Sana'a University
Faculty of Engineering
Mechanical Engineering Department
Mechanical Engineering Program

34. Course Specification of Thermodynamics - I

I. Course Identification and General Information:						
1.	Course Title:	Thermodynamics - I.				
2.	Course Code & Number:	ME 251.				
3.	Credit hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu.	Pr	Tr.	
		2	2	-	-	3
4.	Study level/ semester at which this course is offered:	Third Year - First Semester.				
5.	Pre –requisite (if any):	Engineering Physics (FR002).				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	Mechanical Engineering Program,				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechanical Engineering Department.				
10.	Prepared By:	Asst. Prof.Dr. Abduljalil Al-Abidi.				
11.	Date of Approval:					

II. Course Description:

Thermodynamics is a basic course that serves as the background for many thermo-fluid courses. This course covers some basic thermodynamics concepts such as systems, boundaries, mass, heat, work energy, and entropy. Properties of common substances such as water, air and general working fluids are introduced using property tables and basic state equations. It includes a study of energy and mass analysis for control mass, control volume systems. The laws of thermodynamics will be taken into account in details.

III. Alignments of the Course Intended learning outcomes (CILOs)		Referenced PILOs
a1	Express general principles, theories, fundamentals and specialized knowledge of thermodynamics.	A1

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

a2	Describe an understanding of the thermodynamic properties from tables, the 1st law, 2nd law of thermodynamics and entropy balance on various systems.	A2
b1	Create an ability to apply the 1st law, 2nd law of thermodynamics to engineering processes.	B1
b2	Analyze the 2nd Law of thermodynamics for entropy balance on various applications of thermodynamics systems.	B2
c1	Solve problems in thermodynamics in various engineering applications.	C1
c2	Prescribe the thermodynamics laws, for energy, entropy balance on various systems.	C2
d1	Evaluate effective communication skill through oral and written modes.	D1
d2	Cooperate in a team in an efficient and effective manner under controlled supervision or independently.	D2

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Express general principles, theories, fundamentals and specialized knowledge of thermodynamics.	Lectures, Tutorial Class Activity, Interactive Class Discussion. Problem-Based Learning.	Homework and Assignments. Written Tests. (Mid and Final Terms). Coursework Activities. Quizzes.
a2. Describe an understanding of the thermodynamic properties from tables, the1st law, 2nd law of thermodynamics and entropy balance on various systems.	Lectures, Tutorial Class Activity, Interactive Class Discussion, Exercises and Homework, Problem-Based Learning.	Homework and Assignments. Written Tests. (Mid and Final Terms). Coursework Activities. Quizzes.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Create an ability to apply the 1st law, 2nd law of thermodynamics to engineering processes	Lectures, Tutorial Class Activity, Interactive Class Discussion, Exercises and Homework, Problem-Based Learning.	Homework and Assignments. Written Tests. (Mid and Final Terms). Coursework Activities. Quizzes.
b2. Analyze one or more applications of thermodynamics systems such as vapor power systems, gas power systems, refrigeration, heat pumps.	Lectures, Tutorial Class Activity, Interactive Class Discussion, Exercises and Homework, Problem-Based Learning.	Homework and Assignments. Written Tests. (Mid and Final Terms). Coursework Activities. Quizzes.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1. Solve problems in thermodynamics in various engineering applications.	Lectures, Tutorial Class Activity, Interactive Class Discussion, Exercises and Homework, Problem-Based Learning.	Homework and Assignments. Written Tests. (Mid and Final Terms). Coursework Activities. Quizzes.
c2. Prescribe the thermodynamics laws, for energy, entropy balance on various systems	Lectures, Tutorial Class Activity, Interactive Class Discussion, Exercises and Homework, Problem-Based Learning.	Homework and Assignments. Written Tests. (Mid and Final Terms). Coursework Activities. Quizzes.

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Evaluate effective communication skill through oral and written modes.	Lectures. Interactive Class Discussion. Self-Study Assignments and Homework.	Written Tests. Homework and Assignments. Coursework Activities. Report/Project/ Practical Lab. Sessions.
d2. Cooperate in a team in an efficient and effective manner under controlled supervision or independently.	Lectures. Interactive Class Discussion. Self-Study Assignments and Homework.	Written Tests. Homework and Assignments. Coursework Activities. Report/Project/ Practical Lab. Sessions.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction and Basic Concepts.	a1,a2,b1.b2, c1,c2,d1,d2	• Definition of Thermodynamics. • Definition of Thermodynamics Systems. • Examples of Applications of Thermodynamics. • System of Units; Mass, Length and Time. • Temperature and Pressure.	1	2
2.	Energy, Energy Transfer, and General Energy Analysis.	a1,a2,b1.b2, c1,c2 d1,d2	• Definition of Work. • Various Forms of Work Especially the Moving Boundary Work. • Concept of Heat Transfer.	1	2
3.	Properties of Pure Substance.	a1,a2,b1.b2, c1,c2 d1,d2	• Concept of Pure Substance. • Illustrate the P-V, T-V and P-T Property Diagrams. • Procedures for Determining Properties of Pure Substances by Using Thermodynamic Tables. • Ideal Gas and the Ideal Gas Equation of State. • Ideal Gas Equation to Solve Problems.	3	6

			• Compressibility Factor and Illustrate its Use.		
4.	Energy Analysis of Closed Systems.	a1,a2,b1.b2, c1,c2 d1,d2	• Types of Energy that may be Transferred to or from a Thermodynamic System. • Energy in the Form of Heat or Work that may Cross the Boundaries of a Closed System. • Internal Energy and Enthalpy. • Concept of heat Capacities, C_v and C_p.	2	4
5.	Mid-Term Exam.	a1,a2,b1.b2, c1,c2.	• The First 4 Chapters.	1	2
6.	Mass and Energy Analysis of Control Volumes.	a1,a2, b1,b2,c1,c2 d1,d2	• Conservation of Mass. • First Law of Thermodynamics for an Open System. • Steady State Process. • Examples of Steady State Process such as: Heat Exchanger, Nozzle, Throttle, Turbine, Pump and Compressor. • Transient Process.	3	6
7.	The Second Law of Thermodynamics	a1,a2,b1.b2, c1,c2 d1,d2	• Heat Engines and Refrigerators. • Second Law of Thermodynamics. • Reversible Process Carnot Cycle.	2	4

8.	Entropy.	a1,a2,b1.b2, c1,c2 d1,d2	• Clausius Inequality. • Definition of Entropy. • Entropy of Pure Substance. • Entropy and Relationship with Thermodynamics Properties • Entropy Change and Generation. • Entropy change for Liquid and Ideal Gas.	2	4
9.	Final Exam.	a1,a2,b1.b2, c1,c2.	• All the Chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

B - Tutorial Aspect:				
Order	**Tasks/ Experiments**	**Number of Weeks**	**Contact hours**	**Learning Outcomes**
1.	**Tutorial,** Introduction and Basic Concepts**.**	**1**	**2**	**b1, b2, c1, c2, d1, d2**
2.	Tutorial, Energy, Energy Transfer, and General Energy Analysis.	1	**2**	**b1, b2, c1, c2, d1, d2**
3.	Tutorial, Properties of Pure Substances.	3	**6**	**b1, b2, c1, c2, d1, d2**
4.	Tutorial Energy Analysis of Closed Systems.	2	**4**	**b1, b2, c1, c2, d1, d2**
5.	Tutorial Mass and Energy Analysis of Control Volumes.	3	**6**	**b1, b2, c1, c2, d1, d2**
6.	Tutorial The Second Law of Thermodynamics.	2	**4**	**b1, b2, c1, c2, d1, d2**
7.	Tutorial Entropy.	2	**4**	**b1, b2, c1, c2, d1, d2**
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures.
- Tutorials.
- Team Work (Group Learning).
- Seminar/ Project/Presentation.
- Problem Based Learning.
- Interactive Class Discussions.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Homework 1	a1,a2,b1.b2, c1,c2, d1, d2	2nd	0.75
2.	Homework 2	a1,a2,b1.b2, c1,c2, d1, d2	3rd	0.75
3.	Homework3	a1,a2,b1.b2, c1,c2, d1, d2	4th	0.75
4.	Homework 4	a1,a2,b1.b2, c1,c2, d1, d2	5th	0.75

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

5.	Homework5	a1,a2,b1.b2, c1,c2, d1, d2	6th	0.75
6.	Homework6	a1,a2,b1.b2, c1,c2, d1, d2	7th	0.75
7.	Homework7	a1,a2,b1.b2, c1,c2, d1, d2	8th	0.75
8.	Homework 8	a1,a2,b1.b2, c1,c2, d1, d2	9th	0.75
9.	Homework9	a1,a2,b1.b2, c1,c2, d1, d2	10th	0.75
10.	Homework 10	a1,a2,b1.b2, c1,c2, d1, d2	11th	0.75
Total				**7.5**

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Exercises & Homework.	Weekly	7.5	5 %	b1,b2,c1,c2 d1, d2.
2.	Project (Single\Group).	13	7.5	5 %	a1,a1,b1,b2, d1, d2.
3.	Quizzes.	4, 12	15	10 %	a1, a2, b1,b2.
4.	Mid-Term Exam.	8	30	20 %	a1, a2, b1,b2.
5.	Final Exam.	15	90	60 %	a1, a2, b1,b2.
	Total:		**150**	**100 %**	

VIII. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1- Yunus Cengel and Michel. Boles – 2019- Thermodynamics: An Engineering Approach – 9 th Edition- United States of America - McGraw-Hill Education.
2- Moran, M.J., Shapiro, H.N., Boettner, D. D., and Bailey, M. B., 2018- Fundamentals of Engineering Thermodynamics (9 th Edition), John Wiley.

2- Essential References.

1- 1-Borgnakke, C. and Sonntag, R. E., 2009. Fundamentals of Thermodynamics, 7 th Ed., John Wiley & Sons.
2- T D Eastop; A McConkey, 2009. Applied Thermodynamics for Engineering Technologists
5th Edition, Pearson Education.Ltd.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

3- Electronic Materials and Web Sites *etc*.	
1	https://www.coursera.org/learn/thermodynamics-intro#syllabus

I. Course Policies:

1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:** - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.
3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Assoc. Prof. Dr. Abdul-Malik Momin**

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

Template for Course Plan of Thermodynamics - I

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Asst. Prof. Dr. Abduljalil Al-Abidi	**Office Hours**					
Location& Telephone No.		**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail							

II. Course Identification and General Information:

1.	Course Title:	Thermodynamics - I.				
2.	Course Number & Code:	ME 251.				
3.	Credit hours:	C.H				Total CR. Hrs.
		Th.	Seminar/Tu.	Pr.	Tr.	
		2	2	-	-	3
4.	Study level/year at which this course is offered:	Third Year - First Semester				
5.	Pre –requisite (if any):	Engineering Physics (FR002).				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered	Mechanical Engineering Program**.**				
8.	Language of teaching the course:	English Language.				
9.	System of Study:	Semesters.				
10.	Mode of delivery:	Lectures and Tutorials.				
11.	Location of teaching the course:	Mechanical Engineering Department.				

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

III. Course Description:

Thermodynamics is a basic course that serves as the background for many thermo-fluid courses. This course covers some basic thermodynamics concepts such as systems, boundaries, mass, heat, work energy, and entropy. Properties of common substances such as water, air and general working fluids are introduced using property tables and basic state equations. It includes a study of energy and mass analysis for control mass, control volume systems, 2nd Law of thermodynamics and entropy. The laws of thermodynamics will be taken into account in details.

IV. Intended learning outcomes (ILOs) of the course:

Brief summary of the knowledge or skill the course is intended to develop:

1. To define theories, fundamentals and specialized knowledge of thermodynamics.
2. To demonstrate a basic understanding of the nature of the Thermodynamic processes for pure substances and ideal gases.
3. To demonstrate a basic understanding of the first law of Thermodynamics and its applications to systems and control volumes.
4. To demonstrate an ability to apply the first law of thermodynamics to engineering processes.
5. To characterize and solve problems in thermodynamics in various engineering applications.
6. To evaluate the 2nd Law of thermodynamics for entropy balance on various systems.
7. To demonstrate effective communication skill through oral and written modes.
8. To share ideas and work in a team in an efficient and effective manner under controlled supervision or independently.

V. Course Content:

- Distribution of Semester Weekly Plan Of course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	Sub Topics List	Week Due	Contact Hours
1.	Introduction and Basic Concepts	• Definition of Thermodynamics. • Definition of Thermodynamics Systems. • Examples of Applications of Thermodynamics. • System of Units; Mass, Length and Time. Temperature and Pressure.	1st	2
2.	Energy, Energy Transfer, and General Energy Analysis.	• Definition of Work. • Various Forms of Work Especially the Moving Boundary Work. Concept of Heat Transfer.	2nd	2
3.	Properties of Pure Substance.	• Concept of Pure Substance. • Illustrate the P-V, T-V and P-T Property Diagrams. • Procedures for Determining Properties of Pure Substances by Using Thermodynamic Tables. • Ideal Gas and the Ideal Gas Equation of State. • Ideal Gas Equation to Solve Problems. Compressibility Factor and Illustrate its Use.	3rd, 4th, 5th	6
4.	Energy Analysis of Closed Systems.	• Types of Energy that may be Transferred to or from a Thermodynamic System. • Energy in the Form of Heat or Work that may Cross the Boundaries of a Closed System. • Internal Energy and Enthalpy. Concept of heat Capacities, C_v and C_p.	6 th, 7 th	4
5.	Mid-term Exam	The First 4 Chapters.	8 th	

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

6.	Mass and Energy Analysis of Control Volumes.	• Conservation of Mass. • First Law of Thermodynamics for an Open System. • Steady State Process. • Examples of Steady State Process such as: Heat Exchanger, Nozzle, Throttle, Turbine, Pump and Compressor. Transient Process.	9 th, 10 th, 11 th	6
7.	The Second Law of Thermodynamics.	• Heat Engines and Refrigerators. • Second Law of Thermodynamics. • Reversible Process Carnot Cycle.	12 th, 13 th	4
8.	Entropy.	• Clausius Inequality. • Definition of Entropy. • Entropy of Pure Substance. • Entropy and Relationship with Thermodynamics Properties • Entropy Change and Generation. Entropy change for Liquid and Ideal Gas.	14 th, 15 th	4
9.	Final Exam	All the Chapters.	16 th	2
Number of Weeks /and Units Per Semester			**16**	**32**

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

B – Tutorial Aspect:			
Order	**Topics List**	**Week Due**	**Contact Hours**
1.	**Tutorial,** Introduction and Basic Concepts**.**	1st	2
2.	**Tutorial,** Energy, Energy Transfer, and General Energy Analysis.	2nd	2
3.	**Tutorial**, Properties of Pure Substance.	3rd ,4th ,5th	6
4.	**Tutorial** Energy Analysis of Closed Systems	6th ,7th	4
5.	**Tutorial** Mass and Energy Analysis of Control Volumes	8th ,9th ,10th	6
6.	**Tutorial** the Second Law of Thermodynamics	11th ,12th	4
7.	**Tutorial** Entropy	13th ,14th	4
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures.
- Tutorials.
- Team Work (Group Learning).
- Seminar/ Project/Presentation.
- Problem Based Learning.
- Interactive Class Discussions.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Homework 1	a1,a2,b1.b2, c1,c2, d1, d2	2nd	0.75
2.	Homework 2	a1,a2,b1.b2, c1,c2, d1, d2	3rd	0.75
3.	Homework3	a1,a2,b1.b2, c1,c2, d1, d2	4th	0.75
4.	Homework 4	a1,a2,b1.b2, c1,c2, d1, d2	5th	0.75
5.	Homework5	a1,a2,b1.b2, c1,c2, d1, d2	6th	0.75
6.	Homework6	a1,a2,b1.b2, c1,c2, d1, d2	7th	0.75

Head of Department
Asst. Prof. Dr. Adel Ahmed Al-Shakiri

Quality Assurance Unit
Assoc. Prof. Dr. Mohammad Algorafi

Dean of the Faculty
Prof. Dr. Mohammed AL-Bukhaiti

Academic Development Center & Quality Assurance
Assoc. Prof. Dr. Huda Al-Emad

Rector of Sana'a University
Prof. Dr. Al-Qassim Mohammed Abbas

7.	Homework7	a1,a2,b1.b2, c1,c2, d1, d2	8th	0.75
8.	Homework 8	a1,a2,b1.b2, c1,c2, d1, d2	9th	0.75
9.	Homework9	a1,a2,b1.b2, c1,c2, d1, d2	10th	0.75
10.	Homework 10	a1,a2,b1.b2, c1,c2, d1, d2	11th	0.75
Total				**7.5**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Exercises & Homework.	Weekly	7.5	5 %	b1,b2,c1,c2 d1, d2.
2.	Project (Single\Group).	13	7.5	5 %	a1,a1,b1,b2, d1, d2.
3.	Quizzes.	4, 12	15	10 %	a1, a2, b1,b2.
4.	Mid-Term Exam.	8	30	20 %	a1, a2, b1,b2.
5.	Final Exam.	15	90	60 %	a1, a2, b1,b2.
	Total:		**150**	**100 %**	

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1- Yunus Cengel and Michel. Boles – 2019- Thermodynamics: An Engineering Approach – 9 th Edition- United States of America - McGraw-Hill Education.
2- Moran, M.J., Shapiro, H.N., Boettner, D. D., and Bailey, M. B., 2018- Fundamentals of Engineering Thermodynamics (9 th Edition), John Wiley.

2- Essential References.

1- 1-Borgnakke, C. and Sonntag, R. E., 2009. Fundamentals of Thermodynamics, 7 th Ed., John Wiley & Sons.
2- T D Eastop; A McConkey, 2009. Applied Thermodynamics for Engineering Technologists
5th Edition, Pearson Education.Ltd.

3- Electronic Materials and Web Sites *etc*.

1- https://www.coursera.org/learn/thermodynamics-intro#syllab

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

II. Course Policies:	
1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:** - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.
3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas