

**JEFFERSON COLLEGE**

**COURSE SYLLABUS**

**HRA130**

**SOLAR HOT WATER SYSTEMS**

2 Credit Hours

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## HRA130 Solar Hot Water Systems

### I. CATALOGUE DESCRIPTION

- A. Pre-requisite: Reading Proficiency
- B. 2 Credit Hour Award
- C. Solar Hot Water Systems will expose students to solar hot water theory designs and installation through hands-on projects, experiments, and theory. (F,S)

### II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

Describe solar hot water theory	Quizzes Exams Homework
Differentiate between different solar designs	Quizzes Exams Homework
Design solar systems and measure their efficiencies	Quizzes Lab Exercises
Practice solar principles by experimentation with solar trainer	Lab Exercises

### III. OUTLINE OF TOPICS

- A. Solar Site Assessments
  - 1. Areas of feasibility
  - 2. Solar path finders
  - 3. Site assessments for three
  - 4. Heat flow and storage
  - 5. Cost assessments
  - 6. Rebates and incentives
- B. Components
  - 1. Collectors
  - 2. Tanks
  - 3. Plumbing
  - 4. Controls
- C. System Design
  - 1. Drain back systems
  - 2. Drain back tanks
  - 3. Drain back system design
  - 4. Drain back pumping

5. Transfer fluids
  6. Controls
  7. Piping
- D. Closed Loop Glycol Systems
1. Design closed loops systems
  2. Installation of closed loop systems
  3. Over heat protection
  4. Heat dumps
  5. Steam back design
- E. Thermosiphon Systems
1. Freeze protection
  2. Tank locations
  3. Piping
- F. Solar Pool Heating
1. Pool heat losses
  2. System design
  3. Piping
  4. Collectors
- G. Solar Loop Design
1. Hot Day – no loads
  2. Control requirements
  3. Cold Day – drain back requirements
- H. Load Integration
1. Tank sizing
  2. Preheating
  3. Dip tube options
  4. Parallel tanks
  5. Large storage recirculation
  6. Space heat integration
  7. Piping requirements
  8. Combination system design
  9. Coil designs
  10. Collector designs
  11. Flat plate
  12. Evacuated tubes
  13. Concentrating collectors
  14. Snow and wind loads
  15. Collector performance and ratings
- I. Tanks
1. Tank characteristics

2. Anode and Galvanic Corrosion
3. Heat stratification in tanks
4. Tank sizing

J. Heat Exchanges

1. Types of heat exchangers
2. Drain back tanks
3. External heat exchangers
4. Counter flow heat exchangers
5. Proper sizing
6. 10% approach method
7. Double wall heat exchangers

K. Pumps and Fluids

1. Centrifugal pumps
  - a) Multi and variable speed
  - b) AC/DC
  - c) Mounting
2. Cavitation
3. Head pressure and friction loss
4. Safety margins
5. Propylene glycol mixtures
6. Propylene glycol alternatives

L. Plumbing

1. Copper
  - a) Type L
  - b) Type M
2. Flexible stainless steel
3. Pex
4. PVC
5. Insulation
6. Different flow rates

M. Roofing

1. Safety considerations
2. OSHA regulations
3. Fall protection
4. Ladders
5. Cranes
6. Array layout
7. Mounting options
  - a) Flush
  - b) Tilt
  - c) Free standing
8. Roof attachments

9. Rafters
  10. Connectors
  11. Penetrations
  12. Loads
    - a) Weight
    - b) Wind
  13. Ground mounting
- N. Controllers and Sensors
1. Electrical considerations
    - a) Voltage
    - b) Wire sizing
    - c) Safety devices
  2. Analog controls
  3. Differential controls
  4. Digital controls
  5. Proper settings
- O. Simulations and Monitoring
1. Programs
  2. Solar path finder
  3. Reports and comparisons
  4. Performance monitoring
  5. Solar and web based

#### IV. METHOD(S) OF INSTRUCTION

- A. Lecture
- B. Lab
- C. Videos
- D. PowerPoints

#### V. REQUIRED TEXTBOOK(S)

Solar Hot Water Fundamentals, Skinner, E2G Solar, Current Edition

#### VI. REQUIRED MATERIALS

None

#### VII. SUPPLEMENTAL REFERENCES

Handouts

## VIII. METHOD OF EVALUATION

- A. Exams 40%
- B. Labs 30%
- C. Quizzes 10%
- D. Homework 10%
- E. Attendance 10%

## IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

## X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College website, <http://www.jeffco.edu>).

## XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

## XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.

