**Outcome:** Students will be able to explain the fluid transfer concepts of centrifugal force and positive displacement equipment. Students will be able to describe the operational characteristics, considerations, accessories and operational issues of distinct types of rotating equipment, e.g., pumps, fans, blowers, and compressors. The training will include the equipment’s major components, normal and abnormal operation and their various applications in industry. Emphasis will be on proper operation, inspection, failure modes/causes, and troubleshooting.

**Lecture:** Lecture to review:

1. Basic Concepts
   1. Centrifugal Force
   2. Positive Displacement
2. Fans
   1. Types
      1. Radial
      2. Axial
   2. Operational Characteristics
   3. Components & Construction
   4. Applications
   5. Operational Issues
3. Blowers
   1. Types
      1. Lobe
      2. Screw
      3. Centrifugal
   2. Operational Characteristics
   3. Components
   4. Applications
   5. Operational Issues
4. Compressors
   1. Types
      1. Centrifugal
      2. Positive Displacement
         1. Reciprocating
         2. Screw
   2. Operational Characteristics
   3. Components
   4. Applications
   5. Operational Issues
5. Pumps
   1. Types
      1. Centrifugal
         1. Single Stage
         2. Multi-Stage
      2. Positive Displacement
         1. Reciprocating
            1. Axial
            2. Radial
         2. Screw
         3. Progressive Cavity
         4. Sliding Vane
         5. Peristaltic
         6. Gear
         7. Diaphragm
   2. Operational Characteristics
   3. Components
   4. Applications
   5. Operational Issues
6. ISA symbology

**Demo(s):**

1. Small equipment lab
   1. Inspect centrifugal compressor model
   2. Inspect reciprocating compressor model
   3. Inspect centrifugal pump cutaway

**Lab:**

1. Location: Small equipment lab
   1. Pump demonstrator
2. Location: HOT unit (GRHS)
   1. Pump startup.
   2. Pump cavitation (NPSH & Deadheading)
   3. Metering pump calibration
   4. Demonstrate

**Homework:**

1. PD pump presentation.
2. Pump troubleshooting exercises
   1. PTSE Pump Troubleshooting (Part 1)
      1. Reading & Self-check
      2. Scenarios #’s 1 & 2
   2. PTSE Pump Troubleshooting (Part 2)
      1. Reading & Self-check
      2. Scenarios #’s 1 & 2

**Assessment:**

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

**Documentation:**

1. Lecture: Rotating Equipment Part I – Fans, Blowers & Dampers
2. Lecture: Rotating Equipment Part II - Compressors
3. Lecture: Rotating Equipment Part III - Pumps
4. Lecture: Rotating Equipment Part IV – Pump operational considerations

**Rotating Equipment Troubleshooting Homework**

1. Pump troubleshooting exercises
   1. PTSE Pump Troubleshooting (Part 1)
      1. Reading & Self-check
      2. Scenarios #’s 1 & 2
   2. PTSE Pump Troubleshooting (Part 2)
      1. Reading & Self-check
      2. Scenarios #’s 1 & 2

**PD Pump PowerPoint Homework**

You will be assigned a specific type of positive displacement (PD) pump to be researched for discussion in class and will present your findings to the entire class.

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

Presentations should take approximately 11 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 pump?
* Video from YouTube so we can see the flow paths of the pump.
* 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 20 points

**Grade Breakdown**

* **\_\_\_/3 points:** Presentation needs to have a picture or a drawing with fluid flow indicated.
  + Discussion points
* **\_\_\_/3 points:** Application of where it is used in industry/what type of material is it primarily used for?
* **\_\_\_/1 points:** Advantages: Why would you choose this style of PD pump?
* **\_\_\_/1 points:** Disadvantages: Why wouldn’t you choose this style of PD pump?
* **\_\_\_/1 points:** Video from YouTube so we can see the flow paths of the heat exchanger.
* **\_\_\_/1 points:** What are the common problems that occur with this style of PD pump?
* **\_\_\_/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.