



Mechanical Engineering Dept. Department

Syllabus

ME 431: Refrigeration (3-0-3)

Course Catalog Description:

Mechanical vapor compression refrigeration cycles (single-stage and multi-stage); refrigerant compressors; refrigerants; absorption refrigeration systems; thermoelectric cooling; flash cooling; gas cycle refrigeration; ultra-low-temperature refrigeration (cryogenics); food refrigeration; transport refrigeration; Design and performance evaluation problems in refrigeration systems and applications.

Course Pre-requisites:

- ME 315: Heat Transfer

Course Objectives:

1. To familiarize students with the basic understanding of several types of refrigeration systems
2. To provide students with a working knowledge of the operation of several key components as well their selection
3. To prepare the student to optimize refrigeration systems as well as estimate their economic and environmental impact

Course Learning Outcomes:

CLO1. Be able to demonstrate basic understanding of several types of refrigeration systems that will include vapor compression, vapor absorption, thermoelectric cooling, flash cooling, and gas cycle refrigeration.

CLO2. Be able to identify capabilities and limitations of different refrigeration systems in terms of their performance, energy requirements, maintenance and economic considerations, etc.

CLO3. Be able to demonstrate the operation of several key components in a refrigeration cycle and Explain the proper selection of components in refrigeration systems

CLO4. Be able to explain how to maximize the performance of a refrigeration system.

CLO5. Be able to demonstrate ability to use EES and EXCEL in solving open-ended design problems and demonstrate ability to estimate the economic and environmental impact of refrigeration systems design and performance

CLO6. Be able to present their works in form of technical reports and oral presentation including graphic presentations

Learning Resources:

- T. H. Kuehn, J. W. Ramsey, and J. L. Threlkeld, Thermal Environmental Engineering, 3rd Edition, Prentice Hall, Inc., 1998.
- ASHRAE Handbook: Refrigeration, 2018 Edition
- ASHRAE Handbook: Refrigeration System and Applications, 1998 Edition
- ARI Handbook: Refrigeration and Air-Conditioning, 2nd Edition, 1987

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Second Major Exam	12	20.0%
Project	15	10.0%
Final Exam (Comprehensive)	16	30.0%
First Major Exam	8	20.0%
Homeworks	every week	10.0%
Quizzes	various	10.0%

Lecture Weekly Schedule:

Week#	Topics
1	Mechanical vapor-compression refrigeration cycles
2	Mechanical vapor-compression refrigeration cycles (Continue)
3	Mechanical vapor-compression refrigeration cycles (Continue)
4	Mechanical vapor-compression refrigeration cycles (Continue) Vapor-compression system analysis
5	Vapor-compression system analysis (Continue) Binary mixtures and absorption refrigeration
6	Binary mixtures and absorption refrigeration (Continue)
7	Binary mixtures and absorption refrigeration (Continue)
8	Thermoelectric cooling
9	Thermoelectric cooling (Continue) Flash cooling
10	Gas cycle refrigeration
11	Gas cycle refrigeration (Continue) Ultra-low-temperature refrigeration: cryogenics
12	Ultra-low-temperature refrigeration: cryogenics (Continue)
13	Ultra-low-temperature refrigeration: cryogenics (Continue) Food and transport refrigeration

Week#	Topics
14	Food and transport refrigeration (Continue)
15	Food and transport refrigeration (Continue) Tests