Mechanical Engineering Department
Faculty of Engineering
Philadelphia University

Course Outline

Course Title: **Air Conditioning (1)** ***(0620543)***   ***1st semester 2009/2010***   **Instructor: Dr. Shatha Ammourah**   **Office Hours: 11: – 12:00 Sunday, Tuesday, and Thursday**   **Office No.: E61308**   **Telephone: Ext. 2125**

1. Course Description

The course provides the knowledge of heating, ventilating, and air conditioning to the undergraduate students by combining the fields of thermodynamics, psychrometry, fluid mechanics, and heat transfer, and introduces the principles of design of air conditioning systems and their applications.

2. Required Background or Experience

***Prerequisites by course*:**
Heat transfer (1) (620441), and Thermodynamics (2) (620342)

***Prerequisites by topics*:**
Fundamentals of thermodynamics (systems, properties, mass and energy conservation laws, second law of thermodynamics)
Fundamentals of fluid mechanics (flow in conduits, pumps and fans)
Fundamentals of heat transfer (conduction, convection, and radiation heat transfer, and heaters and heat exchangers)
Solar radiation
Refrigeration systems

***Post requisites*:**
Air conditioning (2)
Final year project

***Equivalent Courses*:**
Air conditioning

3. Course Objectives

The objectives of this course are:

I. To provide the students with the understanding of heating, ventilating and air conditioning concepts.

II. Understands psychrometry and air-water vapor mixtures.
III. Learn the various types of air –conditioning processes.
IV. Be familiar with the complete air conditioning system.
V. Learn the applications of air conditioning.
VI. Compute the heating load of buildings.
VII. Learn solar radiation.

Course Mapping Matrix to the Program Outcomes

Program Outcomes	a	b	c	d	e	f	g	h	i	j	k
Level of Learning	2		2	1	3	1	2	1	1	1	1

(Level of learning: 3 - high, 2 – medium, 1 – low)

4. Course Outcomes

Students will be expected to develop the following skills/understanding upon the successful completion of the course:

i. Identify the components of a complete air conditioning system *(PO e).*
ii. Work in teams to produce a viable solution of a given problem, *(PO d).*
iii. Make proper assumptions to perform design and analysis of heating systems of buildings, *(PO c).*
iv. Select proper equipments to satisfy the design and performance of the required HVAC system, (PO c and e).
v. Apply knowledge of engineering science and mathematics to perform detailed design and analysis work in air conditioning processes, *(PO a and e).*
vi. Address the environmental, social, ethical and legal aspects in design, *(PO f, i, and j).*
vii. Teach the students communication in design, *(PO g).*
viii. Broaden the education necessary to understand the impact of applying air conditioning systems in a global and societal context, *(PO h).*
ix. Use the techniques and modern engineering tools in design of components of air conditioning systems, *(PO k).*

5. Textbook(s) and Readings

- Heating, Ventilation and Air Conditioning, by: F.C. McQuiston, J.D. Parker, and J.D. Spitler. 6th ed., Wiley, 2005.
- ASHRAE Handbook, Fundamental Volume, American Society of Heating, Refrigeration and Air-Conditioning Engineers.
- Heating and Cooling of Buildings, by J. Kreider and A. Rabl, McGraw-Hill.
- Heating and Air-Conditioning, by: M. Alsaad and M.Hammad.
- Principles of heating, ventilating, and air conditioning, By: H, J. Sauer, R. H.Howell, and W. J. Coad.
- Air Conditioning Engineering, by W. P. Jones**.**

Lecture notes would be handed out to the students on the topics and issues which are not adequately discussed in the text books.

6. Minimum Student Materials

Texts, class handouts, engineering calculator, and an access to Personal Computer.

7. Course Contents **Weeks**

The following topics will be covered in this course:

❑ Basics of Air Conditioning – Fundamental Concepts	1
❑ Review of Fundamentals of Thermodynamics	1
❑ Moist Air Properties – Psychrometry	2
❑ Air Conditioning Processes	2
❑ Comfort and Health - Indoor Air Quality	3
❑ Heat Transmission in Buildings Structures	2
❑ Space Heating Load	2
❑ Solar Gain	2

8. Instructional Methods

- Lecture/ Problem solving sessions.
- Case Studies
- Homeworks
- Reading current literature related to engineering design
- Reading assignments

9. Evaluation of Outcomes

Evaluation will be done based on the following:

▪ Homeworks/ Assignments	(4 %)
▪ Design project/ Research/ Written report	(3 %)
▪ Quizzes	(3 %)
▪ Oral presentation	(%)
▪ Examinations	
First Examination	(20 %)
Second Examination	(20 %)
Final Examination	(50 %)
TOTAL	(100 %)

10. Professional Component Contribution

This is a fifth year core course that builds on students skills obtained in prerequisite courses. The student gains the ability to develop design specification, generate options for design, and does detailed design for mechanical components and/or system.

▪ Mathematics and Basic Science	( )
▪ Engineering Topics – (Design)	(3)
▪ General Education	( )

11. Examinations and Solutions

The students will be provided with the key solution after each exam to compare with their answers. If any student has a query then the supervisor should consider it based on the key solution and the marking scheme.

12. Homework Assignments

Assignments are due at the beginning of the class period on the date specified. Late homework will ***not*** be accepted and will be awarded zero. You may discuss the assignments among yourselves. However, direct copying of others work will ***not*** be allowed and will result in a reduction of grade.

13. Academic Honesty (Avoiding Plagiarism)

The university has strict rules and regulations about plagiarism, and it will be put into effect where it is seen to be necessary.

14. Attendance Policy

Students are expected to attend ***every class session***. However, absence from lectures and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

15. Relationship of course to program outcomes

Course Outcomes to achieve Program Outcomes

#	Course Outcome	Program Outcome										
		a	b	c	d	e	f	g	h	i	j	k
1	Identify the components of a complete air conditioning system *(PO e)*.					✓						
2	Work in teams to produce a viable solution of a given problem, *(PO d)*.				✓							
3	Make proper assumptions to perform design and analysis of heating systems of buildings, *(PO c)*.			✓								
4	Select proper equipments to satisfy the design and performance of the required HVAC system, (PO c and e).			✓		✓						
5	Apply knowledge of engineering science and mathematics to perform detailed design and analysis work in air conditioning processes, *(PO a and e)*.	✓				✓						
6	Address the environmental, social, ethical and legal aspects in design, *(PO f, i, and j)*.						✓			✓	✓	
7	Teach the students communication in design, *(PO g)*.							✓				

8	Broaden the education necessary to understand the impact of applying air conditioning systems in a global and societal context, *(PO h)*.								✓			
9	Use the techniques and modern engineering tools in design of components of air conditioning systems, *(PO k)*.											✓