Course Specification
(Bachelor)

Course Title:	Thermodynamic Chemistry
Course Code:	ICHM 241
Program:	Industrial Chemistry
Department:	Chemistry
College:	College of Science Al Zulfi
Institution:	Majmaah University
Version:	TP-153
Last Revision Date:	10/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (.....)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (...4th level .....)					
4. Course General Description:					

The course deals with the following topics

- **Introduction to thermodynamics, Basic concepts**
- **Expansion work, Types of systems & surroundings, Heat capacity, Enthalpy**
- **The first law in thermodynamics**
- **Standard Enthalpy changes, Enthalpies of physical change, Enthalpies of chemical change**
- **Applications of first law in thermodynamics, Temperature dependence of reaction enthalpies, etc.**
- **The Joule-Thomson Experiment, and problems**
- **The Second Law of Thermodynamics, Carnot cycle, and entropy**
- **First and Second laws combined- Entropy changes in different systems, Gibbs-Helmholtz equation- Free energy of ideal gases**

The third law of thermodynamics, Approach to absolute zero- Free energies of gaseous reactions from the third law -Entropy of gases.

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

MTH201

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

7. Course Main Objective(s):

The main purpose for this course
To introduce the main concepts in thermodynamics such as:
- System definition with thermodynamics properties
- Heat transfer in thermodynamics systems
- Pure substance properties -Thermodynamics cycles
-To study the laws in thermodynamic and its application

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	2	90
2	E-learning	1	10
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**	20
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		

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	Recognize the basics of thermodynamics (such as System-types, etc.)	K1	Discussion Exercises Lectures Seminars E-learning	Theoretical tests Homework, Quiz, Exercises, Mid-term exams, Final test.
1.2	Explain the laws of thermodynamics and solve problems	K1		
...	Analysis of scientific facts and theories related to thermodynamic chemistry.	K3		

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	Provides innovative solutions to solve problems according to thermodynamic theories and evaluate the results.	K3		
2.0	**Skills**			
2.1	Apply of the concept of free energies and their relation to the interpretation of automatic chemical reactions to solve the unexpected problems by creative ways.	S1	Problem solving, Class discussion	Homework, Class participation, Midterms, Final Exam
2.2	Participate effective in the activities of the methodology and learn how to search for information through library and internet.	S1	Counsel students that how to make a good presentation, Encourage students to work in a group, Group presentations / assignment	Co-operation with others, Presentation, Observations, Write reports
...	Demonstrate the ability to use modern technology and statistical applications.	S3	Simulation programs, Cooperative work, Practical training, Group assignments, Lab.	Class exercises, Lab exercises
	Perform the laboratory experiments using the right scientific methods	S3	Practical training, Group assignments, Lab, Simulation programs	Practical tests, Lab. reports
3.0	**Values, autonomy, and responsibility**			
3.1	Use information technology, modern computer tools to	V3	Group presentation	Homework, Presentation,

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	locate and retrieve scientific information relevant to thermodynamic chemistry and communicate with teacher through solved problems and work in groups			Evaluation of group reports and individual, Contribution within the group
3.2	Use laboratory tools and security and safety tools properly	V3	Procedure Experiments in lab.	Observation and application
...	Demonstrate the ability to teamwork and lead the team and perform the tasks entrusted to him professionally	V3	Simulation programs, Cooperative work, Working in groups, Practical training, Group assignments, Lab.	Research papers, Group presentation, Group research, Assignment

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to thermodynamics, basic concepts	3
2.	Expansion work, types of systems & surroundings, Heat capacity, Enthalpy	3
3	The first law in thermodynamics	3
4	Standard Enthalpy changes, Enthalpies of physical change, Enthalpies of chemical change	3
5	Applications of first law in thermodynamics, Temperature dependence of reaction enthalpies, etc.	3
6	The Joule-Thomson Experiment, and problems	3
7	The Second Law of Thermodynamics, Carnot cycle, and entropy	3
8	First and Second laws combined- Entropy changes in different systems, Gibbs-Helmholtz equation- Free energy of ideal gases	3
9	The third law of thermodynamics, Approach to absolute zero- Free energies of gaseous reactions from the third law -Entropy of gases.	6
	Practical for theoretical lectures	

	Calculation of the heat capacity of a calorimeter	4
	Heat reaction calculation	4
	Determination of the melting temperature of the potassium nitrate salt	4
	Determination of the burette flow constant	4
	Study of the decomposition of hydrogen peroxide	4
Total		

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm	6	20%
2.	Homework	weekly	2.5%
3.	E-Exam	One/ semester	10%
...	Quizzes	End of topics	2.5%
	Reports of experiment	Weekly	5%
	Final exam practical	9	20%
	Final exam	Last week in semester	40%

*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	1. THERMODYNAMICS AND CHEMISTRY, HOWARD DEVOE, University of Maryland, College Park, Maryland, Second Edition Version 7a, December 2015, http://www.chem.umd.edu/thermobook 2. Thermodynamics and Chemistry, Howard De Voe, ebook Howard De Voe, Second Edition Version 8, October 2016, http://www2.chem.umd.edu/thermobook/v8-print.pdf.
Supportive References	1. Chemistry (10th edition), Raymond Chang, Mc Graw Hil, 2010, 978-007-127220-9. 2. Physical Chemistry, Peter Atkins and etc.,Oxford University Press 11th ed. 2018 3. Elements of physical chemistry, Atkins, P.W., W.H.Freeman, Oxford University Press, New York., 2005. 4. Physical chemistry, Thomas Engel, Philip Reid, Pearson Benjamin Cummings, San Francisco, 2006
Electronic Materials	http://eppe.tripod.com/index.htm http://soo.gd/VfJx

Other Learning Materials	Computer-based programs/CD, professional standards or regulations and software. Excel software for drawing graphs. MS Office for writing reports and presentations.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room, a smart board to write on and computer, white board.
Technology equipment (projector, smart board, software)	Computer, data show and smart board.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	DIRECT
Effectiveness of Students assessment	Students	INDIRECT
Quality of learning resources	Students	DIRECT
The extent to which CLOs have been achieved	Staff members	INDIRECT
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	CHEMISTRY DEPARTMENT COUNCIL
REFERENCE NO.	**16**
DATE	**10/12/2024**