هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	Physical Chemistry I
Course Code:	CHEM243-3
Program:	Bachelor of Science in Chemistry
Department:	Department of Physical Sciences
College:	College of Science
Institution:	Jazan University
Version:	TP-153 (2024)
Last Revision Date:	31 January 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3hrs)

2. Course type

A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (4th Level /2nd Year)

4. Course general Description:

Course title	Course code	Contact Hours			Credit Hours	Year	Level	Prerequisite	Corequisite
		Lec	Tut	Lab					
Physical Chemistry I	CHEM 243-3	2	0	1	3	2nd	4th	CEHM 205-3 MATH 102-4	---

This course aims to provide students with information about thermodynamics, statistical thermodynamics and the phase rule as well as their diverse applications in chemistry.

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

CEHM205-3 and MATH102-4

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

None

7. Course Main Objective(s):

1. Recognize thermodynamics and its applications.
2. Understanding the basic laws of thermodynamics and their applications through physical change chemical reactions.
3. Explore thermodynamic functions, types, and their uses by predicting possible chemical reaction Perform mathematical calculations related to thermodynamic laws.
4. Understand the basic principles of statistical thermodynamics and their applications through chemical reactions.
5. Familiarity with the basics of the phase rule and associated terminology, its application to vario systems, and how to perform related calculations.
6. Study some applications related to thermodynamics

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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**	$2 \times 15 = 30$
2.	**Laboratory/Studio**	$2 \times 15 = 30$
3.	**Field**	
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding;** *Upon completion of the course, students are able to:*			
1.1	***Demonstrate a broad understanding and critical view of the principle, concepts of thermodynamic and statistical thermodynamics, Concepts, and terminology of thermodynamic and statistical topics. (I)***	**K1**	***Lecture discussion***	***Exams Assignments***
1.2	***Describe correctly the different phenomena associated with thermodynamic laws, phase rules, and phase transitions. As well as Translational, rotational and vibrational***	**K2**	***Lecture discussion***	***Exams*** • ***Assignments***

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	thermodynamic functions (I)			
2.0	**Skills;** *Upon completion of the course, students are able to:*			
2.1	*Identify, design, and solve a variety of thermodynamic and statistical thermodynamic problems (from fundamental to complex) by applying mathematical, scientific, and chemical principles, as well as modelling chemical systems. (I)*	**S1**	*Lecture discussion*	*Exams* • *Assignments*
2.2	*Acquire, record, and critically evaluate teamwork results through the use of instrumentation and software, appropriate record-keeping practices, figure preparation, and scrutiny of experimental results (I)*	**S2**	*Lab work, group work*	• *Periodic Exams* • *Assignments & Classroom activities* • *Final Exam*
2.3	*Classify and assess laboratory hazards, practice risk minimization, and conduct safe laboratory practices. (I)*	**S4**	*Lab demonstrations/ hands-on student learning activities*	• *Assignments & Classroom activities* • *Final Exam*

C. Course Content

1- Theoretical Part

No	List of Topics	Contact Hours
1.	*Basic concepts in heat and thermodynamics*	*3*
2.	*thermal equilibrium and the zeroth law of thermodynamics*	*3*
3.	*kinetic gas theory - internal energy and the first law of thermodynamics -*	*3*
4.	*Joule's experiment - entropy and the second law of thermodynamics*	*3*
5.	*heat engines - Carnot cycle - standard entropy and the Third law of thermodynamics*	*3*
6.	*Thermodynamic functions - Maxwell's relationships and their applications*	*3*
7.	*Phase rule*	*2*
8.	*Homogeneous and heterogeneous phase equilibria*	*3*
9.	*Principles of statistical thermodynamics*	*3*
10.	*Translational, rotational and vibrational thermodynamic functions*	*3*

11.	***Molecular distribution in different states -***	***3***
12.	***Boltzmann distribution for the thermal equilibrium system***	***3***
13.	***Molecular Distribution function***	***3***
14.	*relationships of thermodynamic properties to the molecular distribution function*	*4*
15.	*applications of thermodynamics*	*3*
Total		$3 \times 15 = 45$

2- Lab work

No	List of Topics	Contact Hours
1.	***Determination of heat capacity of the Calorimeter***	**2**
2.	***Heat of Fusion of ICE.***	**2**
3.	***Specific Heat Capacity of an Unknown Metal.***	**2**
4.	***Heat of Solution of a Salt. (exo- and endo-) thermic dissolution.***	**2**
5.	***Heat of Neutralization***	**2**
6.	***Heat of Precipitation***	**2**
7.	***Heats of Reaction – Hess's Law.***	**2**
8.	***The Thermodynamics of Solubility.***	**2**
9.	***Spontaneity of Reaction.***	**2**
10.	***Determination of Critical Solution Temperature (CST)***	**2**
11.	***Phase diagram of one Component systems***	**2**
12.	***Phase diagram of 2 Component systems***	**2**
13.	***Phase diagram of 3 Component systems***	**2**
14.	***Revision***	**2**
15.	**Final Exam**	**2**
Total		$2 \times 15 = 30$

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	***Periodic Exams***	***6-8***	***15%***
2.	***Assignments & Classroom activities***	***During semester***	***5%***
3.	***Lab work***	***During semester***	***30%***
4.	***Final Exam***	***16-17***	***50%***
		Total	***100%***

*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. *C Borgnakke, Richard E. Sonntag, Fundamentals of Thermodynamics, 8th ed, (2013).* 2. *Ken A. Dill, Sarina Bromberg, Molecular Driving Forces Statistical Thermodynamics in Biology, Chemistry, Physics, and Nanoscience 2nd edition, (2011).*
Supportive References	*الكيمياء الفيزيائية، بي دبليو- أتكنز- ترجمة د. ناصر بن محمد العنـدس، د. أحمد بن عبد العزيز العويس، د. عبد الله بن علي القحطاني- جامعة الملك سعود للنشر العلمي والمطابع، (2008)، المجلد الأول.*
Electronic Materials	*Peter William Atkins, Julio De Paula, James Keeler, Atkins' Physical Chemistry, (2023).*
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	*1 Lecture room(s) for groups of 50 students* *1 Lab room for group of 25student*
Technology equipment (projector, smart board, software)	*Smart board, Data show, Black board, Internet*
Other equipment (depending on the nature of the specialty)	Thermometers, Calorimeter and Hotplates*, Power source, Balance,*

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Likert-type Survey CES) Indirect
Effectiveness of Students' assessment	Instructor & Course coordinator	Class room evaluation (direct & indirect
Quality of learning resources	Program coordinator	Indirect
The extent to which CLOs have been achieved	Assessment committee	Indirect
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Physical Sciences Department Council
REFERENCE NO.	Meeting (3)
DATE	12/03/2024 -02/09/1445