King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT
ME 430: Air Conditioning

Catalogue Description: (3-0-3)
Thermodynamics of moist air; construction of the psychrometric chart; psychrometric processes; psychrometric systems; industrial processes, air conditioning systems; Air Conditioning for comfort and health- Indoor air quality, cooling and heating load calculations, duct design and air distribution methods; cooling towers.

Status in Curriculum (Required or Elective): Elective

Prerequisites:ME 204, ME 315

Co-requisites: None

Prerequisites by Topics:
1) Basic thermodynamics of refrigeration cycles (ME 203, ME 204)
2) Basic thermodynamics properties of moist air and psychrometric properties (ME 204)
3) Basics of fluid mechanics and conservation of mass, and conservation of energy. (ME 203, ME 311)
4) Basics of different modes of heat transfer (ME 315)

Textbook:F. C. McQuistion and J. D. Parker, Heating, Ventilating, and Air Conditioning: Analysis and Design, 6th Edition, Wiley, New York, 2005.

References:

1. J. L. Threlkeld, Thermal Environmental Engineering, Prentice-Hall, Inc., NJ, 1970.
2. W. F. Stoecker, and J. W. Jones, Refrigeration and Air Conditioning, McGraw-Hill, NY.
3. ASHRAE Handbook of Fundamentals, 2001 and 2011 Edition, Atlanta, GA.
4. T. H. Kuehn, J. W. Ramsey, and J. L. Threlkeld, Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998.

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Goals:(general objectives)

1. Introduce students to basic principles of thermal environment engineering, psychrometrics and air conditioning calculation.
2. Provide students with a working knowledge of components forming air conditioning systems and applications of the basic principles mentioned in 1 above in analysis and design of AC systems.
3. Provide students with a working knowledge of computer-aided calculations of thermal loads and their use in design of AC systems

Course Outline (Lecture Topics):

1.	Air-condition systems and components	(6 Classes)
2.	Thermodynamic properties of moist air	(3 Classes)
3.	Psychrometric processes and AC applications	(8 Classes)
4.	Design and off-design conditions	(2 Classes)
5.	Indoor air quality – comfort and health	(6 Classes)
6.	Heat Transfer in Buildings	(3 Classes)
7.	Heating and Cooling Load Calculations	(6 Classes)
8.	Space air diffusion design	(3 Classes)
9.	Fans and building air distribution system design	(2 Classes)
10.	Diffuser selection	(2 Classes)
11.	Flow in ducts and duct design	(2 Classes)
12.	Tests	(2 Classes)

Design Activities/Projects:
A major project on heating and cooling load calculation for a central air conditioning system and duct design for a building is assigned. A typical architecture drawing for the building is provided to the students and each group of students would carry out the calculations and the design of the air conditioning system for the same building but at different cities and/or different orientations. The effects of the building material features (e.g., the walls and roof insulations) on the heating and cooling loads and on the air conditioning system sizing and operating

power and cost are to be analyzed.

Computer Usage:

The students are asked to use the software's associated with the text book and beyond this such as:

1 – Pshychrometric computer aided software, psychrometric calculators, ..etc.
2 – Heating and cooling load software
3 – Pipe design and pump selection software
4 – duct design software

Laboratory: None

Assessment Tools:

i- Two Major Examinations
ii- Homework Assignments and Term Project
iii- Quizzes
iv- Final Exam (comprehensive)

Course Learning Outcomes:

1. Demonstrate an understanding of various components of AC systems and how they work together in a typical real-life AC system.
2. Utilize psychrometric chart to represent different AC processes and obtain Thermodynamic calculations for them.
3. Analyze typical complete AC systems and represent them on psychrometric charts.
4. Select suitable indoor air quality and design conditions.
5. Select suitable components (pumps, fans, diffusers, etc.,) for typical AC systems.
6. Compute cooling and heating loads for a given building in a given location.
7. Design piping systems for AC systems.
8. Design duct systems for AC systems.
9. Design space air diffusion systems.

Course Learning Outcomes mapped to Student Outcomes:

Student Outcomes	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
Course-to-Student outcome mapping	1	2, 3; 5	7,8,9	4,5,6, 7, 8, 9	4,7,8,9	4, 5, 6	6	6	4, 6	4, 6	2, 3, 6
Emphasis*	L; M	**S**	**S**	S	**S**	S	S	S	M	S	S

* **L**: Little/None **M**: Moderate **S**: Strong

Status of Continuous Improvement review of this Course:

Date reviewed: March 9, 2015 **Reviewed by:** Thermo Fluid Sciences Group
Prepared by: Dr. Esmail M. A. Mokheimer **Date prepared:** January 2011