



Course Specification

(Bachelor)

Course Title: Refrigeration and Air-Conditioning
Course Code: ME4231
Program: Mechanical Engineering
Department: : Mechanical Engineering Department
College: College of Engineering and Architecture
Institution: Umm Al-Qura University
Version: 1
Last Revision Date: 1 January 2025

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)

2. Course type

A. ☐ University ☐ College ☐ Department ☐ Track ☐ Others
B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (7)

4. Course General Description:

4. Course general Description

The course is an introduction to Refrigeration & air-conditioning applications. The basics of Vapor-compression refrigeration systems (VCR), Refrigerants, and Multi-pressure VCR systems are considered. In addition to VCR cycle absorption refrigeration cycle is studied. The Air-conditioning topics contains properties of moist-air, psychrometry of air-conditioning (A/C) processes and design conditions of comfort, Solar radiation, Air-conditioning cooling load.

5. Pre-requirements for this course (if any):

ME3233 - Heat and Mass Transfer

6. Co-requisites for this course (if any):

7. Course Main Objective(s):

The main objectives of the course are to ensure that students are:

- Understanding the refrigeration & air-conditioning applications, and main basic components of the vapor compression refrigeration system.
- Understanding the principles of multi-pressure VCR systems, including multi evaporators, cascade systems and refrigerants selection factors.
- Understanding the principles of multi-pressure VCR systems, including multievacaporators , cascade systems and refrigerants selection factors
- Understanding the concepts of moist-air properties and human comfort.





- Understanding the concepts of psychrometry of air-conditioning (A/C) processes.
- Understanding the calculation concepts of air-conditioning cooling load, including solar radiation effect on buildings.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	80	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours	
1.	Lectures	32	
2.	Laboratory/Studio	48	
3.	Field		
4.	Tutorial		
5.	Others (specify)		
Total		82	82

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Recognize the basic concepts and principles of air conditioning and refrigeration.	K1	Recognize the basic concepts and principles of air conditioning and refrigeration.	1.1
1.2	Analyze the fundamental methodology of VCRS	K1	Analyze the fundamental methodology of	1.2





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	& VARS.		VCRS & VARS.	
1.3	Identify the properties of moist-air and psychrometry of air-conditioning processes.	K1	Identify the properties of moist-air and psychrometry of air-conditioning processes.	1.3
1.4	Design project of HVAC system.	K2	Design project of HVAC system.	1.4
2.0	Skills			
2.1	Design a VCRS/VARS system or some parts or systems to meet desired needs within realistic constraints such as environmental, and safety, manufacturability, and sustainability.	S1	Design a VCRS/VARS system or some parts or systems to meet desired needs within realistic constraints such as environmental, and safety, manufacturability, and sustainability.	2.1
2.2	Communicate within a team to prepare a minor project and/or a presentation about industrial heat transfer applications.	S4	Communicate within a team to prepare a minor project and/or a presentation about industrial heat transfer applications.	2.2
2.3	Practice theoretical knowledge through labs experimentation for the refrigeration and air-condition fields.	S2	Practice theoretical knowledge through labs experimentation for the refrigeration and air-condition fields.	2.3
3.0	Values, autonomy, and responsibility			
3.1	Explain his function effectively as an individual as well as a member or leader in teams during oral presentations about minor group-projects.	V2, P	Groups in class to report and oral presentations on field visits to power stations.	Oral presentations and report evaluations.





C. Course Content

No	List of Topics	Contact Hours
1.	Introduction 1: • Review of Fundamentals: Thermodynamics • Review of Fundamentals: Fluid Flow • Review of Fundamentals: Heat & mass transfer	10
2.	Introduction 2: • Method of Producing Low Temperatures • Air Cycle Refrigeration Systems	10
	Vapour Compression Refrigeration Systems	15
4	Vapour Absorption Refrigeration Systems	10
5	Worked out Examples	10
6	Properties of moist air (psychrometry)	10
7	Air conditioning processes - Cooling loads	15
Total		80

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes		10%
2.	Homeworks		10%
3.	Labs		10%
4.	Minor-group project/ Oral Presentation		10%
5.	Mid-term		20%
6.	Final Exam		40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References

- Arora, C.P. "Refrigeration and Air-Conditioning", Tata-McGraw-Hill, 2003
- Trott, R. and Welch, T., "Refrigeration and Air Conditioning", Butterworth-Heinemann, 2000.
- McQuiston, F.C. Parker, J.D and Spitler, J.D Heating, Ventilating and Air Conditioning", John Wiley & Sons, Inc., 2001
- ASHRAE Handbooks (4 volumes)



Supportive References	
Electronic Materials	Journals International Journal of Refrigeration, Elsevier
Other Learning Materials	Lab. Facilities

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	Lab. Facilities of instrumentations and systems

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	indirect
Effectiveness of Students assessment	Faculty	direct
Quality of learning resources	Students and faculty	indirect
The extent to which CLOs have been achieved		
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify))

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	1. Dr. Kamel Guedri: Coordinator 2. Prof. Abdulmajeed Alghamdi: Member 3. Dr. Abdullah AlZahrani: Member 4. Dr. Bander Fadhl: Member 5. Dr. Basem Makhdoom: Member 6. Prof. Adel Abdeen: Member 7- Dr. Abdulelah Alhamayani
REFERENCE NO.	
DATE	1/1/2025

