Course Specification
(Bachelor)

Course Title:	Thermodynamics-1
Course Code:	ME2231
Program:	Mechanical Engineering
Department:	Mechanical Engineering Department
College:	College of Engineering and Islamic Architecture
Institution:	Umm Al-Qura University
Version:	3
Last Revision Date:	25 December 2024

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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: (...3....)

4. Course General Description:

This course covers the basics of thermodynamics for mechanical engineering students, including basic energy definitions and concepts, first law of thermodynamics, energy conversion efficiency and energy transfer. The topics of properties of pure substances and ideal gas, energy analysis of closed system, and mass and energy analysis of control volume for both steady and unsteady systems are covered. In addition, the second law of thermodynamics is discussed and illustrated through examples leading to the presentation of the entropy and the derivation of the entropy balance equations for the various types of systems.

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

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

7. Course Main Objective(s):

To help students identify definitions and terms associated with thermodynamic concepts and explain them. Define the various forms of energy, energy conversion efficiency, enthalpy, entropy and how to estimate each parameter. Apply the first law and write the energy balances on open and closed systems. Identify a pure substance and explain its phase changes using p-v and T-s diagrams. Apply ideal gas equation. To apply first law on closed system. To determine changes in internal energies of systems. To define and discuss the second law of thermodynamics

2. Teaching mode (mark all that apply)

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

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		45

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	Define the first law of thermodynamics.	**K1**	**Lectures and discussion**	**Exams**
1.2	Define intensive and extensive and intensive properties, a cycle, a process, work, and heat.	**K1**	**Lectures and examples**	**Exams**
1.3	List types of energy forms.	**K1**	**Lectures and examples**	**Exams**
1.4	Classify thermodynamics systems	**K1**	**Lectures and examples**	**Exams**
2.0	**Skills**			
2.1	Differentiate between closed and open systems, heat and work, energy input and energy output. .	**S3**	**Lectures and examples**	**Exams**
2.2	Plot system boundaries and	**S3**	**Lectures and discussion**	**Exams**

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	indicate direction and type of energy.			
2.3	Determine the total energy of a system using property table.	**S1**	**Lectures and examples**	**Exams**
2.4	Recognize the impact of cycle design parameters on performance.	**S1**	**Discussion and examples**	**Exams**
2.5	Able to communicate effectively with others to come up with solutions and justify them.	**S4**	**Discussion**	**Continuous Evaluation**
3.0	**Values, autonomy, and responsibility**			
3.1	Perform energy analysis on closed and open systems.	**V3**	**Examples**	**Exams**
3.2	Calculate energy conversion efficiency of various energy devices.	**V3**	**Examples**	**Exams**
3.3	Writing technical report based on industrial energy data and research outcomes.	**V3**	**Reporting**	**Evaluation of reports**

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction, Definitions, Dimensions and Units.	3
2.	Basic Concepts of Thermodynamics.	6
3	State of Pure Substances and Property Tables	3
4	Energy, Energy Transfer and General Energy Analysis.	6
5	Energy Analysis of Closed Systems.	6
6	Mass and Energy Analysis of Control Volume.	6
7	The Second Law of Thermodynamics.	6
8	Entropy.	9
Total		**45**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	All weeks	10%
2.	Assignments	All weeks	10%
3.	Midterm (written exam)	Twice/ semester	30%
4.	Final Exam (written exam)	After week 16	50%

*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	Thermodynamics: An Engineering Approach (8th ed. 2014). By Yunus A. Cengel , D., and M.A. Boles. McGraw Hill Education.
Supportive References	Property Tables
Electronic Materials	Engineering Equation Solver (EES) software package.
Other Learning Materials	Fundamentals of Engineering Thermodynamics (7th ed. 2011). By Moran, M.J., and H.N. Shapiro, John Wiley & Sons.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room which is equipped with Projector, Laptop, white-board, and internet.
Technology equipment (projector, smart board, software)	Data Show, Engineering Equation Solver (EES) software package.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	independent member teaching staff.	Confidential completion of standard course evaluation survey
Effectiveness of Students assessment	independent member teaching staff.	Direct assessment: Evaluation of all assessment tasks' grades for each student.

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	independent member teaching staff.	Periodic peer review feedback on the quality of the course are conducted and planned remedial/improvements' actions are taken.
The extent to which CLOs have been achieved	independent member teaching staff.	Samples of graded examination papers and assignment tasks are check
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE