ATTACHMENT 5.

Kingdom of Saudi Arabia

The National Commission for Academic Accreditation & Assessment

T6. Course Specifications

(CS)

Statistical Thermodynamics

(402641-3)

Course Specifications

Institution: **Umm Al-Qura University**	Date: **2017**
College/Department: **Faculty of Applied Sciences / Chemistry Department**	

A. Course Identification and General Information

1. Course title and code: **Statistical Thermodynamics / 402641-3**
2. Credit hours: **3 (theoretical)**
3. Program(s) in which the course is offered: **M. Sc. in Chemistry** (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course: **Prof. Alaa El-Shafei**
5. Level/year at which this course is offered: **1st / 1st**
6. Pre-requisites for this course (if any): **not applicable**
7. Co-requisites for this course (if any): **not applicable**
8. Location if not on main campus: **El-Abedyah, El-Azizya, and El-Zaher**
9. Mode of Instruction (mark all that apply)

a. traditional classroom	☐	What percentage?	☐
b. blended (traditional and online)	■	What percentage?	100
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 students will be familiar with: a. Application of basic concepts of statistical thermodynamics. b. Derivation of partition functions for simple and complicated systems. c. Application of the various statistical distribution functions on systems. d. Knowledge of thermodynamical concepts and the application on a broad variety of thermodynamical systems.
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) • Changes in content as a result of new research in the field. • The use of smart teaching halls for lectures. • Increased use of IT or web based reference material. • Encourage students to carry out research reports in the advance statistical thermodynamics subjects using the library, data base services, and/or websites.

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
• Introduction.	**1**	**3**
• Different types of ensembles, ensemble averaging, distribution law (Boltzmann statistics	**2**	**6**

• Partition function and thermodynamic parameters; relation between molecular and molar partition functions, translational partition function.	**2**	**6**
• Rotational partition function for linear and non-linear molecules; vibrational partition function, electronic partition function.	**2**	**6**
• Midterm exam	**1**	
• Reference state of zero energy for evaluating partition function, equilibrium constant in terms of partition function.	**2**	**6**
• Application of statistical thermodynamics: equipartition theorem, heat capacity, behaviour of crystals.	**2**	**6**
• Introduction to quantum statistics: Distribution law for fermions (Fermi-Dirac statistics) and for bosons (Bose-Einstein statistics).	**2**	**6**
• Revision	**1**	**3**

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	**39**	-		-		**39**
Credit	**3**	-		-		**3**

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

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

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning

domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Demonstrate a systematic understanding of fundamental statistical thermodynamics principles.	• Use of the internet to carry out some reports on course subjects. • Lectures • Scientific discussion • Use the library to work duties and a small research on physical chemistry.	• Long and short essays. • Written mid-term and final exams.
1.2	Memorize the different types of ensembles		
1.3	Define the Boltsmann distribution and the role of the partition function.		
1.4	Clarify how the Fermi-Dirac and Bose-Einstein distributions differ.		
2.0	**Cognitive Skills**		
2.1	Discuss of essential facts, concepts, principles and theories relating to Statistical Thermodynamics	• Web-based study. • Lectures. • Scientific discussion • Library visits.	• Measuring the response to the assignments. • Periodic tests and assignments.
2.2	Apply the Fermi-Dirac and Bose-Einstein statistics to calculate thermal properties.		
2.3	Evaluate and interpret of chemical information and data		
2.4	Analyze problems and design plan strategies for their solution		
2.5	Use computational methodology and models skills based on practical applications of		

	theories		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Develop the student's ability in self-reliance and responsibility.	• Periodic individual duties to develop the skill of taking responsibility and self-reliance. • Dividing students into groups to carry out collective scientific reports.	• Assessment of individual tasks and duties to determine the student's ability to self-reliance. • Evaluate the results of collective works and duties as well as knowing the contribution of each individual through dialogue and discussion.
3.2	Choose the suitable method to solve problems..		
3.3	Operate in team work and accept his college's opinions.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Communicate effectively in oral and written forms.	• The use of computers in the training room of the department. • Using the internet for collecting data. • Visiting research centers.	• Web-based student performance systems. • Individual and group presentations. • Evaluation of the duties associated with the proper
4.2	Use basic mathematical and statistical techniques to perform data analysis.		
4.3	Use computers and the international information network (the Internet) to perform calculations and to identify recent research relevant to decision sources.		

			use of numerical and communication skills.
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	Assignments and activities.	--	10 %
2	Midterm Exam.	8	30 %
3	Final Exam.	15-16	60 %
4	**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)

- Availability of Staff members to provide counselling and advice.
- Office hours: During the working hours weekly.
- Academic advising for students.

E. Learning Resources

1. List Required Textbooks

- P. W. Atkins & J. de Paula. Physical Chemistry (8th edn.), OUP, 2006.
- D. A. Mc Quarrie. Statistical Mechanics, Viva Books Pvt. Ltd., New Delhi, 2003
- L.K. Nash . Statistical Thermodynamics, Addison-wesley, 1968.

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) • M. Schäfer, U. Hollenstein, and F. Merkt. Advance Physical Chemistry. Statistical Thermodynamics. Autumn Semester 2012. Zürich: ETH Zürich. • A. Maczek. Statistical Thermodynamics. First. Oxford: Oxford University Press, 1998.
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc . • K. K. Irikura. Essential Statistical Thermodynamics. http://cccbdb.nist.gov/ thermo.asp. • 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. **Non.**

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.) • Equipped lecture hall.
2. Computing resources (AV, data show, Smart Board, software, etc.) • Room equipped with computers, data show 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 • Questionnaires can be used to collect student feedback.

• Student representation on staff-student committees and institutional bodies. • Structured group discussions and/or focus groups.
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Visits by other faculty can provide information about the process of teaching. • Colleagues have the expertise to evaluate the quality of a course as evidenced by its content and format (peer reviewers). • The instructor's statement of his/her goals for the course, teaching methods and philosophy, student outcomes, and plans for improvement are a critical source of information. • A systematic self-review has the potential for contributing significantly to the instructor's teaching improvement by focusing on the strengths and weaknesses of the course in light of his/her original course objectives.
3. Processes for Improvement of Teaching • The application of e-learning. • Exchange of experiences internal and external. • Training programs and workshops for Staff member. • Review of strategies proposed. • Providing new tools for learning.
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) • Periodic exchange and remarking of tests or a sample of assignments with staff at another institution. • Check marking by an independent member teaching staff of a sample of student work.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • Consult other staff of the course. • Hosting a visiting staff to evaluate of the course. • Workshops for teachers of the course.

- Periodic review of the contents of the syllabus and modify the negatives.

Name of Instructor: **Prof. Alaa El-Shafei**

Signature:_____Date Report Completed: **2017**

Name of Field Experience Teaching Staff _____

Program Coordinator:_____

Signature: _____ Date Received:_____