

Kingdom of Saudi Arabia

The National Commission for

Academic Accreditation & Assessment



Course Specifications

Thermodynamics

402241

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 /402241			
2. Credit hours: 3(2+1)			
3. Program(s) in which the course is offered. Chemistry program			
4. Name of faculty member responsible for the course: Professor Alaa El-Shafei			
5. Level/year at which this course is offered: 2nd level/1st year			
6. Pre-requisites for this course (if any): Volumetric Analytical Chemistry (402112)& Calculus (404101)			
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	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
b. Blend (traditional and online)	<input checked="" type="checkbox"/>	What percentage?	100%
c. e-learning	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
d. Correspondence	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
f. Other	<input type="checkbox"/>	What percentage?	<input type="checkbox"/>
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 mentioned to prepare an essay or a report from literature using the library, data base services, and/or websites to follow up and update the new topics of 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		
a. General introduction	1	2
b. Thermodynamic terms: Heat, energy and work (the mechanical equivalent of heat). Different types of systems	1	2
c. Thermodynamics variables and characteristics of intensive, extensive and thermodynamics processes.	1	2
d. Zero and first laws of thermodynamics and their applications	1	2
e. The relationship between enthalpy change and internal energy change, heat capacity	1	2
f. The Jules-Thompson's effect, Adiabatic and isothermal expansions, Determination of Joule's coefficient from heat capacity measurements.	1	2
g. Thermochemistry. Exothermic and endothermic reactions. Kirchhoff's law, Hess's law and its applications.	1	2
h. The second law of thermodynamics and its applications. Spontaneous and non spontaneous processes. Heat machines and thermal efficiency	1	2
i. Heat transfer to work. Carnot cycle (efficiency and compression ratio) Otto cycle.	1	2

j. Entropy. Gibbs free energy, work function, Gibbs and Gibbs – Helmholtz Equations.	1	2
k. Van't Hoff Equations, Chemical Equilibrium and spontaneity.	1	2
l. Third law of thermodynamics and its applications.	1	2
m. General revision	1	2
Practical Part		
• Instructions on rules and methods of safety at work and an 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 alkaline.	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 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

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory	Practical	Other:	Total
Contact Hours	26	-		36		62
Credit	2	-		1		3

3. Additional private study/learning hours expected for students per week.	<input type="text"/>
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4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy
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	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	Knowledge		
1.1	Recognize the intensive and extensive properties	<ul style="list-style-type: none"> • Lectures • Scientific discussion • Library visits • Web-based study 	<ul style="list-style-type: none"> • 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 Joule and Joule-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 endothermic reactions		
2.0	Cognitive Skills		
2.1	Apply the thermodynamic laws	<ul style="list-style-type: none"> • Lectures • Scientific discussion • Library visits • Web-based study 	<ul style="list-style-type: none"> • Exams • web-based student performance systems • portfolios • posters • demonstrations
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 engine		

3.0	Interpersonal Skills & Responsibility		
3.1	Manage resources, time and collaborate with members of the group.	<ul style="list-style-type: none">• Teamwork groups for cooperative work making.• Presenting the case study for each group to the other groups in class.• Open a general discussion with students in the area of educational issues for knowledge transfer between the students.	<ul style="list-style-type: none">• Writing group scientific report for a case study.• Assessment of the solution of problems submitted by the students.
3.2	Use university library and web search engines for collecting information and search about different topics.		
4.0	Communication, Information Technology, Numerical		
4.1	Work effectively both in a team, and independently on solving chemistry problems.	<ul style="list-style-type: none">• Write a Report• Use digital libraries and/or E-Learning Systems for the communication with lecturer through the course work	<ul style="list-style-type: none">• Evaluating the activities of the students through the semester for their activities on the E-learning system, as well as, their communication with each other in different tasks.• Evaluation of the report presented
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	NOT APPLICABLE		
5.2			

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	Exam	5-14	20%
2	Quizzes	To be assigned	5%

3	Project	14	5%
4	Practical Exam	15	30%
5	Final Exam	16	40%

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

- **الكيمياء الفيزيائية: J. Berro ترجمة أحمد محمد عزام وآخرون – مكتبة الانجلو المصرية 1982م**
- 2. B. S. Bahl, Advanced Physical Chemistry, S. Chand & Co., 1993, New Delhi, India.
- 3. R. A. Alberty and R. J. Silbey, Physical Chemistry, 1992, John Wiley & Sons.
- 4. J. P. Bromberg, Physical Chemistry, 1980, Allyn and Bacon.
- 5. 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 capacity (30) students.**
- **Providing hall of teaching aids including computers and projector.**

2. Computing resources (AV, data show, Smart Board, software, etc.)

- **Room 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.

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.**
- **Independent 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.

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Faculty or Teaching Staff: Professor Alaa El-Shafei

Signature:



Date Report Completed: 2017

Received by: Dr Hatem Altass Department Head

Signature: _____

Date: _____