimate time, materials, tools and labor required for installation.
- 4. Evaluate structural integrity and suitability of collector site.
- 5. Demonstrate acceptable national Roofing Contractor?s Association roof mounting and penetration methods.
- 6. Calculate system requirements and use appropriate materials and procedures for system assembly.
- 7. Determine mechanical/structural mounting of racking, collectors, piping, valves and other components.
- 8. Interpret plans and schematics for on site design implementation.

Lecture Content

Orientation of lab classroom, equipment and safety procedures
Review of the course syllabus, class expectations, resources, textbook, websites Solar Thermal Applications and Technologies Safety Basics,

OSHA regulations Lab activity Solar Basics for Thermal Applications
Absorbance vs. Reflectance Heat transfer Temperature differential
Thermal Mass Lab Activity Swimming Pool Heating Systems Economics
Collectors Plumbing Schematics Lab Activity Pool Heating System
Evaluation Sizing filter pumps and pipe runs Sizing filtration and circulation systems Lab Activity Pool Heating System Collector installation Flow control and safety devices Activating the system Lab Activity Solar Water Heating System Types Active Direct Systems Active Indirect Systems Lab Activity Solar Water Heating System Types Passive Direct and Passive Indirect Systems Freeze Protection Lab Activity Solar Thermal System Collectors Flat Plate collector Evacuated-tube collectors Integral collectors Lab Activity 9. Solar Thermal System Components Storage Tanks, Controllers Heat Exchangers Valves, gauges and meters Lab Activity Collector Mounting Locations, orientation Roof construction and materials Roof penetrations Piping Collector Arrays Lab Activity Installing and Connecting Pipe Collector-to-Storage piping installation Insulation Connections Piping runs Lab Activity Installing Mechanical/ Plumbing Equipment Location plumbing valves Monitoring Components Pump location and function Lab Activity 13. Electrical Integration National Electrical Code Conductors and wiring methods Lab Activity Permitting and Inspection Building codes and regulations Lab Activity Performance Analyses and Troubleshooting a System Design errors, performance problems Maintenance for a PV system Monitoring and measuring output Lab Activity NABCEP Thermal Installer Exam (optional)

Lab Content

Orientation of lab classroom, equipment and safety procedures
Review of the course syllabus, class expectations, resources, textbook, websites Solar Thermal Applications and Technologies Safety Basics, OSHA regulations Lab activity Solar Basics for Thermal Applications Absorbance vs. Reflectance Heat transfer Temperature differential Thermal Mass Lab Activity Swimming Pool Heating Systems Economics Collectors Plumbing Schematics Lab Activity Pool Heating System Evaluation Sizing filter pumps and pipe runs Sizing filtration and circulation systems Lab Activity Pool Heating System Collector installation Flow control and safety devices Activating the system Lab Activity Solar Water Heating System Types Active Direct Systems Active Indirect Systems Lab Activity Solar Water Heating System Types Passive Direct and Passive Indirect Systems Freeze Protection Lab Activity Solar Thermal System Collectors Flat Plate collector Evacuated-tube collectors Integral collectors Lab Activity 9. Solar Thermal System Components Storage Tanks, Controllers Heat Exchangers Valves, gauges and meters Lab Activity Collector Mounting Locations, orientation Roof construction and materials Roof penetrations Piping Collector Arrays Lab Activity Installing and Connecting Pipe Collector-to-Storage piping installation Insulation Connections Piping runs Lab Activity Installing Mechanical/ Plumbing Equipment Location plumbing valves Monitoring Components Pump location and function Lab Activity 13. Electrical Integration National Electrical Code Conductors and wiring methods Lab Activity Permitting and Inspection Building codes and regulations Lab Activity Performance Analyses and Troubleshooting a System Design errors, performance problems Maintenance for a PV system Monitoring and measuring output Lab Activity NABCEP Thermal Installer Exam (optional)

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- Lab (04)
- DE Live Online Lab (04S)

Instructional Techniques

Lecture, Presentations, Demonstrations, Hands-on Activities, Guest Speakers, Cooperative Learning

Reading Assignments

Writing Assignments

Completion of lab and homework assignments in a neat, workmanlike manner that meet safety and industry standards.

Out-of-class Assignments

Demonstration of Critical Thinking

Written tests that may be identification, multiple choice, fill-in the blank, and mathematical calculation. Participation in class discussions and presentations. Lab assignments completed in timely manner.

Required Writing, Problem Solving, Skills Demonstration

Completion of lab and homework assignments in a neat, workmanlike manner that meet safety and industry standards.

Other Resources

1. Florida Solar Energy Center. Solar Thermal Manual: Design and Installation Repair and Maintenance. University of Central Florida. http://www.fsec.ucf.edu/en/industry/resources/solar_thermal/manual/ 2006 2. North American Board of Energy Practitioners. Study Guide for Solar Water and Pool Heating System Installers. NABCEP. <http://www.nabcep.org/>. 2008. 3. National Fire Protection Association. National Electrical Code 2008. New York: Thomson Delmar Learning, 2007. http://www.fsec.ucf.edu/en/industry/resources/solar_thermal/manual/ 4. Plumbing-Heating-Cooling Contractors National Association. National Standard Plumbing Code. <http://phcc.files.cms-plus.com/Depts/Technical/2006NSPCNonIllustratedWeb.pdf> Virginia: PHCC, 2006.