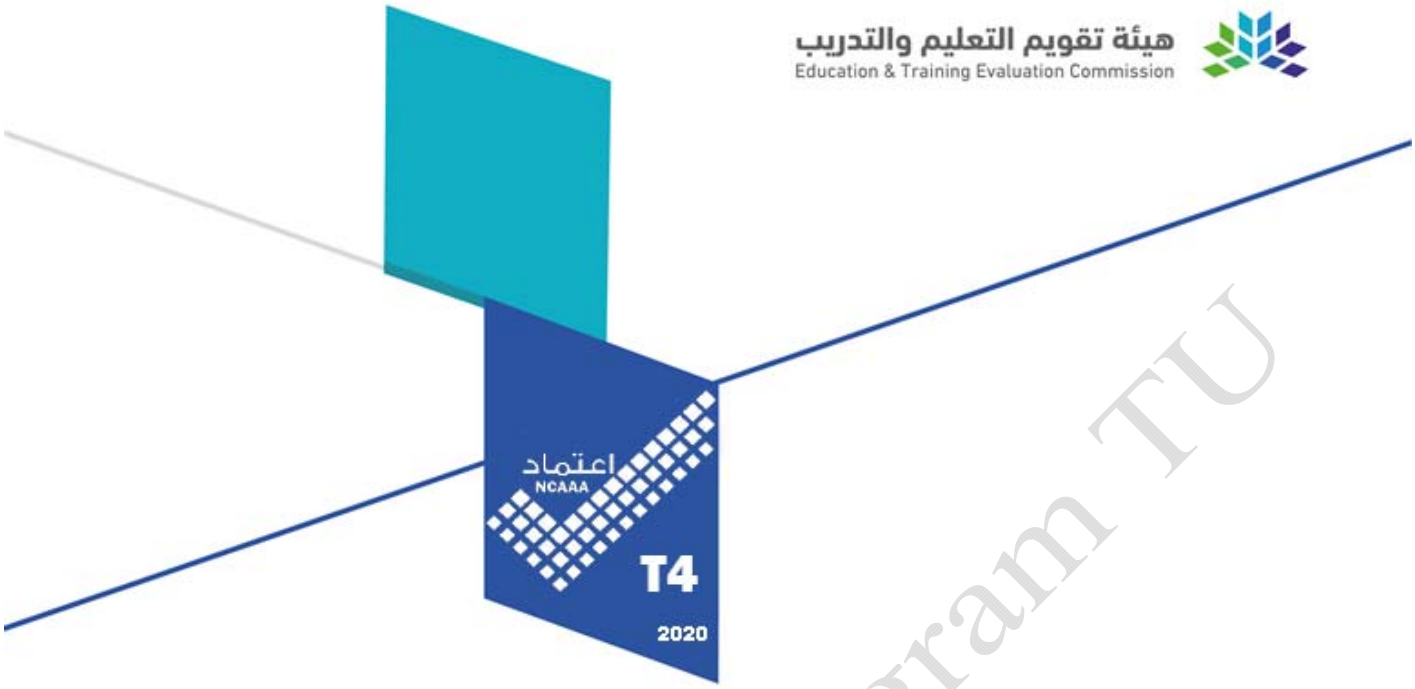
هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission




# Course Specifications

| | |
|---|---|
| **Course Title:** | **Thermodynamics** |
| **Course Code:** | **2042202-3** |
| **Program:** | **Bachelor in Chemistry** |
| **Department:** | **Department of Chemistry** |
| **College:** | **College of Sciences** |
| **Institution:** | **Taif University** |

## Table of Contents

## A. Course Identification

| | |
|---|---|
| **1. Credit hours:** | **3 (Theoretical)** |
| **2. Course type** | |
| **a.** | University ☐ College ☐ Department √ Others ☐ |
| **b.** | Required √ Elective ☐ |
| **3. Level/year at which this course is offered:** | **4th Level / 2nd Year** |
| **4. Pre-requisites for this course** (if any)**:** | **General Chemistry 2 (2042103-3)** |
| **5. Co-requisites for this course** (if any)**:** | **NA** |

**6. Mode of Instruction** (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | **Traditional classroom** | 3 Theoretical hours/ Week | 100% |
| 2 | **Blended** | - | - |
| 3 | **E-learning** | - | - |
| 4 | **Distance learning** | - | - |
| 5 | **Other** | - | - |

**7. Contact Hours** (based on academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1 | **Lecture** | 45 |
| 2 | **Laboratory/Studio** | - |
| 3 | **Tutorial** | - |
| 4 | **Others** (specify) | - |
| | **Total** | **45** |

## B. Course Objectives and Learning Outcomes

**1. Course Description**

The course describes the principles of classical thermodynamics, thermodynamic terms, thermodynamic equilibrium, thermodynamic processes and states, nature of energy, heat and work, zero law, Internal energy and first law of thermodynamic, second law, entropy and spontaneous processes, Carnot cycle and efficiency, Gibb's free energy and chemical equilibrium, Chemical potential and Clausis- Clapryon equation.

**2. Course Main Objective**

The objective of this course is to introduce the basic concepts of all laws of thermodynamics and their applications in real life and chemistry problem.

**3. Course Learning Outcomes**

| | CLOs | Aligned PLOs |
|---|---|---|
| **1** | **Knowledge and Understanding:** | |
| 1.1 | Recall basic concepts, definitions and terminology of thermodynamics. | K1 |
| 1.2 | Describe the concept of the energy units. | K2 |

| CLOs | | Aligned PLOs |
|---|---|---|
| **2** | **Skills:** | |
| 2.1 | Apply the thermodynamic relations. | S1 |
| 2.2 | Explain the concept of entropy. | S2 |
| **3** | **Values:** | |
| 3.1 | Participate in the development of the performance of work teams. | V1 |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | Thermodynamic terms, Types of thermodynamic systems. Intensive and extensive properties. Thermodynamic process | 3 |
| 2 | Nature of heat and work. Isothermal reversible expansion work of an ideal gas. Isothermal irreversible expansion work of an ideal gas | 6 |
| 3 | Maximum Work done in reversible expansion | 3 |
| 4 | Internal energy First law of thermodynamic. Enthalpy of the system. Molar Heat capacities Joule. Thomson Effect | 3 |
| 5 | Adiabatic expansion of an ideal gas. Work done in adiabatic reversible expansion | 3 |
| 6 | Enthalpy of reaction. Exothermic and endothermic reaction. Different type of heat of reaction. Energy Change during transition or phase change. Hess's law. Application of Hess's law | 6 |
| 7 | Bond Energy. Measurement of heat of reaction. Spontaneous process and non-spontaneous process | 3 |
| 8 | Entropy: Units, standard entropy, numerical definition, physical significance. Entropy change for an ideal gas. Accompanying change of phase | 6 |
| 9 | Gibb's Helmholtz equations- Clausis and Clapryon equation | 6 |
| 10 | Vanthoff isotherm. Chemical potential | 6 |
| **Total** | | **45** |

## 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 | Recall basic concepts, definitions and terminology of thermodynamics | Lecture | Written exam |
| 1.2 | Describe the concept of the energy units | Lecture | Written exam |
| **2.0** | **Skills** | | |
| 2.1 | Apply the thermodynamic relations | Discussion | Homework Assignments |
| 2.2 | Explain the concept of entropy | Discussion | Homework Assignments |
| **3.0** | **Values** | | |
| 3.1 | Participate in the development of the | Collaborative | Individual |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| | performance of work teams | Learning | presentations |

**2. Assessment Tasks for Students**

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| 1 | Homework Assignments (Electronic) | Throughout Semester | 15% |
| 2 | Individual presentations | Throughout Semester | 5% |
| 3 | Periodical Exam | 7/8 | 15% |
| 4 | Mid Term Exam | 11/12 | 15% |
| 5 | Final exam | 16 | 50% |

***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 :**

Commitment to the rules of the Academic Advising Department at the university in accordance with the academic guidance manual approved by the university and the attached forms, there are different arrangements made by teaching staff to support student consultations including;
- Office hours: 8 hours per a week for each academic member.
- Academic guidance: an academic member has a number of students to guide them throughout degree journey.

## F. Learning Resources and Facilities

**1. Learning Resources**

| | |
|---|---|
| **Required Textbooks** | • Physical Chemistry Essentials, Andreas Hofmann, 2018, Springer, Latest Edition. ISBN: 978-3-319-74167-3. |
| **Essential References Materials** | • Physical Chemistry, P. W. Atkins, 2017, Oxford University Press, Latest Edition. ISBN: 9780198769866. |
| **Electronic Materials** | • Saudi Digital Library (SDL) |
| **Other Learning Materials** | • Learning Management System (Blackboard) |

**2. Facilities Required**

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | A classroom with movable tables and chairs conducive to group discussion and teamwork. |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | Data show, smart board |
| **Other Resources** (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | ---- |

## G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Effectiveness of Teaching and assessment | Students | Survey (indirect method) |
| Extent of achievement of course learning outcomes | Program leader | Reports (Direct method) |
| Quality of learning resources | Peer referees<br>Students | Reports (Direct method)<br>Survey (indirect method) |

**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** | **Department Council/ Quality assurance committee** |
| **Reference No.** | 7-3-1445 |
| **Date** | 27/2/1445 HJ<br>12/09/2023 G |