

COURSE SYLLABUS

Fall Semester 2023

HART 2349 (3:2:4)

Course Title: HEAT PUMPS
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Heating, Air Conditioning and Refrigeration Technology

Industrial Technology Department

Technical Education Division

South Plains College

Levelland Campus

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**Students can find statements for:** Intellectual Exchange, Disabilities, Non-Discrimination, Title IX Pregnancy Accommodations, CARE, Covid (Campus Assessment, Response, and Evaluation) Team, and Campus Concealed Carry at <https://www.southplainscollege.edu/syllabusstatements/>.

## **I. Course description:**

**Prerequisite:** HART 1303 and HART 1307.

**Course Level:** Advanced

**Course Description:** A study of heat pumps, heat pump control circuits, defrost controls, auxiliary heat, air flow, and other topics related to heat pump systems.

**End-of-Course Outcomes:** Explain a reverse cycle system; list the mechanical and electrical components for the heat pump operation; and explain the operation of heat pump modes including cooling, heating, defrost, emergency heat, and auxiliary heat mode. Identify and explain different methods of accomplishing defrost; charge a system correctly in the heating and cooling mode; troubleshoot electrical and mechanical components; perform tests for adequate air flow; and determine balance point and coefficients of performance (C.O.P.); and define attributes of geothermal heat pump systems.

### **Attendance Policy:**

#### **a. South Plains College Attendance Policy**

Excessive absences are a serious problem, and as a part of technical training good attendance habits are necessary. Positive steps will be taken in this program to develop these habits. The employer demands good work habits, and in order for the student to learn good work habits our attendance policy will require punctual and regular attendance.

Students must attend and/or participate in all classes for which financial aid is awarded. If it is determined that a student is awarded financial aid for a class or classes in which the student never attended or participated, the financial aid award will be adjusted in accordance with the classes in which the student did attend/participate and the student will owe any balance resulting from the adjustment.

#### **Absence for Military Service**

In accordance with Texas Education Code Section 51.9111, a student is excused from attending classes or engaging in other required activities, including exams,

if he or she is called to active military service of a reasonably brief duration. The maximum time for which the student may be excused has been defined by the Texas Higher Education Coordinating Board as “no more than 25 percent of the total number of class meetings or the contact hour equivalent (not including the final examination period) for the specific course or courses in which the student is currently enrolled at the beginning of the period of active military service.” The student will be allowed a reasonable time after the absence to complete assignments and take exams.

### Religious Holy Days

In accordance with Texas Education Code Section 51.911, South Plains College will allow a student who is absent from class for the observance of a religious holy day to take an examination or complete an assignment scheduled for that day within seven (7) calendar days after the absence. Students are required to file a written notification of absence with each instructor within the first fifteen (15) days of the semester in which the absence will occur. Forms for this purpose are available in the Dean of Students Office along with instructions and procedures. “Religious holy days” means a holy day observed by a religion whose place of worship is exempt from property taxation under Texas Tax Code Section 11.20.

It is the student’s responsibility to verify administrative drops for excessive absences through MySPC using his or her student online account.

- An absence is defined as a student entering class after the scheduled class/lab begin time or a student leaving before the scheduled class/lab end time.
- A student is allowed **three absences**. Students exceeding three unexcused absences will automatically be given a failing grade and administratively withdrawn from the course. Three absences are considered 10% of total contact hours. Academic standards considers absence over 10% excessive and unacceptable.
- The attendance policy of this class and program area will be as follows:

#### **No excused absences except for**

##### **A. Military service**

##### **B. Official trip authorized by the college**

##### **C. Documented religious holidays as defined by SPC course Catalog.**

#### **b. Unexcused absence Make-up Policy:**

A student will only be allowed to make-up tests and assignments for extenuating problems such as surgery, severe illness, pregnancy and family emergencies. The student is responsible for providing satisfactory evidence to substantiate the reason

for the absence within two working days of the absence to the instructor. A grade of zero will be given to tests and assignments if the student fails to meet these requirements. A student meeting these requirements will be provided a make-up class, not to exceed 14 days after the absence. A make-up class including tests and assignments will not be given during the course's scheduled class/lab time but on a specific date and time as scheduled by the instructor. A grade of zero will be given to tests and assignments if the student does not attend the make-up class. A student attending a make-up class does not constitute an excused absence and the original absence will not be dismissed. Students cannot attend more than three make-up classes per course/semester.

**II. Academic Integrity**

Refer to SPC Course Catalog and the Student Handbook

**III. Student Conduct**

Refer to SPC Course Catalog the Student Handbook and Syllabi Foundation Scan Skills.

**IV. SPECIFIC COURSE/INSTRUCTOR REQUIREMENTS:**

Only closed toed shoes, long pants, and sleeved shirts will be allowed in the classroom or in the lab. No shorts, sunglasses, sandals, or tank tops will be worn. Safety glass' and gloves are required.

**a. Assignment Policy**

*Classroom assignments:*

1. Chapter assignments will be given by the instructor. Questions at the end of the chapter will be graded on a percent basis and must be completed above 70% correct.
2. Tests on chapter assignments will be given by the instructor at his option. Tests will be graded on a percent basis.
3. Both a Written and Practical Final examination will be given.
4. Due dates for assignments and exams are non-negotiable, and late work will be given a zero.

*Lab Assignments:*

1. The student will demonstrate his knowledge of the subjects by completing Lab Assignments with 100% accuracy. These Lab Assignments are Cognitive in nature and will be evaluated by the Instructor.
2. Additional Lab Assignments will be given to evaluate the Psycho-motor skills of the Student. The instructor will also evaluate these.
3. A minimum number of Lab assignments are required and must be completed.
4. Students will be assigned individual and group lab projects. Students are prohibited from participating in projects not assigned to them.
5. Late work will not be accepted. Anything turned in after the due date will receive a zero for that assignment.

**b. Grading Policy/Procedure and/or methods of evaluation.**

- i. Grades are compiled in the following manor:

Lab. Assignments	15%
Chapter Test	30%
Chapter assignments	15%
Final Exam. Practical	15%
Final Exam. Written	25%
TOTAL	100%

Grading	100% to 90%	=	A
	89% to 80%	=	B
	79% to 70%	=	C
	69% below	=	F

- ii. Students will be graded on Course Scan Competencies and Foundation Skills. Points will be deducted from the total grade for not meeting minimum requirements.
- iii. A student will be given a failing grade if a student is consistently late to class and/or lack of motivation that is distracting to others. In accordance with HVAC/R industry standards, SPC student handbook, SPC course catalog and the syllabi SCANS and Foundation Skills.

Examples of distractions to others;  
Sleeping in class/lab  
Excessive interruptions  
Propping feet up on projects, tables, chairs etc...

c. **Learning Outcomes**

Students must demonstrate the learning outcomes in the Practical and Written Final Exams.

Practical Exam

Requirements:

Practical exam grading is based on 100 total points. Students will be given three opportunities to correct mistakes. The first mistake 10 points will be deducted or a grade of 90. The second mistake an additional 20 points will be deducted or a grade of 70. The third mistake will be a grade of 50. The fourth mistake will be given a zero.

Written Exam

Requirements:

Written exam grading: zero through 100 points.

Course outline, required text and materials

*To be handled on the first day of Class.*

V. **GENERAL COURSE INFORMATION:**

a. **Electronic course access**

All students must access Blackboard and EdReady the first week of the course.

b. **Tutoring Policies**

Students who do not pass their first exam will be required to attend three hours of tutoring each week until they pass their next exam. This is a course requirement and will be reflected in the course grade.

Resources available to all students; Blackboard course with information about study skills and strategies, how to use EdReady and ETS Success Navigator, campus resources, and how to use tutorial services effectively.

## VI. VERIFICATION OF WORKPLACE COMPETENCIES

A Capstone Experience Written and Practical examination tests will be given at the designated exit points. These tests must be completed with a grade of 70 or better before Certificates or Associate of Applied Science degree credits can be given.

### Tool requirements

Students are required to purchase tools to use in the lab. A mandatory list of the tools **required** for lab assignments are listed below. **Students are required to have all tools before they will be admitted into the course.**

- 1 EA 8" ADJUSTABLE WRENCH
- 1 EA 10" ADJUSTABLE WRENCH
- 1 EA #1 PHILLIPS SCREWDRIVER
- 1 EA #2 PHILLIPS SCREWDRIVER
- 1 EA #1 STANDARD SCREWDRIVER
- 1 EA #2 STANDARD SCREWDRIVER
- 1 EA SMALL POCKET PHILIPS SCREWDRIVER
- 1 EA SMALL POCKET FLATHEAD SCREWDRIVER
- 1 EA COMBINATION BOX/OPEN END WRENCH SET (3/8 TO 7/8 IN.)
- 1 EA 6" NEEDLE NOSE PLIERS
- 1 EA 6" DIAGONAL CUTTERS
- 1 EA 4 WAY REFRIGERATION SERVICE VALVE WRENCH
- 1 EA WIRE STRIPPER
- 1 EA CHANNEL LOCK Pliers #420
- 1 EA SOCKET SET (STANDARD NOT METRIC)
- 1 EA NUT DRIVER SET (3/16 TO 1/2 IN.)
- 1 EA ALLEN WRENCH SET (STANDARD NOT METRIC)
- 1 EA FLASHLIGHT
- 1 EA CALCULATOR
- 1 EA COMBINATION 410a/22 MANIFOLD GAUGE SET WITH HOSES (NOT AUTOMOTIVE).
- 1 EA A combination RMS volt/amp meter with digital thermometer equivalent to KLEIN TOOLS CL200 OR 1 EA RMS VOLT- AMP- OHM METER AND 1 DIGITAL THERMOMETER.

## **SCANS and Foundation Skills.**

Appropriate Competencies and Foundation Skills set forth by the Secretaries Commission on Achieving Necessary Skills appointed by the Secretary of Labor to determine the skills that people need to succeed in the world of work. These have been integrated into the RACST training program.

**Specifically they are:**

**Work-place Skills: C1-C3-C4-C5-C6-C7-C9-C11-C14–C18-C19**

**Foundation Skills: F3-F4-F5-F7-F13-F15-F17**

References and methods are detailed in the SCANS document filed in the office of the coordinator of the Refrigeration, Air Conditioning Service Technology program.

### **A. SCANS COMPETENCIES**

#### **a) RESOURCES: Identifies, organizes, plans and allocates resources.**

- C-1 **TIME**—Selects goal—relevant activities, ranks them, allocates time, and prepares and follows schedules.
- C-2 **MONEY**—Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives
- C-3 **MATERIALS & FACILITIES**—Acquires, stores, allocates, and uses materials or space efficiently.
- C-4 **HUMAN RESOURCES**—Assesses skills and distributes work accordingly, evaluates performances and provides feedback.

#### **b) INFORMATION—Acquires and Uses Information**

- C-5 Acquires and evaluates information.
- C-6 Organizes and maintains information.
- C-7 Interprets and communicates information.
- C-8 Uses computers to Process information.

#### **c) INTERPERSONAL—Works With Others**

- C-9 Participates as members of a team and contributes to group effort.
- C-10 Teaches others new skills.
- C-11 Serves clients/customers—works to satisfy customer's expectations.
- C-12 Exercises leadership—communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.
- C-13 Negotiates-Works toward agreements involving exchanges of resources resolves divergent interests.
- C-14 Works with Diversity-Works well with men and women from diverse backgrounds.

#### **d) SYSTEMS—Understands Complex Interrelationships**

- C-15 Understands Systems—Knows how social, organizational, and technological systems work and operates effectively with them
- C-16 Monitors and Correct Performance-Distinguishes trends, predicts impacts on system operations, diagnoses systems' performance and corrects malfunctions.
- C-17 Improves or Designs Systems-Suggests modifications to existing systems and develops new or alternative systems to improve performance.

#### **e) TECHNOLOGY—Works with a variety of technologies**

- C-18 Selects Technology—Chooses procedures, tools, or equipment including computers and related technologies.
- C-19 Applies Technology to Task-Understands overall intent and proper procedures for setup and operation of equipment.
- C-20 Maintains and Troubleshoots Equipment-Prevents, identifies, or solves problems with equipment, including computers and other technologies.

### **B. FOUNDATION SKILLS**

#### **a) BASIC SKILLS—Reads, writes, performs arithmetic and mathematical operations, listens and speaks**

- F-1 Reading—locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.
- F-2 Writing-Communicates thoughts, ideas, information and messages in writing, and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.
- F-3 Arithmetic—Performs basic computations; uses basic numerical concepts such as whole numbers, etc.
- F-4 Mathematics—Approaches practical problems by choosing appropriately from a variety of mathematical techniques.
- F-5 Listening—Receives, attends to, interprets, and responds to verbal messages and other cues.



- F-6 Speaking—Organizes ideas and communicates orally.  
**THINKING SKILLS—Thinks creatively, makes decisions, solves problems, visualizes, and knows how to learn and reason**
- F-7 Creative Thinking—Generates new ideas.
- F-8 Decision-Making—Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative.
- F-9 Problem Solving—Recognizes problems and devises and implements plan of action.
- F-10 Seeing Things in the Mind’s Eye—Organizes and processes symbols, pictures, graphs, objects, and other information.
- F-11 Knowing How to Learn—Uses efficient learning techniques to acquire and apply new knowledge and skills.
- F-12 Reasoning—Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.
- b) PERSONAL QUALITIES—Displays responsibility, self-esteem, sociability, self-management, integrity and honesty**
- F-13 Responsibility—Exerts a high level of effort and preserves towards goal attainment.
- F-14 Self-Esteem—Believes in own self-worth and maintains a positive view of self.
- F-15 Sociability—Demonstrates understanding, friendliness, adaptability, empathy, and politeness in-group settings.
- F-16 Self-Management—Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control.
- F-17 Integrity/Honesty—Chooses ethical courses of action.