Course Specification
(Bachelor)

Course Title:	Thermodynamics
Course Code:	241CHEM3
Program:	Bachelor of Science in Chemistry
Department:	Physical Sciences
College:	College of Science
Institution:	Jazan University (JU)
Version:	TP 153 2024
Last Revision Date:	5/5/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3h)

2. Course type

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

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

4. Course general Description:

Course Title	*Course Number*	*Contact Hours (CH)*		*Credit unit (CU)*	*Year*	*Level*	*Pre-requisite*
		Lecture	*Practical*				
Thermodynamics	*241 CHEM3*	*2*	*1*	*3*	*2*	*4*	*201CHEM-4*

The course is designed to give the students basic information about the thermodynamic chemistry, laws, thermochemistry, and phase rule

Course objectives: They are to identify the following.

- ***1. Identify the types of thermodynamic systems and processes***
- ***2. Recognize the different thermodynamic laws and thermochemistry***
- ***3. Calculate the required thermodynamic parameters via solving problems***
- ***4. Identify the applications of thermodynamic phenomena***
- ***5. Understand the phase rule and related phase transitions***
- ***6. Investigate one, two and three component system and calculate degree of freedom.***

Syllabus: A-Theoretical contents

Heat and work, Heat capacity, specific heat, thermodynamic process, thermodynamic laws: thermochemistry, Carnot cycle, Joule-Tomson effect Gibbs- Helmholtz free energy, phase rule, system with different component.

Syllabus: A-Practical contents

Experimental work illustrating selected parts of the theoretical content.

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

344CHEM-3

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

None

7. Course Main Objective(s):

The course is designed to give the students basic information about the thermodynamic chemistry, laws, thermochemistry, and phase rule

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**	30
2.	**Laboratory/Studio**	30
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
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, student will be able to)			
1.1	Demonstrate a broad understanding and critical view on the principle of thermodynamic chemistry, Concepts, and terminology of thermodynamic topics, including Heat, Work, different types of systems, and laws of thermodynamic	K(1.1)	***lecture / discussion Seminars***	***Objective question***
1.2	Describe correctly the different phenomena associated with	K(1.2)	***lecture / discussion / Seminars***	Essay question

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	thermodynamic laws, phase rule, and phase transitions		*/Individual presentation*	
2.0	**Skills**; (Upon completion of the course, student will be able to)			
2.1	Demonstrate critical thinking, numeracy, statistical, analytical reasoning, use graphs, charts and solve problems related to work, Enthalpy, internal energy, Entropy, Gibbs free energy, Helmholtz free energy, degree of freedom, and systems with different components.	S(2.1)	*lecture / discussion / Seminars /Individual presentation*	Solving Problems & chart analysis
2.2	Perform experiments in Thermodynamic chemistry, record, analyze, interpret the scientific data, and write reports. (M)	S(2.2)	*Lab work, group work*	*Objective question, Essay question,* *lab report rubric*
2.3	Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the correct techniques and rules for secure handling when using chemicals. (P)	S(2.3)	*lab demonstrations / hands-on student learning activities*	*Safety exam*
3.0	**Values, autonomy, and responsibility**; (Upon completion of the course, student will be able to)			
3.1	Working as a group leader in cooperation with other colleagues. (P)	V(3.1)	*lab demonstrations / whole group and small group discussion*	*Practical group work Rubric*

C. Course Content

No	List of Topics	Contact Hours
1.	*Basics of thermodynamic chemistry*	3
2.	*The 0th. Law of thermodynamics and Gases*	3
3.	*Work and Heat, Internal Energy and the 1st. Law of Thermodynamics*	3
4.	*Entropy, the 2nd. Law of Thermodynamics and More on Entropy*	3
5.	*The 3rd. Law of Thermodynamics*	3
6.	*Thermochemistry*	3

7.	*Solutions and Condensed Phases Equilibrium and Chemical Equilibrium, Changes in Equilibrium Constants*	**4**
8.	*A Single -Component System and Phase Transition*	**4**
9.	*The Gibbs Phase Rule and Two Components: Liquid/Liquid Systems*	**4**
10.	Selected topics related to course content	**30**
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	***Homework assignment***	***3-8***	***1%***
2.	***Lecture Quizzes***	***4-6***	***4%***
3.	***Mid-term exam***	***6-8***	***15 %***
4.	***LAB Sheet***	***15***	***5 %***
5.	***Quiz in Safety***	***14-15***	***3%***
6.	***Final practical exam***	***15***	***10 %***
7.	***Lab report***	***2-15***	***10 %***
8.	***Group work evaluation***	***2-15***	***2%***
9.	***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	Physical Chemistry (Second Edition) **by** David W. Ball, Cleveland State University, 2014**.**
Supportive References	Essentials Of Physical Chemistry. Bahl A., et al. S. Chand. 2010, English. 4ed. 1166\1166. 1122910 Translated Arabic version of peter Atkins (KSU)
Electronic Materials	Some course contents and materials are posted on Black board sites
Other Learning Materials	***www.wikipedia.org/*** https://chem.libretexts.org/Special:Search?qid=&fpid=230&fpth=&query=thermodynamic&type=wiki

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	1 Lecture room(s) for groups of 50 students
Technology equipment (projector, smart board, software)	Smart board, Data show, Black board, internet
Other equipment (depending on the nature of the specialty)	none

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	Classroom 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.	Psci2415
DATE	28/03/1446 Corresponding to 1 / 10 /2024

H. Attachments

1- Practical Work

Week	EXPERMENTAL TITLE	Chemicals and Apparatus used	Remarks
1	Safety and regulations		
2	*The Heat Capacity of the Calorimeter.*	•Styrofoam cups • Ice • 100 mL graduated cylinder • Cardboard lid w/ hole • DI water • Burner or hot plate • Thermometer (-10 to 110 °C) • 150 mL Beaker • Watch or Clock • Thermometer clamp • 250 mL Beaker • Centigram balance	None
3	*Heat of Fusion of ICE.*		None
4	*Specific Heat Capacity of an Unknown Metal.*	•Styrofoam cups • Ice • 100 mL graduated cylinder • Cardboard lid w/ hole • DI water • Burner or hot plate • Thermometer (-10 to 110 °C) • 150 mL Beaker • Watch or Clock • Thermometer clamp • 250 mL Beaker • Centigram balance •metal sample (i.e.: Iron, Copper, Zinc, Aluminum...)	None
5	*Heat of Solution of a Salt. (exo- and endo-) thermic dissolution.*	• Styrofoam cup • Balance • Thermometer • 100 mL graduated cylinder • Anhydrous Sodium acetate, • Ammonium nitrate, NH4NO3	None
6	*Heat of Neutralization.*	•Styrofoam cups • Ice • 100 mL graduated cylinder • Cardboard lid w/ hole	None

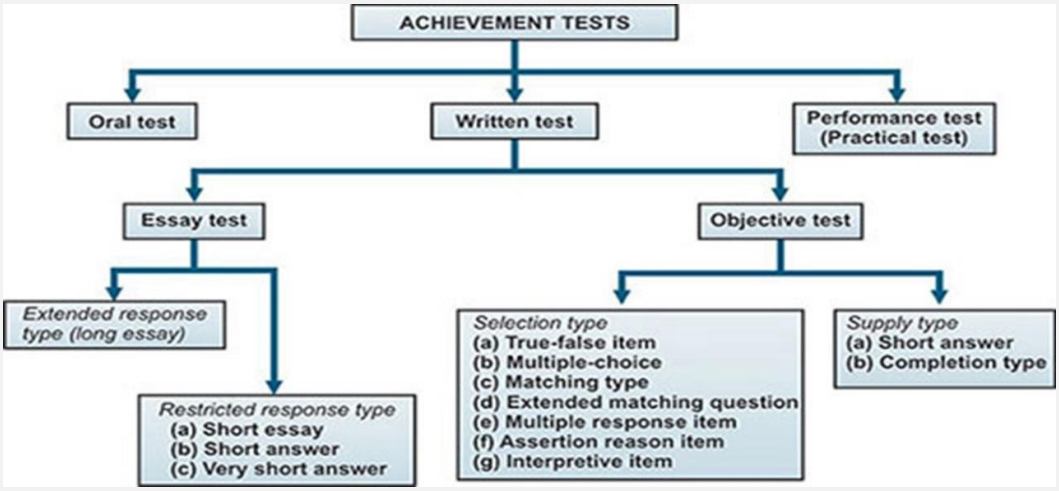
		• DI water • Burner or hot plate • Thermometer (-10 to 110 °C) • 150 mL Beaker • Watch or Clock • Thermometer clamp • 250 mL Beaker • centigram balance • NaOH, HCl and CH3COOH	
7	*Heat of Precipitation.*	• Foam cup • Thermometer • Silver nitrate solution • Sodium chloride solution	***None***
8-9	*Heats of Reaction – Hess's Law.*	• Styrofoam cup • Balance • Thermometer • 100 mL graduated cylinder • sodium hydroxide, NaOH • 1M sodium hydroxide • 1M Hydrochloric acid • 0.5M Hydrochloric acid • Distilled water	***None***
10	*The Thermodynamics of Solubility.*	•Solid KNO_3 • Boiling water bath • Graduated cylinders • one 50 mL graduated cylinder with the plastic base removed • one 25 mL graduated cylinder • one 10 mL graduated cylinder • Thermometer or temperature measuring probe • Large test tube	***None***
11	*Spontaneity of Reaction.*	• Solid KNO_3 • Foam cup • Graduated cylinders • Thermometer or temperature • measuring probe	***Metal sheets and equipment are not available***
12	*Determination of Critical Solution Temperature (CST)*	•Test tubes, • boiling tube as air jacket, • thermometer (graduated to 0.1◦C), • stirrer, • beakers, • phenol, water • sodium chloride 1N, • Hot plate.	***Metal sheets and equipment are not available***
13	*Phase diagram of 3 Component systems*	• Test tubes, • thermometer (graduated to 0.1◦C), • stirrer, • beakers, • Ethanol / Toluene / Water	***Metal sheets and equipment are not available***
11	***Final exam***		

2- Blue Print

Course Name	Thermodynamics
Course Code	241 CHEM-3

PLOs	K1	K2	S1	S2	S3	S4	V1	V2
CLOs	1.1	1.2	2.1	2.2	2.3	2.4	3.1	3.2
Marks	30	24	16	25	3		2	---

Learning Domain	PLOs	CLOs	Assessment Type	Assessment Tool	No of Questions	Marks of the Assessment	Weight of the Assessment
Knowledge & understanding	K1	1.1 (30 M)	Quiz	Objective question	4	2	2
			Mid term	Objective question	1	6	6
			Final Exam	Objective question	2	22	22
	K2	1.2 (24 M)	Quiz	***Essay question***	2	2	2
			Mid term	***Essay question***	1	5	5
			Final Exam	***Essay question***	2	17	17
Skills	S1	2.1 (16M)	H.W	Solving Problems & chart analysis	4	1	1
			Mid term	Solving Problems & chart analysis	2	4	4
			Final Exam	Solving Problems & chart analysis	6	11	11
	S2	2.2 (25 M)	Practical Sheet	MCQ	6	5	5
			Lab Report	Lab Report Rubric	10	10	10
			Final Lab Exam	I Task experiment	1	12	10
	S3	2.3 (3 M)	Safety Quiz	MCQ	8	3	3
Values	V1	3.1(2M)	Groupwork evaluation	rubric			2
TOTAL		100					100


ACHIEVEMENT TESTS
Oral test
Written test
Performance test (Practical test)
Essay test
Objective test
Extended response type (long essay)
Restricted response type
(a) Short essay
(b) Short answer
(c) Very short answer
Selection type
(a) True-false item
(b) Multiple-choice
(c) Matching type
(d) Extended matching question
(e) Multiple response item
(f) Assertion reason item
(g) Interpretive item
Supply type
(a) Short answer
(b) Completion type