

**ME 183: Refrigeration and Air Conditioning**  
**Second Semester, AY 2016-2017**

Class Schedule    WF 1:00 PM – 4:00 PM

Room    ME 3

Instructor    John Carlo S. Garcia  
 Consultation Hours    TTh 8:30 AM – 11:30 AM  
                                  TTh 1:00 PM – 4:00 PM

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**Course Description**

Standard vapor compression cycle, its components, system analysis and balance. Psychrometry, air-conditioning processes, cooling load and heating load calculations, fan and duct design, cooling coils and heat exchanger design.

**Course Objectives**

1. To introduce the fundamentals of thermodynamic processes involved in mechanical refrigeration systems and enable the student to understand these processes and apply to the analysis of performance of refrigerating cycles and their components.
2. To gain an understanding of the operation of refrigeration and air conditioning components such as compressors, fans, heat exchangers, expansion devices, ducting, pipes and fittings.
3. To synthesize previously learned principles in thermodynamics, fluid mechanics, and heat transfer in the analysis and design of refrigeration and air conditioning systems and their components.

**Prerequisite:**            ME 164

**Textbooks:**             Refrigeration and Air Conditioning by Stoecker and Jones

**Additional References:**    Refrigeration and Air Conditioning by C. P. Arora  
    ASHRAE Manual, Carrier Manual

**COURSE SCHEDULE**

Dates	Lec No.	Lecture Topics	Textbook Sections	Suggested Textbook Problems
<b>FIRST LONG EXAM TOPICS: <i>Introduction and Review of Basic Principles</i> (Chapters 1 and 2)</b>				
<b><i>The Vapor-Compression Cycle</i> (Chapter 10)</b>				
18 Jan	0	Introduction, Discussion of Syllabus		
20 Jan	1	Applications of Refrigeration and Air Conditioning, Thermal Principles: Thermodynamics	1.1 – 1.10, 2.1 – 2.11	2.1, 2.2, 2.3, 2.4
25 Jan	2	Thermal Principles: Modes of Heat Transfer, Heat Exchangers	2.12 – 2.23	2.5, 2.6, 2.7 2.8
27 Jan	3	Carnot Cycle, Vapor-Compression Cycle (VCC) and Variations	10.1 – 10.16	10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7
01 Feb		Review		
03 Feb		<b>FIRST LONG EXAM</b>		
<b>SECOND LONG EXAM TOPICS: <i>Vapor System Analysis</i> (Chapters 11, 12, 13, 14, 16)</b>				
08 Feb	4	Compressors	11.1 – 11.28	11.1, 11.2, 11.3, 11.5
10 Feb	5			
15 Feb	6	Condensers and Evaporators	12.1 – 12.20	12.1, 12.4, 12.8, 12.11
17 Feb	7			
22 Feb	8	Expansion Devices	13.1 – 13.13	13.3, 13.4, 13.5, 13.6
24 Feb	9	Vapor-Compression-System Analysis	14.1 – 14. 11	
01 Mar	10	Multi-pressure Systems	16.1 – 16.11	16.2, 16.3, 16.4, 16.5
03 Mar	11			
08 Mar		Review		
10 Mar		<b>SECOND LONG EXAM</b>		
15 Mar	12	Reports on Alternative Refrigeration Systems		
17 Mar	13			
<b>THIRD LONG EXAM TOPICS: <i>Psychrometry</i> (Chapter 3), <i>Heating – and Cooling-Load Calculations</i> (Chapter 4)</b>				
<b><i>Cooling Towers and Evaporative Condensers</i> (Chapter 19)</b>				
22 Mar	14	Psychrometry and Wetted-Surface Heat Transfer	3.1 – 3.16	3.2, 3.5, 3.7, 3.10
24 Mar	15			

Dates	Lec No.	Lecture Topics	Textbook Sections	Suggested Textbook Problems
29 Mar 31 Mar	16 17	Heating- and Cooling-Load Calculations	4.1 – 4.14	4.1, 4.4, 4.5, 4.8
05 Apr		Experiment		
07 Apr	18	Cooling Towers and Evaporative Condensers	19.1 – 19.10	19.1, 19.2, 19.3, 19.4
19 Apr		Deadline of Submission of Experiment Report Discussion of Design Project		
19 Apr		Review		
21 Apr		<b>THIRD LONG EXAM</b>		
<b>FOURTH LONG EXAM TOPICS: <i>Air Conditioning Systems</i> (Chapter 5), <i>Cooling and Dehumidifying Coils</i> (Chapter 8)</b>				
26 Apr	19	Air Conditioning Systems	5.1 – 5.10	5.1, 5.2, 5.3, 5.4
28 Apr	20	Cooling and Dehumidifying Coils	8.1 – 8.10	8.1, 8.2, 8.3, 8.4
03 May		Review		
05 May		<b>FOURTH LONG EXAM</b>		
10 May 12 May		Design Project Making		
17 May		Design Project Presentation		
<b>Schedule of Exams: The SATURDAY, 5-8 PM, of the scheduled exam week is the automatic fall back schedule in case of cancellation, unless announced otherwise. No make-up long exam will be given. Any potential conflict must be brought to the instructor IN WRITING at least a week prior to the scheduled exam.</b>				

**Holidays:** Chinese New Year – 28 Jan 2017 (Sat), EDSA People Power Revolution Anniversary – 25 Feb 2017 (Sat), Araw ng Kagitingan – 09 Apr 2017 (Sun), Maundy Thursday – 13 Apr 2017 (Thu), Good Friday – 14 Apr 2017 (Fri), Black Saturday – 15 Apr 2017 (Sat), Labor Day – 01 May 2017 (Mon), Independence Day – 12 June 2017 (Mon)

**Last Day of Dropping:** 19 Apr 2017 (Wed)

## GENERAL CLASS POLICIES

### Attendance

Attendance is required. A student who incurs absences of more than **6 class meetings** (9 hours) will be “dropped”. If s/he does not drop the course before the last day of dropping (19 April 2017, Wednesday) and the majority of the absences are excused, the student will be given a grade of **DRP**. If the majority of the absences are unexcused, the student will be given a grade of **5.00**. A student is considered late if s/he arrives **15 minutes** and absent if s/he arrives **30 minutes** after the official starting time of the class.

### Course Requirements

This course is divided into two 1.5-hour lecture meetings and two 1.5-hour lab meetings per week. Students will be evaluated based on their performance in four long exams, report on alternative refrigeration system, experiment report, design project, and class performance.

- Report on alternative refrigeration system requires the students to research on the advancements in refrigeration and on different refrigeration systems aside from the standard vapor-compression system. Students will be graded from the oral presentation and the technical paper. **A student who will be late or absent from any of the reporting days (15 and 17 March 2017) will be given a grade of 5.00 if he/she does not drop the subject** before the last day of dropping (19 April 2017, Wednesday).
- Experiment and design project will be determined by the instructor/s. If a student comes late or absent on the experiment day, he/she will be given a grade of **INC**. Late submission of any of experiment report and/or design project will be penalized by giving **10% deduction per day late** after the given due date. If the student fails to submit any of the reports within the semester, he/she will be given a grade of **INC**.
- Class Performance may mean computational lab exercises, recitation, class participation, homework, problem sets and/or projects. This requirement depends mainly on the instructor on what he/she deemed to be necessary for the learning experience of his/her class.
- There are four departmental long exams for the entire semester. A student must have a grade of **at least 30%** in each exam for him/her to continue or pass the course. Any student who will get an exam grade below 30% needs to drop the course on or before the dropping deadline (19 April 2017, Wednesday); otherwise he/she will be given a grade of **5.00**.

- Below are standard instructions that must be strictly followed during long exams:
  - Week before the exam, submit blank answer sheets properly marked and **stapled together at the upper left corner** STRICTLY according to the detailed instructions by the instructor. Refer to item 2 for details. Answer sheets must be **A4 size white paper**
  - Make sure to have written your **name, student number, and section on every sheet**, as well as consecutive **sheet numbers**, all at the **upper right corner**.
  - Turn all mobile phones and electronic devices OFF and keep them in your bag during the entire examination period, except for one calculator that is being used. Use of any of these devices during an examination is strictly prohibited.
  - Any form of intellectual dishonesty will be strictly penalized.** Refer to the enumerated list of acts of intellectual dishonesty from the 2012 Code of Student Conduct of UP Diliman on page 3 of this syllabus.
  - Keep all answer sheets stapled together during the entire examination period; otherwise your paper will NOT be graded.
  - Submit the questionnaire together with your answer sheets. Do NOT unstaple the questionnaire.
  - Do NOT write anything else on the questionnaire except your name, signature, section and/or corrections.
  - Use only a blue or black ink pen.
  - Start the solution to each problem on a new sheet; do not write at the back; and always put a box on your final answer/s. Solutions written at the back will not be considered for grading.
  - Do NOT use correction fluid/tape and/or friction pen in your solution.
  - Show clearly all pertinent solutions, and state the assumptions made, if any.
  - After the exam results are returned in class, any complaints/queries will be entertained by the exam grader only within a week.

### Grading System

Raw Grade =  $0.60$  \*(Long Exam Average) +  $0.10$ \*(Report) +  $0.10$ \*(Experiment) +  $0.15$ \*(Design Project) +  $0.05$ \*(Assignments and Quizzes)

### Grading Scale

Raw Grade	Grade	Raw Grade	Grade
92 and higher	1.00	72 to below 76	2.25
88 to below 92	1.25	68 to below 72	2.50
84 to below 88	1.50	64 to below 68	2.75
80 to below 84	1.75	60 to below 64	3.00
76 to below 80	2.00	Below 60	5.00

### Intellectual Dishonesty (from Section 14, Article III of the 2012 Code of Student Conduct of UP Diliman)

Intellectual dishonesty is any fraudulent act performed by a student to achieve academic advantage or gain for oneself or others, including but not limited to:

- Plagiarism, defined as “the appropriation of another person’s idea, processes, results or words without giving appropriate credit”;
- Fabrication, defined as “making up data or results”; falsification, or “manipulating research materials, equipment, or processes or changing or omitting data or results such that the research is not accurately represented in the research record”; distortion and/or destruction of data;
- Copying or providing the means or assessing means to copy exam answers, homework, laboratory experiments, term papers, etc.; possession and/or use of cheat devices during an examination; allowing another person to take an examination in one’s name, and/or impersonating another student or allowing someone to impersonate oneself in an academic activity; and manipulating a corrected exam paper;
- Submission of the same work in two or more courses without the instructor’s consent;
- Other acts analogous to 1, 2, 3, and/or 4.

**Any student found guilty of committing intellectual dishonesty will be penalized in accordance with prevailing University rules and regulations.**