

PRGR 643

Refrigeration and Heat Pumps (2 credits)

Catalog description:

This course is designed to introduce students to refrigeration and heat pump theory. Topics introduced include: basic mechanical vapor-compression cycle, refrigerant properties, multistage vapor compression cycles, compressors types, condensers and evaporators, expansion devices, refrigeration piping material, selection and proper sizing, and simulation of heat pumps and cost-effective design options.

Textbook:

Reinhard Radermacher, Yunho Hwang, "Vapor Compression Heat Pumps: with Refrigerant Mixtures", Publisher: CRC – Taylor & Francis Group, 2005

References:

- 1) Billy C. Langley, "Heat Pump Technology", 3rd edition, Publisher: Prentice Hall, 2002.
- 2) Roald Nydal, "Refrigeration Manual", Publisher: The Swedish Society of Refrigeration, 2000.
- 3) Karl Ochsner, "Geothermal Heat Pumps: A guide for Planning & Installing", Publisher: EARTHSCAN, 2008.

Coordinator:

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Prerequisite by Topic:

Thermodynamics

Educational Objectives/Learning Outcomes

Students that successfully complete this course will have:

- Knowledge of the vapor compression heat pump types and its different components.
- Ability to mathematically model the performance different components of the heat pump and to integrate these models in one cycle.
- Familiarity with the different refrigerants (pure and mixture) used in heat pumps
- Ability to use commercial software such as REFPRO for refrigerant thermodynamics properties needed in simulating the heat pump cycle.
- Familiarity with the ground source and solar assisted heat pumps.

Topics covered

- Reasons to use a Heat Pump
- Introduction to heat pumps
- Vapor Compression Heat Pumps
- (Vapor Compression) Heat Pump Components
 - Geothermal Heat Pumps (Ground-Source Heat Pumps)
 - Simulation of the Vapor Compression Cycle

Working Fluids, Accessories and Refrigerant Pipes in Vapor Compression Heat
Pumps Heat Pumps Troubleshooting

Assessment and grades

Class Participation (10%)

Projects and homework

(50%) Term Exam (40%)

Resources for the course

Course handouts and slides

Research publications and reports