هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Thermodynamic Chemistry**
Course Code:	**CHEM 241**
Program:	**Bachelor in Chemistry**
Department:	**Chemistry**
College:	**College of Science**
Institution:	**Jazan University (J U)**

Table of Contents

A. Course Identification

1. Credit hours: 3hs **Workload:** 166.2 **ECTS:** 5.9	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 4 Year 2	
4. Pre-requisites for this course (if any)**:** none	
5. Co-requisites for this course (if any)**:** none	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	60	100 %
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

Course Title	Course Number	Contact Hours (CH)		Credit unit (CU)	Year	Level	Pre-requisite
		Lec.	Prac.				
Thermodynamic	CHEM 241	2	1	3	2	4	none

Course Objectives

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- Helmholtes free energy, phase rule, system with different component.

Syllabus: A-Practical contents

Experimental work illustrating selected parts of the theoretical content.

2. Course Main Objective

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

3. Course Learning Outcomes

	CLOs	Aligned-PLOs	
1	**Knowledge and Understanding:** *Upon completion of this course, student will be able to*		
1.1	*Demonstrate a broad understanding and critical view on principal of thermodynamic chemistry, Concepts and terminology of thermodynamic topics including; Heat, Work, different types of systems and laws of thermodynamic*	*(I)*	*K1*
1.2	*Describe correctly the different phenomena associated with thermodynamic laws, phase rule and phase transitions*	*(I)*	*K2*
2	**Skills :** *Upon completion of this course, student will be able to*		
2.1	*Demonstrate an ability in critical thinking, numeracy, statistical, analytical reasoning, use graphs, charts and to solving problems related to work, Enthalpy, internal energy, Entropy, Gibbs free energy, Helmholtz free energy, degree of freedom and systems with different component.*	*(I)*	*S1*
2.2	*Perform experiments in thermodynamic chemistry, record, analyze, interpret the scientific data, and write reports.*	*(I)*	*S2*

CLOs		Aligned-PLOs	
2.3	***Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals.***	***(I)***	***S3***
3	**Values:** ***Upon completion of this course, student will be able to***		
3.1	***Cooperate with other colleagues to prepare an article review on selected thermodynamics topic.***	***(I)***	***V1***

C. Course Content

No	List of Topics	Contact Hours
1	*Basics of thermodynamic chemistry*	2
2	*The 0th. Law of thermodynamics and Gases*	2
3	*Work and Heat, Internal Energy and the 1st. Law of Thermodynamics*	5
4	*Entropy, the 2nd. Law of Thermodynamics and More on Entropy*	5
5	*The 3rd. Law of Thermodynamics*	4
6	*Thermochemistry*	4
7	*Solutions and Condensed Phases Equilibrium and Chemical Equilibrium, Changes in Equilibrium Constants*	4
8	*A Single -Component System and Phase Transition*	2
9	*The Gibbs Phase Rule and Two Components: Liquid/Liquid Systems*	2
10	*Selected topics related to course content*	30
Total		***60***

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding** ***Upon completion of this course, student will be able to***		
1.1	***Demonstrate a broad understanding and critical view on principal of thermodynamic chemistry, Concepts and terminology of thermodynamic topics including; Heat, Work, different types of systems and laws of thermodynamic***	***lecture / discussion Seminars /presentation***	***oral and written examinations laboratory reports***
1.2	***Describe correctly the different phenomena associated with thermodynamic laws, phase rule and phase transitions***	***lecture / discussion / Seminars /Individual presentation***	***oral and written examinations laboratory reports***
2.0	**Skills** ***Upon completion of this course, student will be able to***		
2.1	***Demonstrate an ability in critical thinking, numeracy, statistical, analytical reasoning, use graphs, charts and to solving problems related to work, Enthalpy, internal energy, Entropy, Gibbs free energy, Helmholtz free energy, degree of***	***lecture / discussion / Seminars /Individual presentation***	***oral and written examinations laboratory reports***

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	freedom and systems with different component.		
2.2	*Perform experiments in Thermodynamic chemistry, record, analyze, interpret the scientific data, and write reports.*	*Lab work, group work*	*lab report/ Lab notebook.*
2.3	*Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals.*	*lab demonstrations / hands-on student learning activities*	*Observation of practical skills / Safety exam / Practical assignments and laboratory reports*
3.0	*Values* *Upon completion of this course, student will be able to*		
3.1	*Working a group leader in cooperation with other colleagues.*	*lab demonstrations / whole group and small group discussion*	*group project reports / Practical assignments and laboratory reports /*

2. Assessment Tasks for Students

#	Assessment task*		Week Due	Percentage of Total Assessment Score
1	*Homework assignment*		*2*	*1 %*
2	*Lecture Quizzes*		*4*	*3 %*
3	*Mid-term exam*		*6*	*15 %*
4	*Homework assignment*		*8*	*1 %*
5	*Group work presentation*		*12*	*0*
6	*LAB*	*Quiz in Safety*	*5*	*0*
7		*LAB Sheet*	*15*	*10 %*
8		*Final practical exam*	*15*	*15 %*
9		*Lab report*	*15*	*5 %*
10	*Final Exam*		*16*	*50 %*
			Total	*100 %*

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- *Instructor will be available for academic counseling on daily basis for at 4h/day during office hours.*
- *The office hours are listed in the instructor time table and delivered to students in the first lecturer in each semester.*
- *Instructor is available in a WhatsApp group with student.*
- *E-mail and Telephone number are delivered to student for any help during semesters.*

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Physical Chemistry (Second Edition) **by** David W. Ball, Cleveland State University, 2014**.**
Essential References Materials	Translated Arabic version of peter Atkins (KSU)
Electronic Materials	Physical Chemistry (Second Edition) **by** David W. Ball, Cleveland State University, 2014**.**
Other Learning Materials	***www.wikipedia.org/*** https://chem.libretexts.org/Special:Search?qid=&fpid=230&fpth=&query=thermodynamic&type=wiki

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	***1 Lecture room(s) for groups of 50 students*** ***1 Lab room for group of 25student***
Technology Resources (AV, data show, Smart Board, software, etc.)	***Smart board, Data show, Black board, Internet***
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Thermometers, Calorimeter and Hotplates

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching and Assessment	***Student***	***Likert-type Survey (CES) Indirect***
Extent of achievement of course learning outcomes	***Instructor & Course coordinator***	***Class room evaluation (direct & indirect)***
Quality of learning resources	***Program coordinator***	***Indirect***
Exam Quality assessment	***Assessment committee***	***Indirect***
Effectiveness of Teaching and Assessment	***Student***	***Likert-type Survey (CES) Indirect***

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Chemistry Department Council**
Reference No.	42 / 35 /102 112
Date	17 /09 /1442 Corresponding to 28 / 04 /2021

Laboratory equipment's and chemicals for

Course Name: Thermodynamic Chemistry
Code: - 241 CHEM-3

No.	Experiment Titles	Equipment, Chemicals and Tools.	No of weeks for experiment
	Lab Safety		One week
1	*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	One week
2	*Heat of Fusion of ICE.*		One week
3	*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,...)	One week
4	*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	One week
5	*Heat of Neutralization.*	Styrofoam cups Ice 100 mL graduated cylinder Cardboard lid w/ hole DI water Burner or hot plate Thermometer (-10 to 110 °C)	One week

		□ 150 mL Beaker □ Watch or Clock □ Thermometer clamp □ 250 mL Beaker □ centigram balance □ NaOH, HCl and CH3COOH	
6	*Heat of Precipitation.*	□ Foam cup □ Thermometer □ Silver nitrate solution □ Sodium chloride solution	One week
7	*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	One week
8	*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	One week
9	*Spontaneity of Reaction.*	□ Solid KNO_3 □ Foam cup □ Graduated cylinders □ Thermometer or temperature □ measuring probe	One week
10	*Determination of Critical Solution Temperature (CST)*	□Test tubes, □ boiling tube as air jacket, □ thermometer (graduated to 0.1^{o}C), □ stirrer, □ beakers, □ phenol, water □ sodium chloride 1N, □ Hot plate.	One week
11	*Phase diagram of 3 Component systems*	□ Test tubes, □ thermometer (graduated to 0.1^{o}C), □ stirrer, □ beakers, □ Ethanol / Toluene / Water	One week