

COURSE OUTLINE DETAILS

1. Course: Thermodynamic Engineering (Nhiệt kỹ thuật)

- Code number: NS121H
- Credits: 2
- Hours: 30 theory hours and 60 self-study hours.

2. Management Unit:

- Department: Department of Food Technology
- Faculty: College of Agriculture

3. Requisites:

- Prerequisites: TN014
- Corequisites:

4. Course objectives:

Objectives	Descriptions	Program Outcomes
4.1	Provide knowledge related to units and dimensions as a basis for calculations in engineering, the ability to apply the two basic laws of thermodynamics as well as processes occurring in the atmosphere.	2.1.2a; 2.1.2b
4.2	Training skills to quickly identify the properties of water and steam as well as the humid air - 2 common heat transfer media in food processing and preservation by means of graphs and data tables.	2.2.1a
4.3	Accumulated ability to work in groups with an effective way and skills issues presented before the crowd and be able to analyze things in a positive methods.	2.2.2b; 2.2.2c
4.4	Get the right attitude in problem solving such as accuracy, honesty and cooperation in the work.	2.3c

5. Course learning outcomes:

COs	Descriptions	Objectives	POs
	Knowledge		
CO1	Provides an overview of units and dimensions, the two basic laws of thermodynamics and the properties of water and atmosphere air. Understand the knowledge of water properties and phase transition, air quality, phase balance, basic processes related to thermal energy as well as air conditioning processes.	4.1	2.1.2a;
CO2	Understand and apply the two basic laws of thermodynamics applied in technical equipment and in food processing. Understand the working principle of energy generation systems and energy consumption in food processing plants..	4.1	2.1.2b
	Skills		
CO3	It is possible to help students develop and set up a practical problem related to food technology. Can calculate and design the systems of generation and consumption of works in the factories.	4.2	2.2.1a
CO4	Apply the theory of two basic laws of thermodynamics to explain and control the quality of food products. Ability to solve problems and work in teams based on the practice and participation in group exercises.	4.3	2.2.2b; 2.2.2c
	Attitudes/Autonomy/Responsibilities		
CO5	Have professional ethics, respect the rules of the organization when implementing this course, have a positive application in practice by discussing each content in class	4.4	2.3c

Note: "COs" means Course Outcomes; "POs" means Program Outcomes

6. Brief description of the course:

Thermodynamic Engineering is a fascinating and exciting subject related to the energy required for engineering and life. This is a necessary part of the technical training program of most countries in the world. Course content includes issues related to units and dimensions as the basis for technical calculations. The course also deals with the properties of water and phase transition, properties of atmosphere air, the phase balance, the basic processes involved in the forms of thermal energy as well as the air conditioning processes. Most importantly, the two basic laws of thermodynamics that underlie engineering and processing systems in the processing plant are also introduced in detail. In food processing as well as in related industries, such as seafood processing, post-harvest technology, chemical technology apply these thermodynamic processes.

7. Course structure:

7.1. Theory

	Content	Hours	COs
Chapter 1.	Introduction and basic concepts	6	
1.1.	Thermodynamics and Energy		CO1
1.2.	Dimensions and Units		CO2; CO5
1.3.	Closed systems & Control volume system		CO1
1.4.	Properties of a system		CO1; CO3
1.5.	State and Equilibrium		CO1
1.6.	Processes and Cycles, forms of energy		CO1
Chapter 2.	Pure substance và its properties	6	
2.1.	Properties of pure substances	1	CO1
2.2.	Phases of water and phase-change processes	1	CO1
2.3.	Property diagrams for phase-change processes	2	CO1; CO3
2.4.	Property tables for phase-change processes	2	CO3; CO5
2.5.	Exercises		CO4; CO5
Chapter 3.	The First Law of Thermodynamics	6	
3.1.	Introduction	1	CO1
3.2.	The first law of thermodynamics	1	CO2
3.3.	Energy change of a closed system	1	CO2
3.4.	Energy change of steady-flow systems	1	CO2
3.5.	Energy change of unsteady-flow systems	1	CO2; CO3
3.6.	Exercises	1	CO4; CO5
Chapter 4.	The Second Law of Thermodynamics	6	
4.1.	Introduction to the Second Law	1	CO1
4.2.	Heat engines	1	CO2
4.3.	Refrigerators and heat pumps	1	CO2
4.4.	Reversible and Irreversible Processes	1	CO2
4.5.	The Carnot Cycle	1	CO3
4.6.	The Carnot Principles	1	CO3
4.7.	Exercises		CO4; CO5
Chapter 5.	Properties and Processes of air	6	
5.1.	Dry air and atmospheric air	1	CO1
5.2.	Determination of properties of air	1	CO1
5.3.	The Psychrometric chart and Mollard chart	1	CO1; CO3
5.4.	Determine air properties by charts	1	CO3; CO5
5.5.	Gas-Vapor Mixtures and Air-Conditioning	2	CO4; CO5
5.6.	Exercises		CO4; CO5

7.2. Practice: none

8. Teaching methods:

- Attend the theory lessons, combine with discussion, and exchange topics.
- Finish homework, and present striking solutions to each group in the class.

9. Duties of student:

Students have to do the following duties:

- Complete 80% of the theory lessons.
- Complete all of the assignment for the project and report the project result.
- Take the mid-term test, and the final exam.
- Organize self-study hours effectively.

10. Assessment of course learning outcomes:

10.1. Assessment

No.	Point components	Rules and Requirements	Weights	COs
1	Participation	Complete 100% of the classroom activities	10%	CO5
2	Project completion	- Presentation - Acceptable group members.	20%	CO3
3	Mid-term test	- Quiz (30 minutes)	20%	CO1; CO2
4	Final test	- Written test (60 minutes) - Complete 80% of the theory lessons. - Take the final exam	50%	CO1; CO2; CO3

10.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.
- Course score is the sum of all the components of the evaluation multiplied by the corresponding weight. The course score is marked on a scale of 10 and rounded to one decimal place, then it is converted to A-B-C-D score and score on a scale of 4 under the academic regulations of the University.

11. Learning materials:

Learning materials information	Barcode number
[1] Thermodynamics : An engineering approach / Yunus A. Çengel, Michael A. Boles.- New York: McGraw-Hill Education, 2015.- 1023 p.: ill.; 26 cm, 9780073398174.- 621.4021/ C395	MON.063099
[2] Introduction to Food engineering / R. Paul Singh, Dennis R. Heldman.. - Amsterdam,Boston : Elsevier/Academic Press, 2009. -664/ S617	DIG.001582
[3] Elementary principles of chemical processes / Felder, Richard M. - Hoboken, N.J.: Wiley, 2005. - 660.28 / F312	CNSH.000670

12. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Student's Tasks
1-3	Chapter 1: Introduction and basic concepts	6		Read the previous week's lecture again. See the book [1] (chapter 1), book [2] (chapter 1), and book [3] (chapter 2, 3) according to each respective content of the next week.
4-6	Chapter 2: Pure substance và its properties	6		Read the previous week's lecture again. See the book [1] (chapter 3), book [2] (chapter 3), and book [3] according to each respective content of the next week
7-9	Chapter 3: The first law of thermodynamics	6		Read the previous week's lecture again. See the book [1] (chapter 2), book [2] (chapter 1) according to each respective content of the next week
10-12	Chapter 4: The second law of thermodynamics	6		Read the previous week's lecture again. See the book [1] (chapter 6, 11), book [2] (chapter 1) according to each respective content of the next week
13-15	Chapter 5: Properties and Processes of air	6		Read the previous week's lecture again. See the book [1] (chapter 13, 14), book [2] (chapter 9) according to each respective content of the next week

Can Tho, .../.../2019

ON BEHALF OF RECTOR
DEAN OF COLLEGE/SCHOOL
(or DIRECTOR OF INSTITUTE)



HEAD OF DEPARTMENT

[Signature]
Nguyễn Công Hòa