

Spring 2021

## **ME 432-002: Air Conditioning & Refrigeration**

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## ME 432 – Principles of Air Conditioning and Refrigeration (Spring, 2021)

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*Tuesdays and Thursdays: 11:00 am -12:20 pm*

Pre-requisite: Thermodynamics, Fluid Mechanics, and Heat Transfer

**Text: Heating Ventilating and Air Conditioning – Analysis and Design** by F. C. McQuiston, J. D. Parker, and J. D. Spitler; 6<sup>th</sup> Edition, John Wiley & Sons, 2005

(5<sup>th</sup> Edition is also fine, but homework assignment will be based on 6<sup>th</sup> Edition)

**Lecture Notes:** from <http://mie.njit.edu/students/me-electives.php>, then go to ME432, password: me432fall

Week	Content & Chapter(s)	Due (Thursday)
1	Introduction; Refrigeration cycles (Chap 15)	-
2	Psychrometrics, processes (Chap 3)	HW#1
3	HW#1 soln; Psychrometric cycles;	-
4	Indoor air quality (Chap 4)	HW#2
5	HW#2 soln; Heat transmission in buildings (Chap 5)	-
6	Infiltration/exfiltration (Chap 7); <b>Quiz 1</b>	-
7	Quiz 1 soln; Infiltration/exfiltration (cont.)	HW#3
8	HW#3 soln; Solar radiation & Windows (Chap 6);	-
9	Solar radiation & Windows (cont.); Cooling loads (Chap 8)	-
10	Virtual visit to a HVAC company (or Introduction of Chillers)	HW#4
11	HW#4 soln; <b>Quiz 2</b>	-
12	Quiz 2 soln; Energy calculation methods (Chap 9);	-
13	Energy calculation methods (cont.); Project Presentation	HW#5
14	Project Presentation (continue); HW#5 Soln	Project

HW#1: Chap 15 & Chap 3

HW#2: Chap 3 & Chap 4

HW#3: Chap 5 & Chap 7

HW#4: Chap 6 & Chap 8

HW#5: Chap 8 & Chap 9

## Grading Rules and Requirements

(1) Grade Calculations (100% + 20% bonus)

25% + 5% bonus: Homework (5)

15% + 3% bonus: Term Project with presentation (1)

30% + 6% bonus: Quiz (2)

30% + 6% bonus: Final Examination (1)

Final Grade is based on the accumulated grade:

Above 90 is guaranteed to get “A”; below 60 is assessed as “F”. No curve on grading!

(2) Homework Requirements

(a) Five Assignments will be given, with 5 problems and 1 bonus problem per assignment.

(b) Assignments are due biweekly. **No late submission or re-submission.**

(c) Homework grade is based on “efforts” and “completeness”, rather than “perfect correctness”.

(d) Solutions will be explained in the next class after due date.

(3) Quiz & Exam Requirements

(a) Two quizzes (1.5-hour each) & one final exam (2.5-hour) will be given (open book and notes). Solutions for quizzes (but not for final exam) will be explained in class.

(b) Only basic concepts and simple calculations are involved.

(c) For each quiz or exam, there will be extra problem or question for bonus points.

(4) Term Project

One self-defined term project done by an individual student or a team of two is required. The term project should be a combined design of a HVAC system (see the following for detailed requirements). The term project is to be presented (5% on presentation and 10% on writing) before the end of semester.

### Term Project of ME432, Spring 2021

#### Teamwork and Report Requirement:

(1) Two (2) students per team or an individual student.

- (2) If two a team, one presents and the other defends the project. Each has his own presentation grade, but both have the same grade for the project writing.
- (3) Project report includes the (revised) ppt presentation (as an extract report, with outlines of methods and main results) plus all detailed calculations (as appendices).  
**An electronic copy for record keeping is required.**

**Detailed Requirement and Grading Method (Total 15 + 3 marks):**

- (1) (3 marks) Define your project (**air-conditioning: cooling**), including:
  - i) background and conditions, such as room (location, wall and roof facing direction; window; door); vehicle (window; body material)
  - ii) human (number, activity, human comfort condition)
  - iii) environmental concern (particulate or gaseous pollutant control)
- (2) (6 marks) Cooling load calculation, including:
  - i) Heat transmission through wall;
  - ii) Solar radiation through window;
  - iii) Infiltration;
  - iv) Heat generation, including human factors
- (3) (3 marks) Minimum fresh air requirement based on environmental concern, including
  - i) by-pass factors;
  - ii) filter efficiency and location;
  - iii) selection of filters with pressure drop consideration
- (4) (3 marks) Air-conditioning unit requirement, including:
  - i) return air ratio (based on minimum fresh air required) and mass flow rate;
  - ii) cooling coil capacity and SHR;
  - iii) compressor capacity with a selected refrigerant (e.g., R134a)
- (5) (3 bonus marks) Extra analysis
  - (i) Bin-Method Energy Analysis & Cost-based Equipment Selection; **OR**
  - (ii) Cooling Load Analysis on Daily Operation of an A/C System

Week	Tuesday	Thursday	Due
1	1/19	1/21	-
2	1/26	1/28	HW-1
3	2/2	2/4	-
4	2/9	2/11	HW-2
5	2/16	2/18	-
6	2/23	2/25 (Quiz-1)	-
7	3/2	3/4	HW-3
8	3/9	3/11	-
9	3/23	3/25	-
10	3/30	4/1	HW-4
11	4/6	4/8 (Quiz-2)	-
12	4/13	4/15	-
13	4/20	4/22	HW-5
14	4/27	4/29	Project Report
Final			-