

EML 4600/Fall 2020 (August 31, 2020)
REFRIGERATION AND AIR CONDITIONING FUNDAMENTALS

1. **Catalog Description:** Credits: 3; Fundamentals of refrigeration theory, vapor compression and absorption, refrigeration components and systems, psychrometric theory, analysis of cooling and dehumidifying coils.

2. **Pre-requisites and Co-requisites:** Prereq: EML 3100.

3. **Course Objectives:** At the end of the course the students will be able to understand refrigeration theory and perform calculations involving refrigeration cycles and refrigeration processes and components for both vapor compression and vapor absorption refrigeration technologies. They will also be able to understand air conditioning theory and perform calculations involving psychrometry and wetted surface heat transfer, cooling and dehumidifying coils, cooling and heating load, and duct design.

4. **Contribution of course to meeting the professional component:**

4A. EML 4600 supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical and Aerospace Engineering. Specific ME program outcomes supported by this course include: (1) Using knowledge of chemistry and calculus based physics with depth in at least one of them (**ME Program Outcome M1**); (2) Using knowledge of advanced mathematics through multivariate calculus and differential equations (**ME Program Outcome M2**); (3) Being able to work professionally in the thermal systems area (**ME Program Outcome M4**).

4B. Engineering Science (100%)

5. **Relationship of course to program outcomes:**

This course achieves the following ABET outcomes [note that the outcome number corresponds to the respective ABET outcomes (1) through (7):

(1) Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [Method of assessment is one or more exam or project problems]

6. **Instructor:**

Dr. SA Sherif, Professor
Department of Mechanical and Aerospace Engineering
232 MAE Bldg. B, P.O. Box 116300, Gainesville, FL 32611-6300
Tel (352) 392-7821, sasherif@ufl.edu
<https://faculty.eng.ufl.edu/sa-sherif/>
Office Hours via Zoom: MWF 9th Period (4:05-4:55pm) **for this class**

7. **Teaching Assistants (Office Hours):**

Mr. Zhong Guo, zhong.guo@ufl.edu, 227 MAE-B, Tuesday and Thursday 4:00-5:30pm

8. **Meeting Times:** Lectures are available online [published meeting times MWF 4:05-4:55pm (9th Period)]

9. **Class/Laboratory Schedule/Homepage:** No lab

Homepage: Students have access through E-Learning with Canvas

10. **Meeting Location:** Class lectures have been recorded and are available online [published meeting location LAR 239]

11. **Material and Supply Fees:** None

12. **Textbooks and Software Required:** Refrigeration and Air Conditioning, Stoecker and Jones, McGraw-Hill, 1986, ISBN: 0070616191.

13. **Recommended Reading:** ASHRAE Handbook: Fundamentals-2017, The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, Georgia 30329

14. Course Outline:

<u>Lecture #</u>	<u>Topic Covered</u>
Lecture 1	Introduction to course/refrigeration
Lecture 2	Single-stage vapor compression cycles
Lecture 3	Compressors 1
Lecture 4	Compressors 2
Lecture 5	Condensers and evaporators 1
Lecture 6	Condensers and evaporators 2
Lecture 7	Comprehensive review problem
Lecture 8	Multistage vapor compression cycles 1
Lecture 9	Multistage vapor compression cycles 2
Lecture 10	Absorption refrigeration 1
Lecture 11	Absorption refrigeration 2
Lecture 12	Absorption refrigeration 3
Lecture 13	Absorption refrigeration 4
Lecture 14	Expansion devices
Lecture 15	Introduction to air conditioning
Lecture 16	Moist air properties
Lecture 17	Moist air properties/psychrometry
Lecture 18	Psychrometric processes 1
Lecture 19	Psychrometric processes 2
Lecture 20	Psychrometric processes 3
Lecture 21	Psychrometric processes 4
Lecture 22	Solved problem in psychrometry 1
Lecture 23	Solved problem in psychrometry 2

<u>Lecture #</u>	<u>Supporting Sources of Information</u>
Lecture 1	Notes/Chapter 10
Lecture 2	Notes/Chapter 10
Lecture 3	Notes/Chapter 11
Lecture 4	Notes/Chapter 11
Lecture 5	Notes/Chapter 12
Lecture 6	Notes/Chapter 12
Lecture 7	Notes/Chapter 12
Lecture 8	Notes/Chapter 16
Lecture 9	Notes/Chapter 16
Lecture 10	Notes/Chapter 17
Lecture 11	Notes/Chapter 17
Lecture 12	Notes/Chapter 17
Lecture 13	Notes/Chapter 17
Lecture 14	Notes/Chapter 13
Lecture 15	Notes/attachments
Lecture 16	Notes/attachments
Lecture 17	Notes/attachments
Lecture 18	Notes/attachments
Lecture 19	Notes/attachments
Lecture 20	Notes/attachments
Lecture 21	Notes/attachments
Lecture 22	Notes/attachments
Lecture 23	Notes/attachments

<u>Lecture #</u>	<u>Topic Covered</u>
Lecture 24	Solved problem in psychrometry 3
Lecture 25	Solved problem in psychrometry 4 (BP Factor)
Lecture 26	Solved problem in psychrometry 5 (ERSHR)
Lecture 27	Solar radiation/solar angles 1
Lecture 28	Solar radiation/solar angles 2
Lecture 29	Solar radiation/solar angles 3
Lecture 30	Heat gain through fenestrations
Lecture 31	Space heating load 1 (transmission/infiltration)
Lecture 32	Space heating load 2 (infiltration)
Lecture 33	Space heating load 3 (infiltration)
Lecture 34	Space cooling load 1 (CLTD method)
Lecture 35	Space cooling load 2 (CLTD method)
Lecture 36	Airflow in ducts/duct design 1
Lecture 37	Airflow in ducts/duct design 2
Lecture 38	Airflow in ducts/duct design 3
Lecture 39	Airflow in ducts/duct design 4
Lecture 40	Airflow in ducts/duct design 5/Fans
Lecture 41	Cooling towers (FYI only-not on any exam)
Exam 1	Covers Lectures 1 through 9
Exam 2	Covers Lectures 10 through 26
Exam 3	Covers Lectures 27 through 40
Final	Covers Lectures 1 through 40
Project	Covers Lectures 1 through 40

<u>Lecture #</u>	<u>Source of Information</u>
Lecture 24	Notes/attachments
Lecture 25	Notes/attachments
Lecture 26	Notes/attachments
Lecture 27	Notes/attachments
Lecture 28	Notes/attachments
Lecture 29	Notes/attachments
Lecture 30	Notes/attachments
Lecture 31	Notes/attachments
Lecture 32	Notes/attachments
Lecture 33	Notes/attachments
Lecture 34	Notes/attachments
Lecture 35	Notes/attachments
Lecture 36	Notes/attachments
Lecture 37	Notes/attachments
Lecture 38	Notes/attachments
Lecture 39	Notes/attachments
Lecture 40	Notes/attachments
Lecture 41	Notes/Chapter 19

Course Calendar

Date	Event	Date	Event
Aug 31	Classes start	Oct 23	
Sep 2		Oct 26	
Sep 4		Oct 28	
Sep 7	Labor Day	Oct 30	EXAM 2
Sep 9		Nov 2	
Sep 11		Nov 4	
Sep 14		Nov 6	
Sep 16		Nov 9	
Sep 18		Nov 11	Veteran's Day
Sep 21		Nov 13	
Sep 23		Nov 16	
Sep 25		Nov 18	
Sep 28		Nov 20	
Sep 30		Nov 23	
Oct 2	EXAM 1	Nov 25	Thanksgiving Holiday
Oct 5		Nov 27	Thanksgiving Holiday
Oct 7		Nov 30	
Oct 9		Dec 2	EXAM 3
Oct 12		Dec 4	
Oct 14		Dec 7	
Oct 16		Dec 9	Last day of classes
Oct 19		Dec 11	Reading Days
Oct 21		Dec 13	Reading Days
		Dec 14	Final Exam 3:00-5:00pm

15. **Attendance and Expectations:** Watching the video lectures online is a necessary condition but it is not a sufficient one to be able to do well in this class. It is expected that 3 to 5 study hours for each contact hour are to be spent every week studying for this class. If a week is missed, the study hours need to be made up in the following weeks. Homework problems will be assigned via Canvas and submitted through Canvas. No email or hard copy submissions will be accepted. You may upload homework assignments early, but not past the due date. The assignments will be due at 11:59pm on the due date. After that, the system will stop accepting the assignments. Late homework is not accepted via any other means. I am available 24/7 via 352-392-7821 or sasherif@ufl.edu

16. Grading:

Homework	7%
Project	8%
Exam #1	20%
Exam #2	20%
Exam #3	20%
Final Exam	25%

17. Grading Scale:

A	90-100		
A-	86-90	B+	82-86
B	78-82	B-	74-78
C+	70-74	C	66-70
C-	62-66	D+	58-62
D	54-58	D-	50-54
E	0-50		

18. **Make-up Exam Policy:** There will be no make-up exams. Unless there is a documentable extreme

medical emergency, no credit will be given for a missed exam. It is the student's responsibility to make sure he/she is available to take the exam. **All midterm exams will be given in the evening (Periods E2 and E3) online with Honorlock.** For more information on Honorlock see the following link:

<https://dce.ufl.edu/services/online-proctoring/>

Please be reminded that all students in the HWCOE are required to have a laptop/mobile computer. <https://mae.ufl.edu/academics/prospective/undergraduate/computer-requirements/>

19. **Honesty Policy** – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others. **Honor code violations will be reported and will result in grade penalty.**

20. **Accommodation for Students with Disabilities** – Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. **UF Counseling Services** – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling

22. **Software Use** – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.