هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Principle of Chemical Thermodynamics**
Course Code:	**CHEM 233**
Program:	**BCs**
Department:	**Chemistry**
College:	**Science**
Institution:	**KSU**

Table of Contents

A. Course Identification

1. Credit hours: 3(2 + 0 + 1)
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 4 th level / Second year
4. Pre-requisites for this course (if any)**:** CHEM 101 and MATH 101
5. Co-requisites for this course (if any)**:**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	30	54
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**	26	46

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	26
3	**Tutorial**	
4	**Others** (specify)	
	Total	56

B. Course Objectives and Learning Outcomes

1. Course Description

Importance and terminologies, Work and Heat, Zeroth law, First law, Thermochemistry, The second and Third law, Gibbs Free energy, Chemical and physical equilibrium. The practical part includes: Heat capacities, thermodynamic of electrochemical reactions Enthalpies measurements, calculating the equilibrium constants for some reactions, , distribution coefficients measurements, estimating the strength of hydrogen bonds.

2. Course Main Objective

- To explain the importance of thermodynamics.
- To understand the driving forces of changes.
- To recognize factors affecting changes.
- To explain different ways for evaluation of thermodynamics parameters.
- To describe the relations between thermodynamics' parameters.
- To recognize the applications of thermodynamics.
- To recognize the applications of thermodynamics.
- To experimentally determine the applications of thermodynamics' parameters
- Experimental evaluation of many parameters.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Define types of systems	K1
1.2	Recognize types of processes	K2
1.3	Understand relations between different forms of energy	
1...	Recognize and explain internal energy, enthalpy, entropy, free energy, and equilibrium.	
2	**Skills :**	
2.1	Calculate heat, work, entropy, free energy and enthalpy.	S1
2.2	Construct steps required to calculate thermodynamics' functions.	S2
2.3	Predict the establishment of chemical equilibrium.	S3
2...	Differentiate between reversible and irreversible processes	S2
	Compare between different processes	S2
	Evaluate values and justify signs of work and heat, and other parameters	S3
	Practical evaluation and estimation of thermodynamic properties: ΔU, q, w, Cs , ΔH, ΔS, K	S3
	Prove of some thermodynamics laws	S2
3	**Values:**	
3.1	Work independently and as a part of a team during group discussions and exercises.	V2
3.2	Demonstrate safe handling of laboratory chemicals and glass ware during experiments.	V3
3.3	Demonstrates good capability of save lab evacuation.	V3
3.3	Develop a habit of self-learning.	V2
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction and terminologies	3
2	Work and heat	3
3	The zeroth law	2

4	The first law	4
5	Thermochemistry	4
6	Midterm exam	1
7	The second law	4
8	The third law	4
9	The free energy and equilibrium	5
10	Different experiments related to the thermodynamic topics	26
Total		56

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**		
1.1	Define types of systems	• Class discussion • Illustration of examples • Homework assignment	• two short quizzes • Presentations and discussion • Homework • mid exam • Final exam
1.2	Recognize types of processes		
1.3	Understand relations between different forms of energy		
1.4	Recognize and explain internal energy, enthalpy, entropy, free energy, and equilibrium.		
1.5	Compare between different processes		
1.6			
2.0	**Skills**		
2.1	Calculate heat, work, entropy, free energy and enthalpy.	• Homework assignment • Solving problems • Comparison between theoretical & experimental data • Extract important data from curves& tables.	Quizzes-Mid-term and final exams-Question during the lecture
2.2	Construct steps required to calculate thermodynamics' functions.		
2.3	Predict the establishment of chemical equilibrium.		
2.4	Differentiate between reversible and irreversible processes		
2.5	Evaluate values and justify signs of work and heat, and other parameters		
2.6	Practical evaluation and estimation of thermodynamic properties: ΔU, q, w, Cs , ΔH, ΔS, K	Practical laboratory experiments	Lab reports, and practical exams.
3.0	**Values**		
3.1	Work independently and as a part of a team during group discussions and exercises.	Working as a team work in lab .	Individual performance within the group. Reports submitted by students midterm and final exams
3.2	Demonstrate safe handling of laboratory chemicals and glass ware during experiments.	Perform lab. Experiments individually and in groups	
3.3	Practicing accurate measurements of quantities of substances.	Give student problems which they share solving to encourage	

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		group discussion and develop communication skills with others.	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Quizzes	4&11	10%
2	Homework and assessments	Continues	20%
3	Oral discussion	Continues	10%
4	Midterm exam	9	20%
5	Final exam	16	40%
6			
7			
8			

***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 :

Office hours (4 hours per week)

Help session (problem solving)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• Physical chemistry by P. W. Atkins
Essential References Materials	Chemical Thermodynamics by Dr. Sulaiman AlQuoater and Dr. Abdulaziz AlSuhaibani
Electronic Materials	Websites that are related to thermodynamic
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Medium size classroom with smartboard and internet connection through the university network. Laboratories should be supplied with basic chemicals, acids, bases, indicators, glass ware, and basic equipment. Body

Item	Resources
	protection safety accessories should be available to all students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show &computers
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Basic chemical laboratory equipment.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
assessment	Lecturer	Indirect
Quizzes	Lecturer	Direct
Exam	Lecturer	Direct
Work in lab and reports write up	Demonstrator	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	
Reference No.	
Date	