MEP 451: Refrigeration and Air Conditioning (I) (3; 3, 1)
Spring 2011, 1431-1432H

Instructor

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Class Meeting Time & Place

Section	Class time	Place [Bldg. & Room]	Tutorial
BA	.S.T. 8:00-9:20	Bldg. B Room 310	.S… 14:30-15:30

Laboratory Location: Refrigeration and Air Conditioning Laboratory, 2nd Floor, Bldg. 106 [Solar Energy Bldg.]

Catalog Description MEP

MEP 451 Refrigeration and Air Conditioning (1) (3: 3, 1)
Review of basic thermodynamics, Analysis of vapor compression cycles. Refrigerants and their characteristics. Basic vapor compression equipment. Introduction to absorption refrigeration. Space air conditioning. Human thermal comfort. Air conditioning systems. Heat transmission in building materials. Heat gains through walls and fenestrations. Cooling load calculations. Duct design. Calculation using software packages

Topics

1. Review of thermodynamics: First and second law. Carnot Ideal vapor compression cycle. Properties diagrams. Units, Introduction to AC & Ref.
2. Deviations from theoretical vapor compression refrigeration cycle
3. Refrigerants: types, characteristics, numbering system, and safety groups
4. Basic vapor compression refrigeration equipment: Compressors, condensers, evaporators, etc
5. Introduction to absorption refrigeration. Analysis of H_2O-LiBr absorption refrigeration system
6. Space air conditioning: Review of psychrometrics and air conditioning processes. Space air conditioning processes, and their representations on psychrometric chart
7. Thermal comfort: Factors affecting thermal comfort in occupied spaces. ASHRAE comfort chart, Indoor air quality.
8. Air Conditioning systems (all-air systems, all-water systems, air-and-water systems, and unitary air conditioners). Central mechanical equipment
9. Heat transmission in building materials. Overall heat transfer coefficient. Tabulated data for heat transmission in building materials
10. Solar heat gain calculations including earth's motion about the sun and the relation between solar time and civil time. Calculation of solar angles, solar irradiation using ASHRAE clear sky model, and solar heat gain through fenestrations
11. Cooling load calculations. Heat gains, cooling load. External and internal heat gains. Outdoor and indoor design conditions. Cooling loads due to heat transmission through walls, roofs, and fenestration. Cooling load due to internal sources such as people, lights and equipment. Ventilation & infiltration Cooling load calculation using the Radiant Time Series Method (RTS)
12. Duct design: Air flow through ducts and fittings. Equal friction method

Prerequisite Courses

MEP-261: Thermodynamics
MEP-360: Heat Transfer
MEP361: Thermodynamics II

Prerequistes by Topics

1. Understanding the basic concepts of thermodynamics especially the first and second laws applications.
2. Basic fluid mechanics: Bernoulli's equation. Major and minor losses in pipes
3. Understanding of basic modes of heat transfer
4. Ability to use personal computers and familiarity with Internet browsing and Microsoft office applications

Course Goals & Objectives

1. Introduce students to basic principles of thermal environment engineering, psychrometrics, air conditioning and refrigeration cycles calculation.
2. Provide students with a working knowledge of components forming refrigeration cycles and air conditioning systems and applications of the basic principles mentioned in (1) above in analysis and design of refrigeration and air conditioning cycles.
3. 3.Provide students with a working knowledge of computer-aided calculations using software packages such as EES, EXCEL, etc

Textbook & Other Required Material

Refrigeration and Air Conditioning notes
Additional Handout materials: appendix A & Appendix B [Tables, charts, handouts, etc…]

References

1. Heating Ventilating and Air conditioning, F.C. McQuiston, J.D. Parker, and J.D. Spitler, 6th Edition, John Wiley Publishers, 2005.
2. Thermal Environmental Engineering, Kushen, Rensey, and Threlkeld, 3rd ed., Prentice Hall Inc., I 998.
2. Heating Ventilating and Air conditioning, McQuiston and Parker,
4th ed., John Wiley Publishers, 1994.
4. ASHRAE Handbook of Fundamentals, 2009.

Laboratory Work

1. Touring AC lab. and/or a nearby Air conditioning system of a building.
2. Experiment # 1 Performance of an actual vapor compression refrigeration cycle-
3. Experiment #2 Psychrometric processes
4. Possible field trip site visit to a central air conditioning system

Computer Usage

- Through students assignments using EES software & Excel
- Internet search for related topics

Evaluation	1. Final Exam	30 %
	2. Mid. Term exam	20 %
	3. Quizzes	20 %
	4. Design Report	10 %
	5. Labs	5%
	6. HWs & term paper	15

Website for the course: http://engg.kaau.edu.sa/~alrabghi
or http://orabghi.kau.edu.sa

Topics, duration and excluded parts

			Notes		
	Topic	**Duration (week)**	**Chapters**	**Sections**	**Excluded parts**
1	Introduction	1	1	All	
2	Basic Vapor compression Ref.	1	2	2.1 through 2.6	2.7 to the end
3	Refrigerants	1	3	All	
4	Refrigeration Equipment	1	4	4.1, 4.2, 4.3.1, 4.3.2.1, 4.3.2.2, 4.4.3, 4.4.4, 4.5.1, 4.6, 4.7	4.3.2.2 Shell and coil HX, 4.3.3 Evaporative condensers, 4.4.1 Hand exp. valve, 4.4.2 Automatic expansion valve, 4.5.2 classification of evaporator acc…
5	Absorption Ref.	1	5	All	
6	Psychrometrics	2	7	All	
	Mid, term exam				
7	Thermal Comfort	0.5	8	All	
8	AC systems	1	9	All	
9	Heat transmission in buildings	1.5	10	All	
10	Solar	1.5	11	All	
11	Cooling load	2	12	All	
12	Duct Design*	1	13		
	Finals				

* Chapter 13 from Heating Ventilating and Air conditioning, F.C. McQuiston, J.D. Parker, and J.D. Spitler, 6th Edition, John Wiley Publishers, 2005