

## **Heat Pumps (HART 2449)**

### **CREDIT**

4 Semester Credit Hours (2 hours lecture, 6 hours lab)

### **MODE OF INSTRUCTION**

Hybrid

### **PREREQUISITE/CO-REQUISITE:**

HART 1407 Or HART 1441

### **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

### **COURSE OBJECTIVES**

Upon completion of this course, the student will be able to

1.
  1. Identify a reverse cycle system
  2. List the mechanical and electrical components for the heat pump operation.
  3. Identify the operation of heat pump modes including cooling, heating, defrost, emergency heat, and auxiliary heat mode.
  4. Identify and explain different methods of accomplishing defrost.
  5. Perform charging a system correctly in the heating and cooling modes.  
Troubleshoot electrical and mechanical components.
  6. Perform tests for adequate air flow.

Calculate balance point and C.O.P. (co-efficiency of performance)

### **Course Outline**



- A. Introduction
  - 1. Introduction of faculty and students
  - 2. Review Syllabus
  - 3. Review Class Policies
  - 4. Review Lab Assignments
- B. Review of Basic HVAC Systems
  - 1. Refrigeration Theory
  - 2. Electrical Theory
- C. Electrical Components Unique to Air-to-Air Heat Pumps
  - 1. Reversing Valves
  - 2. Defrost Sensors & Relays
  - 3. Auxiliary & Emergency Heaters
- D. Heat Pump Thermostats & Wiring
  - 1. Multi-Stage Terminals
  - 2. Reversing Valve Terminals
  - 3. Additional Control Circuits
- E. Charging Heat Pumps
  - 1. Super Heat and Subcool Method
  - 2. Manufacturer Charging Charts
  - 3. Weigh-in Charge
- F. System Efficiency
  - 1. SEER
  - 2. COP
- G. Geothermal Heat Pump Systems
  - 1. Explore Principles of Geothermal
  - 2. Explain Heat Transfer through Coaxial Heat Exchangers
  - 3. Identify different Loop Designs
  - 4. Perform Polyethylene Loop Fusion

#### **INSTRUCTOR CONTACT INFORMATION**

Instructor: Paul Johnson

Email: [pjohnson@lit.edu](mailto:pjohnson@lit.edu)

Office Phone: 409).839.2004

Office Location: Tommy Williams Building ITC 2 102

Office Hours: 1230-1:00pm Monday-Thursday

#### **REQUIRED TEXTBOOK AND MATERIALS**

**SKILLMILL Online digital learning resource provided by Lamar Institute of Technology.**

**Modern Refrigeration and Air Conditioning textbook by Althouse, Turnquist, and Bracciano, either of the two latest editions**

**ATTENDANCE POLICY**  
**20% of class meetings**

**DROP POLICY**

If you wish to drop a course, you are responsible for initiating and completing the drop process. If you stop coming to class and fail to drop the course, you will earn an “F” in the course.

**COURSE CALENDAR**

DATE	TOPIC	READINGS (Due on this Date)	ASSIGNMENTS (Due on this Date)
WEEK 1-2	HVAC SAFETY	SKILLMILL	SKILLMILL ASSIGNED
WEEK 2-3	INTRO TO REFRIGERATION SYSTEMS	SKILLMILL	SKILLMILL ASSIGNED
WEEK 2-3	TEMPERATURE PRESSURE & HEAT	SKILLMILL	SKILLMILL ASSIGNED
WEEK 2-3	BASIC HVAC TOOLS	SKILLMILL	SKILLMILL ASSIGNED
WEEK 2-3	METERING DEVICES	SKILLMILL	SKILLMILL ASSIGNED
WEEK 4-5	COMPRESSORS	SKILLMILL	SKILLMILL ASSIGNED
WEEK 4-5	LEAK CHECK AND EVACUATION	SKILLMILL	SKILLMILL ASSIGNED
WEEK 4-5	CHARGING PART 1: TOOLS AND RULES	SKILLMILL	SKILLMILL ASSIGNED
WEEK 4-5	CHARGING PART 2: SUBCOOLING AND SUPERHEAT	SKILLMILL	SKILLMILL ASSIGNED
WEEK 6-7	HVAC SUPPLIES	SKILLMILL	SKILLMILL ASSIGNED
WEEK 6-7	INTRO TO HEAT PUMPS	SKILLMILL	SKILLMILL ASSIGNED
WEEK 6-7	HEAT PUMP TROUBLESHOOTING	SKILLMILL	SKILLMILL ASSIGNED
WEEK 6-7	INTRO TO CHILLERS	SKILLMILL	SKILLMILL ASSIGNED

**\*\*ADDITIONAL HAND-OUTS MAYBE GIVEN AND DUE DATE WILL BE ASSIGNED IN CLASS.\*\***

### **COURSE EVALUATION**

Final grades will be calculated according to the following criteria:

- DISCUSSION POSTS 5%
- HOMEWORK/ASSIGNMENTS (KC) 20%
- QUIZZES (FKC) 10%
- EXAMS 25%
- LAB/PROJECTS 40%

### **GRADE SCALE**

**A= 90-100**

**B= 80-89**

**C=70-79**

**D=60-69**

**F= 0-59**

### **TECHNICAL REQUIREMENTS**

The latest technical requirements, including hardware, compatible browsers, operating systems, etc. can be online at <https://lit.edu/online-learning/online-learning-minimum-computer-requirements>. A functional broadband internet connection, such as DSL, cable, or WiFi is necessary to maximize the use of online technology and resources.

### **DISABILITIES STATEMENT**

The Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. LIT provides reasonable accommodations as defined in the Rehabilitation Act of 1973, Section 504 and the Americans with Disabilities Act of 1990, to students with a diagnosed disability. The Special Populations Office is located in the Eagles' Nest Room 129 and helps foster a supportive and inclusive educational environment by maintaining partnerships with faculty and staff, as well as promoting awareness among all members of the Lamar Institute of Technology community. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409)-951-5708 or email [specialpopulations@lit.edu](mailto:specialpopulations@lit.edu). You may also visit the online resource at [Special Populations - Lamar Institute of Technology \(lit.edu\)](#).

### **STUDENT CODE OF CONDUCT STATEMENT**

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in the *LIT Catalog and Student Handbook*. The *LIT Catalog and Student Handbook* may be accessed at [www.lit.edu](http://www.lit.edu). Please note that the online version of the *LIT Catalog and Student Handbook* supersedes all other versions of the same document.

## **STARFISH**

LIT utilizes an early alert system called Starfish. Throughout the semester, you may receive emails from Starfish regarding your course grades, attendance, or academic performance. Faculty members record student attendance, raise flags and kudos to express concern or give praise, and you can make an appointment with faculty and staff all through the Starfish home page. You can also login to Blackboard or MyLIT and click on the Starfish link to view academic alerts and detailed information. It is the responsibility of the student to pay attention to these emails and information in Starfish and consider taking the recommended actions. Starfish is used to help you be a successful student at LIT.

## **ADDITIONAL COURSE POLICIES/INFORMATION**

### **Course Requirements**

1. Homework assignments
2. Hands on lab activities
3. Use of Blackboard and other Web based platforms and resources
4. It is require to complete a safety policy form

### **Course Policies**

1. No horse playing tolerated, always maintain a safe learning environment.
2. No open foot shoes, sandals, or flip-flops: closed foot shoes *only*.
3. No smoking, eating, or sleeping will be tolerated during class; LIT is a tobacco free campus
4. No rings or other jewelry and lanyards worn exterior that can be a lab hazard.
5. No unauthorized use of cell phones and computers during class.
6. Safety glasses or goggles and gloves are required while working in the lab
7. No make-up for missed exams; but lowest written exam score will be dropped from final grade
8. Due dates are *final*, acceptance of late work will be instructor's discretion
9. Two times tardy will result in an absence; always notify the instructor for excused absences
10. Executed completion of the HVAC Safety Policy and Procedure Form required before working in Lab.