

## **PRGR 643**

### **Heat Pumps (2 credits)**

#### **Catalog description:**

A course that focuses on heat pumps in low energy and passive buildings as well as ground source heat source fundamentals, loop systems, open systems, soil classification and conductivity, grouting procedures, performance of ground source heat pumps in housing units. Simulation of heat pumps and cost effective design options will be considered.

#### **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