

Identification	Subject	ME411, Heating, ventilation, and air conditioning, 6 ECTS
	Department	Mechanical Engineering
	Program	Undergraduate
	Term	Spring 2026
	Instructor	Dr. Mehdi Kiyasatfar
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	Phone:	
	Classroom/hours	
	Office hours	
Prerequisites	Heat Transfer	
Language	English	
Compulsory/Elective	Compulsory	
Required textbooks and course materials	<ol style="list-style-type: none"> 1. HVAC Fundamentals: System Design, Operation, Selection, and Optimization, 4th Edition by Samuel C. Sugarman, River Publishers, 2024 2. Heating, Ventilating, and Air Conditioning, Analysis and Design, 7th Edition. Wiley 2023. 	
Course website		
Course outline	<p>This course introduces the fundamental principles and practical applications of Heating, Ventilation, and Air Conditioning (HVAC) systems. The course covers refrigeration cycles, psychrometric processes, heat transmission in buildings, space heating and cooling load calculations, and HVAC equipment such as air and water distribution systems, fans, pumps, and cooling towers. In addition, basic engineering drafting skills related to HVAC systems are introduced using standard practices and AutoCAD tools. The course aims to provide students with the theoretical background and practical skills required to analyze, design, and understand HVAC systems commonly used in residential, commercial, and industrial buildings.</p>	
Course objectives	<p>The objectives of this course are to:</p> <ul style="list-style-type: none"> • Introduce the fundamental concepts and terminology of heating, ventilation, and air conditioning (HVAC) systems. • Develop an understanding of refrigeration cycles and psychrometric processes relevant to HVAC applications. • Enable students to analyze heat transmission in buildings and evaluate space heating and cooling loads. • Familiarize students with the operation and selection of major HVAC equipment, including air and water distribution systems, fans, pumps, and cooling towers. • Provide students with practical skills in interpreting standards and applying basic engineering drafting techniques related to HVAC systems using AutoCAD. • Prepare students to apply engineering principles to the analysis and preliminary design of HVAC systems used in residential, commercial, and industrial buildings. 	
Learning outcomes	Upon successful completion of this course, students will be able to:	

	<ul style="list-style-type: none"> • Explain the fundamental principles and terminology of HVAC systems and their role in building environmental control. • Analyze refrigeration cycles and evaluate their performance in HVAC applications. • Use psychrometric charts to analyze air-conditioning processes and determine air properties under different operating conditions. • Calculate heat transmission through building elements and estimate space heating and cooling loads. • Identify, analyze, and select major HVAC equipment such as air distribution systems, ducts, fans, pumps, piping networks, and cooling towers. • Apply relevant standards and engineering practices in HVAC system analysis and design. • Prepare basic HVAC layouts, including ducting and piping systems, using engineering drafting principles and AutoCAD tools. • Apply engineering judgment to solve practical HVAC problems through assignments, projects, and examinations. 		
Teaching methods	Lecture	x	
	Group discussion	x	
	Experiential exercise	-	
	Tutorials once a month on weekends	-	
	Case analysis and assignments	x	
	Course paper	-	
	Others	---	
Evaluation	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Attendance & Activity	At each lesson	5
	Seminar	During the semester	10
	Project (3 projects)	During the semester	15
	Final Exam		40
	Total		100
Policy	<ul style="list-style-type: none"> ▪ Ethics Copy of other students' work is highly discouraged. All assignments must be handled by the student himself. This is a university policy and violators will be reprimanded accordingly. ▪ Preparation for class The structure of this course demands your individual effort outside the classroom for extra practice of many problems within the textbook. After each session, every student needs to put sufficient time to practice and finish the assignments by the predetermined date. • Withdrawal (pass/fail) This course strictly follows the grading policy of the School of Engineering. Thus, a student is expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following 		

term or year.

- **Cheating/plagiarism**

Cheating or other plagiarism in handling the assignments, Mid-term and Final Examinations will lead to course failure. In this case, the student will automatically get zero (0), without any considerations.

- **Professional behavior guidelines**

The students shall behave in a way to create a favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly discouraged.

- **Attendance & Activity**

Attendance and in-class activity constitute 5 marks out of the total 100 marks for this course. Students who attend and actively participate in class activities will receive these marks. For each unexcused absence, 1 mark will be deducted from the attendance and activity score.

- **Seminar**

As part of this course, each student is required to deliver an individual seminar on a topic related to the subject of HVAC systems, which will be assigned or approved by the instructor during the semester. The seminar aims to enhance students' understanding of course concepts, practical HVAC applications, and current engineering practices, as well as to develop their technical presentation skills. The seminar will be evaluated based on: Technical content and accuracy, Depth of understanding and analysis, Organization and clarity of the presentation, Quality of visual materials, Ability to explain concepts clearly and respond to questions.

- **Project**

Students are required to complete three individual projects, each worth 5 marks, assigned during the semester and related to different chapters of the course. These projects are designed to strengthen students' ability to apply HVAC principles to the analysis and design of engineering systems.

Each project will involve appropriate assumptions, calculations, analysis, and interpretation of results, and may include analytical, design, or basic engineering drafting components, depending on the assigned topic. Each project will be evaluated based on:

Correct formulation of the engineering problem, Application of HVAC principles and design methodology, Accuracy and clarity of calculations and analysis, Quality and justification of engineering assumptions and design choices, Clarity and organization of the submitted work. Further details regarding the scope, deliverables, and deadlines of each project will be provided during the course.

- **Exam**

The midterm and final examinations will evaluate students' understanding of the HVAC concepts covered in the course, with an emphasis on system analysis, thermal performance, and problem-solving skills.

Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook/ Assignments
1		Syllabus - Introduction to HVAC	Chapter 1
2		HVAC Systems	Chapter 2-Ref 1, 2
3		Refrigeration cycles	Chapter 15-Ref 1, 2
4		Psychrometric processes - I	Chapter 3-Ref 1
5		Psychrometric processes - II	Chapter 3- Ref 1
6		Heat transmission in buildings - I	Chapter 5- Ref 1, 2
7		Heat transmission in buildings - II	Chapter 5- Ref 1, 2
8		Review Midterm Exam	
9		Space heating load - I	Chapter 7- Ref 1, 2
10		Space heating load - II	Chapter 8- Ref 1, 2
11		HVAC Equipment: Air Distribution System, Ducting and Air Terminals, Fans	10 &12- Ref 1, 2
12		HVAC Equipment: Water Distribution System- Pipes and Valves, Pump	10 &12- Ref 1, 2
13		Cooling Tower Types of Cooling Tower, Fill Material, Selection of Cooling Tower.	pptx-1
14		Engineering Drafting - I Standards and Practices, Introduction to AutoCAD Basic Commands, Creating Block formation of AC Equipment Drafting of Ducting & Piping Layout	pptx-2
15		Engineering Drafting - II Standards and Practices, Introduction to AutoCAD Basic Commands, Creating Block formation of AC Equipment Drafting of Ducting & Piping Layout	pptx-3
16		Final Exam	

This syllabus is a guide for the course and any modifications to it will be announced in advance.