**Outcome:** Students will be able to explain the basic concepts of heat transfer, the common factors affecting the transfer of heat between fluids and be able to demonstrate calculating heat transfer rates. Students will be able to describe the concepts represented in an enthalpy diagram and be able to determine the enthalpy of water in its various phases and demonstrate an understanding of latent heat of vaporization of water. The students will be able to describe the phases, properties, and usage of liquid, saturated and superheated steam for heat transfer in various industries. Several types of heat exchangers and their application in the industry will be examined and discussed.

**Lecture:** Lecture to review:

1. Basic concepts of heat transfer
   1. Fluid heat energy
      1. Enthalpy
   2. Heat transfer concepts
   3. Factors affecting heat transfer
2. Fluid (water/steam) thermodynamics
3. Steam tables
4. Heat exchanger types
   1. Shell & Tube
   2. Fin-Fan
   3. Plate & Frame
   4. Kettle Reboiler
   5. Electric Heaters
   6. Gas Fired Heaters
   7. Jacketed Vessels
   8. Cooling Towers
   9. Heaters
   10. Furnaces
5. ISA symbology

**Demo(s):**

1. Small equipment lab
   1. Disassemble and inspect Shell & Tube
   2. Inspect Boiler model
   3. Inspect Radiator

**Lab:**

1. Location: Small equipment lab
   1. Heat exchanger demonstrator
   2. Demonstrate heat transfer basics.
2. Location: HOT unit (GRHS)
   1. Demonstrate Heater
   2. Demonstrate Heat Exchanger
   3. Demonstrate Fin-Fan

**Homework:**

1. Heat Exchanger Presentation
2. Heat Transfer Problems
   1. Word problems
   2. PSTE Cooling Tower Module

**Documentation:**

1. Lecture: Heat Transfer .ppt
2. Control Valve Sourcebook-Power Sec 7 Pages 1-3
3. PTSE Cooling Tower Lesson Module
4. <http://www.spiraxsarco.com/global/us/Resources/Pages/steam-tables.aspx>
5. <https://www.steamtablesonline.com/Steam97Web.aspx>
6. <http://www.tlv.com/global/TI/calculator/steam-table-pressure.html>

**Assessment:**

1. Homework
2. Lab Work
3. Lab Safety
4. Heat exchanger hands-on
5. Quiz(s) & Final Exam

**Heat Exchanger PowerPoint Homework**

You (and a partner) will be assigned a specific type of heat exchanger to be researched for discussion in class and will teach/present your findings to the entire class.

Presentations will take place on \_\_\_\_\_\_\_.

Presentations should take approximately 15 minutes (give or take). Please include the following items in your presentation:

**Presentation Requirements:**

* Presentation needs to have a picture or a drawing preferably cutaway style showing fluid flow paths.
  + Discussion of fluid flow paths
* Application of where it is used in industry/what type of processes is it primarily used for?
* Advantages/Disadvantages
* What are the common problems that occur with this style of heat exchanger?
* Video from YouTube so we can see the flow paths of the heat exchanger.
* Presentation slides must be neat and well organized:
  + Easy to read & follow
  + Pictures and visuals where necessary
* The presentation must be informative and interesting:
  + Presenters should not read from the slides, make good eye contact with listeners
  + Presenters should be enthusiastic and do not speak in a monotone voice
* Your class peers and I will evaluate the presentation based on the criteria indicated on the attached form.
* The presentations and the peer evaluations will be turned in.
* I will be grading both the presentation for technical content, clarity and presenter deportment and the evaluation form for objectively.

***Evaluation Criteria:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **5 = Exceeds** | **4 = Meets** | **3 = Mostly Meets** | **2 = Somewhat/Partially Meets** | **1 = Doesn't Meet** |
| Proficiently explains and engages peers actively in discussion of technical concepts in context; inspires, deepens rich technical understanding of others | Clearly and competently discusses technical concepts (technology, applications) with peers; enhances technical knowledge of others | Understandably explains technical concepts (technology, applications) with peers; reinforces technical expertise of others | Unclearly discusses technical concepts (technology, applications) with peers; does not aid but may confuse understanding of others | Incompetently presents technical concepts (technology, applications) to peers; leaves others confused, doubting the correctness of the information |

**Grading Details**

This presentation will go towards your Lab grade and is worth 30 points

**Grade Breakdown**

* **\_\_\_/5 points:** Presentation needs to have a picture or a drawing with fluid flow indicated.
  + Discussion points
* **\_\_\_/5 points:** Application of where it is used in industry/what type of material is it primarily used for?
* **\_\_\_/2 points:** Advantages: Why would you choose this style of heat exchanger?
* **\_\_\_/2 points:** Disadvantages: Why wouldn’t you choose this style of heat exchanger?
* **\_\_\_/2 points:** Video from YouTube so we can see the flow paths of the heat exchanger.
* **\_\_\_/2 points:** What are the common problems that occur with this style of heat exchanger?
* **\_\_\_/2 points:** Presentation slides must be neat and well organized:
  + Easy to read
  + Easy to follow
  + Pictures and visuals where necessary
* **\_\_\_/10 points:** Presentation must be informative and interesting:
  + Presenters didn’t read off the slides, made good eye contact with listeners
  + Presenters were enthusiastic and did not speak in a monotone voice
    - Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_\_\_\_
    - Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_\_\_\_

**Peer Evaluation Form**

Peer evaluation completion and turned in up to 10 Points

Presenter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Evaluator: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Evaluation components:

Content: Did the content of the presentation meet the required project expectations?

1 2 3 4 5

Was the technical information communicated effectively? (Did you understand it?)

1 2 3 4 5

Deportment/Presentation Skills. (e.g., eye contact, not reading the slide, speaking quality, confidence)

1 2 3 4 5

Overall score: \_\_\_\_\_\_\_\_\_

Write three compliments on how the presenter was effective:

1.

2.

3.

Make two suggestions for how the presenter can improve in the future:

1.

2.