Course Specification
(Bachelor)

Course Title:	**Thermodynamics 2**
Course Code:	**ME2232**
Program:	**BSc.**
Department:	**Mechanical Engineering**
College:	**Engineering and Islamic Architecture**
Institution: :	**Umm Al Qura University**
Version:	*Course Specification Version Number*
Last Revision Date:	**10 December 2024**

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A. General information about the course:

1. Course Identification

1. Credit hours: (4)					
2. Course type					
A.	☒ University	☐ College	☐ Department	☐ Track	☐ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (6th/3rd), (2024)					
4. Course General Description:					
Thermodynamics 2 extends the foundational concepts covered in Thermodynamics 1, focusing on more advanced thermodynamic principles and their applications in engineering, physics, and chemical processes. The course will cover essential topics like thermodynamic cycles, phase changes, statistical mechanics, and non-equilibrium thermodynamics. It is designed to understand the energy systems and their transformations, providing students with the necessary tools to analyze and optimize thermodynamic processes.					
5. Pre-requirements for this course (if any):					
Thermodynamics 1					
6. Co-requisites for this course (if any):					
7. Course Main Objective(s):					
1. Analyze the second law of thermodynamics in the context of energy transformations and system behavior. **2. Design and optimize thermodynamic cycles for power generation and refrigeration applications.** **3. Evaluate real gas behavior and apply equations of state for practical problem-solving in thermodynamics.** **4. Apply the concepts of entropy, exergy, and Gibbs free energy to assess system performance and reaction spontaneity.** **5. Model the thermodynamic properties of various materials and**					

systems.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	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**	30
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	10
5.	**Others (specify)**	
Total		40

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	Analyze and evaluate complex thermodynamic systems using principles of the second law of thermodynamics.	**K1**	Lecture	Summative assessment
1.2	Design and optimize thermodynamic cycles (e.g., Rankine, Brayton, refrigeration) for maximum efficiency and practical	**K1**	Lecture/ case discussion	Summative assessment

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	application in engineering systems			
1.3	Apply advanced thermodynamic principles such as exergy analysis and entropy generation to evaluate the efficiency of real-world processes			
1.4	To define the basic laws of refrigeration.	**K1**	Lecture/ case discussion	Summative assessment
1.5	To define the basic cycle of combined power generation.	**K1**	Lecture/ case discussion	Summative assessment
2.0	**Skills**			
2.1	To identify second law analysis of thermodynamic process.	**S2**	Lecture/ case discussion	Summative assessment
2.2	To perform second law analysis of gas power cycle.	**S2**	Lecture/ case discussion	Summative assessment
2.3	To review the factor involved in selecting the right refrigerant for an application.	**S2**	Lecture/ case discussion	Summative assessment
2.4	To analyze the reheat and regenerative vapor power cycle.	**S2**		
3.0	**Values, autonomy, and responsibility**			
3.1				
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	Entropy	**5**
2.	Gas power cycle	**5**
3.	Vapor and combined cycle	**5**
4.	Refrigration cycle	**5**
5.	Gas Mixture	**5**

6.	Gas vapor mixture and air conditioning	5
Total		30

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Home works	Every two weeks	10
2.	Academic Report	4	10
3.	Quiz	1	10
4.	Mid term exam	1	20
5.	Final exam	1	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 Edition (SI units)
Supportive References	
Electronic Materials	Power point slides for each chapter
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (projector, smart board, software)	projector
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching		
Effectiveness of Students assessment		
Quality of learning resources		

Assessment Areas/Issues	Assessor	Assessment Methods
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	
REFERENCE NO.	
DATE