ATTACHMENT 2 (e)

Course Specifications

Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

Thermodynamics

4022135-3

Course Specifications
(CS)

Course Specifications

Institution: **Umm Al-qura University** Date of Report: **2017**
College/Department : **Faculty of Applied Science/ department of chemistry**

A. Course Identification and General Information

1. Course title and code: **Thermodynamics / 4022135-3**
2. Credit hours: **3 (2 theoretical + 1 practical)**
3. Program(s) in which the course is offered. **Chemistry and Industrial Chemistry**
4. Name of faculty member responsible for the course: **Dr. Ahmed Fawzy**
5. Level/year at which this course is offered: **3rd level/2nd year**
6. Pre-requisites for this course (if any): **Volumetric Analytical Chemistry & Calculus**
7. Co-requisites for this course (if any)---
8. Location if not on main campus: **both on El-Abedyah and El-Zaher**
9. Mode of Instruction (mark all that apply)

a. Traditional classroom	■	What percentage? 100%	
b. **Blend (traditional and online)**		What percentage	
c. e-learning		What percentage?	
d. Correspondence		What percentage?	
f. Other		What percentage?	

Comments:

B Objectives

1. What is the main purpose for this course? **By the end of this course the students will be able to:** **1. Describe the fundamental principles of thermodynamics.** **2. State the fundamental application of thermodynamic laws in various fields** **3. Develop physical intuition, mathematical reasoning, and problem solving skills.** **4. Analyze the thermodynamic data and predict the processes spontaneity**
2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field) **The students will be asked to prepare an essay or a report according to the literature survey using the library, data base services, and/or websites to follow up and update the topics related to the subject of the course**.

C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
Theoretical part		
1. General introduction: objectives of the thermodynamics, some thermodynamics terms	1	2
2. Heat, energy and work (the mechanical equivalent of heat). Different types of systems	1	2
3. Thermodynamics variables and characteristics of intensive, extensive and thermodynamics processes.	1	2
4. Zero and first laws of thermodynamics and their applications	1	2
5. The relationship between enthalpy change and internal energy change, heat capacity	1	2
6. The Jules-Thompson's effect, Adiabatic and isothermal expansions, Determination of Joule's coefficient from heat capacity measurements.	1	2
7. Thermochemistry. Exothermic and endothermic reactions. Kirchhoff's law, Hess's law and its applications.	1	2
8. The second law of thermodynamics and its applications.	1	2
9. Spontaneous and non spontaneous processes. Heat machines and thermal efficiency		

10. Heat transfer to work. Carnot cycle (efficiency and compression ratio) Otto cycle.	1	2
11. Entropy. Gibbs free energy, work function, Gibbs and Gibbs – Helmholtz Equations.	1	2
12. Van't Hoff Equations, Chemical Equilibrium and spontaneity.	1	2
13. Third law of thermodynamics and its applications.	1	2
14. General revision	1	2
Laboratories		
• Instructions on rules and methods of safety at chemical lab.	1	3
• Introduction to the objectives of thermodynamics and various types of thermo-chemical reactions.	1	3
• Determination of the heat capacity and specific heat of the calorimeter using distilled water.	1	3
• Determination of the heat capacity of the calorimeter using solutions.	1	3
• Determination of the heat capacity for different concentration of sodium chloride solutions.	1	3
• Determination of the heat of neutralization between acid and alkali.	1	3
• Determination of the heat of salvation of ammonium chloride as an endothermic reaction at infinite dilution.	1	3
• Determination of the heat of salvation of sodium hydroxide as an exothermic reaction at infinite dilution.	1	3
• Hess's Law.	1	3
• Determination of the higher critical temperature for water-phenol system.	1	3
• Determination of the lower critical temperature in two component system.	1	3
• Three component systems.	1	3

• General revision	1	3
• Final practical exam	1	3

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	28	-	42			70
Credit	2	-	1			3

3. Additional private study/learning hours expected for students per week. 2hr

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the intensive and extensive properties	• Lectures • Scientific discussion • Library visits • Web-based study	• Exams • web-based student performance systems • portfolios • long and short essays • posters • lab manuals
1.2	Know the classifications of thermodynamic systems		
1.3	Describe Joul and Joul-Thompson effects		
1.4	Familiar with systems and various dynamic processes.		
1.5	Identify the different thermodynamics functions		
1.6	Write thermal equations for various thermodynamic processes.		
1.7	Determine the relationship between chemical equilibrium and spontaneity.		
1.8	Memorize different laws of thermodynamics		
1.9	Outline the different uses of thermodynamics functions		
1.10	Define exothermic and exothermic reactions		
2.0	**Cognitive Skills**		
2.1	Apply the thermodynamic laws	• Lectures • Scientific discussion • Library visits • Web-based study	• Exams • web-based student performance systems • portfolios • posters
2.2	Compare between various thermodynamic systems		
2.3	Explain the conversion of heat to work		
2.4	Analyze the thermodynamic data		
2.5	Predict the spontaneity of the reactions		

2.6	Evaluate the efficiency of various heat engines		• individual and group presentations
3.0	**Interpersonal Skills & Responsibility**		
3.1 3.2	• Ability to work in a team to perform a specific experimental tasks. • Ability to work independently to handle chemicals • Ability to communicate results of work to classmate and participation in class or laboratory discussions	• Class discussions • Research activities	• Performance on in-practical exams. • Work on research activity. • Overall student performance in Lab. discussions • Cross questions after finishing laboratory work
4.0	**Communication, Information Technology, Numerical**		
4.1	Work effectively both in a team, and independently on solving chemistry problems.	• Scientific discussion • Library visits • Web-based study	• web-based student performance systems • Individual and group presentations.
4.2	Communicate effectively with his lecturer and colleagues		
4.3	Use IT and web search engines for collecting information**.**		
5.0	**Psychomotor**		
5.1 5.2	Laboratory practice . including 1.Locate Materials Safety Data Sheets, chemicals carcinogens list, and hazardous chemicals list. 2. Handle chemicals safely with a proper PPE 3.Dilute solutions, repeat analysis and calculate true result for all procedures performed as required. 4.Dispose the hazardous solution in right way	Practical session should include both demonstration and experiments .	1.Repetition of the experiments , to reproduce the results 2.Written report of chart and procedures. 3.The students should be able to correlate their results with experimental conditions

5. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment

1	Homework or activities.	--	10 %
2	Midterm Exam.	8	20 %
3	Practical Exam.	14	30 %
4	Final Exam.(2 hours exam)	16	40 %
5	**Total**	**100 %**	

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

- **We have faculty members to provide counseling and advice.**
- **Office hours: During the working hours weekly.**
- **Academic Advising for students.**

E. Learning Resources

1. List Required Textbooks

- B. S. Bahl, Advanced Physical Chemistry, S. Chand & Co., 1993, New Delhi, India.
- R. A. Alberty and R. J. Silbey, Physical Chemistry, 1992, John Wiley & Sons.
- J. P. Bromberg, Physical Chemistry, 1980, Allyn and Bacon.
- P. Atkins and J. de Paula, Physical Chemistry, 7 th ed., Oxford University press, New York, 2014.

2. List Essential References Materials (Journals, Reports, etc.)

- Lecture Hand outs available on the coordinator website

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

- Thermodynamics: an engineering approach, Yunus A. Cengel and Michael A. Boles, 7 th. SI ed., McGraw- Hill, London, 2011.

4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)

- **http://www.chemweb.com**
- **http://www.sciencedirect.com**
- **http://www.rsc.org**

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • **Classrooms and lab of capacity (30) students.** • **Providing hall of teaching aids including computers and projector.**

2. Computing resources (AV, data show, Smart Board, software, etc.) ▪ **Rooms equipped with computer and projector and TV.**
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) • **No other requirements.**

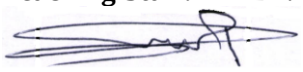
G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching Complete the questionnaire evaluation of the course in particular. **Assess the progress of the operation by the students using the evaluation forms or group discussion in order to reach weaknesses and processed.**
2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor • **Observations and the assistance of colleagues.** • **Independent evaluation for extent to achieve students the standards.** • **Iindependent advice of the duties and tasks.**
3 Processes for Improvement of Teaching • **Workshops for teaching methods.** • **Continuous training of member staff.** • **Review of strategies proposed.** • **Providing new tools for learning.** • **The application of e-learning.** • **Exchange of experiences internal and external.**
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) ▪ **Check marking of a sample of exam papers, or student work.** ▪ **Exchange corrected sample of assignments or exam basis with another staff**

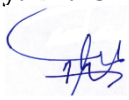
member for the same course in other faculty.

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • **Periodic Review of the contents of the syllabus and modify the negatives.** • **Consult other staff of the course.** • **Hosting a visiting staff to evaluate of the course.** • **Workshops for teachers of the course.**

Faculty or Teaching Staff: **Dr. Ahmed Fawzy**

Signature:  **Date Report Completed: 12/1/2019**

Received by: Dr. Ismail Althagafi **Department Head**

Signature:  **Date: 20/1/2019**