COURSE SPECIFICATIONS

Form

Course Title: **Statistical Thermodynamics**.

Course Code: **4026812-3**

Date: 22-10-2018	**Institution:** **Umm Al-Qura University**.
College: **Faculty of Applied Science**	**Department:** **Department of Chemistry**

A. Course Identification and General Information

1. Course title and code: **Statistical Thermodynamics / 4026812-3**
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. **Dr. Ahmad Fawzy**
5. Level/year at which this course is offered: **1st / 1st**
6. Pre-requisites for this course (if any):--
7. Co-requisites for this course (if any):--
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		percentage?	
b. Blended (traditional and online)	■	percentage?	90
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other	■	percentage?	10

Comments:

B Objectives

1. The main objective of 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 ofthermodynamical systems.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

- Updating the course content with the techniques that will be recently introduced 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 subjects using the library, data base services, and/or websites.

C. Course Description (Note: General description in the form used in the program's 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 and credit hours per semester):							
		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	39	-	-	-	-	39
	Actual	39	-	-	-	-	39
Credit	Planned	3	-	-	-	-	3
	Actual	3	-	-	-	-	3

3. Individualstudy/learning hours expected for students per week.

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

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

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 • Discussion groups • Seminar • In class problems	• Written assignments • Presentations • Formal 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	• Web-based study.	• Measuring the

	thermodynamics	• Lectures. • Scientific discussion • Library visits.	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	Manage resources, time and collaborate with members of the group	• Teamwork groups for cooperative work making. • Solving problems in groups during lecture. • Open discussion about recent topic of the course	• Oral presentations • Group discussion • Reports
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.	• Use digital libraries for literature survey • Use E-Learning Systems for the communication with lecturer through the course work	• Web-based student performance systems. • Individual and group presentations. • Evaluating the activities of the students through the semester .
4.2	Communicate effectively with his lecturer and colleagues		
4.3	Use information and communication technologies		
5.0	**Psychomotor(if any)**		
5.1	Not applicable		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, 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 counseling. (include the time teaching staff are expected to be available per week)

- Availability of Staff members to provide counselling and advice.
- Office hours: During the working hoursweekly.
- Academic advisingforstudents.

E Learning Resources

1. List Required Textbooks

- P. W. Atkins & J. de Paula. Physical Chemistry (8thedn.), OUP, 2006.
- D. A. McQuarrie. Statistical Mechanics, Viva Books Pvt. Ltd., New Delhi, 2003
- John W. Daily. Statistical Thermodynamics, Cambridge University Press, 2018.

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

- Lecture hand outs available on the coordinator website.

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

- http//:en.wikipedia.org/wiki/
- http//:www.chemweb.com/
- Websites on the internet relevant to the topics of the course

4. 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.)

- Appropriate teaching class including white board and data show with at least 25 seats.

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

- Computer halls access for the students will be helpful in doing their tasks during the course.

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

- Noother requirements.

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

- Student discussion with the instructor allow for continuous feedback through the course progress.
- Student Evaluation Questionnaires.

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

- Discussions within the group of faculty teaching the course.
- Peer consultation on teaching strategies and its effectiveness.

3. Procedures for Teaching Development

- Workshops given by experts on new teaching and learning methodologies will be attended.
- Improving of the teaching strategies by monitoring the evaluation of the students progress through the semester

4. **Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)**

- Peer reviewing of random samples including periodic and final exams of the students will be done.

5. **Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.**

- The course will be evaluated periodically after each semester based on the results of the students and the report presented by the teaching stuff that will be discussed with the course coordinator to improve the course.

Name of Course Instructor: **Dr. Ahmad Fawzy**

Signature:  **Date Completed: 22 – 10 - 2018**

Program Coordinator: **Dr. Ismail Ibrahim Althagafi**

Signature:  **Date Received: 23/10/2018**