COURSE SPECIFICATIONS
(CS)

Statistical Physics

PHYS 342

June 2018

Course Specifications

Institution	King Saud University	Date: 27/3/2017
College/Department college of Science – Department of Physics and Astronomy		

A. Course Identification and General Information

1. Course title and code: Statistical Physics - **PHYS 342**
2. Credit hours 3(3+0+0)
3. Program(s) in which the course is offered. Physics (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
5. Level/year at which this course is offered: Sixth Level
6. Pre-requisites for this course (if any) PHYS 241
7. Co-requisites for this course (if any)
8. Location if not on main campus

9. Mode of Instruction (mark all that apply)

a. traditional classroom	X	What percentage?	100
b. blended (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?

- The student should review the basic concepts of classical thermodynamics Make the connections between classical equilibrium thermodynamics and the basic statistical mechanics
- Should learn the basic techniques in statistical mechanics and the different types of ensembles applicable to physical systems
- Should gain the ability to apply the different ensembles to simple systems such as ideal gases and investigate the different properties of the system such as the specific heat capacity
- Should get acquainted with statistical description of systems that contains large number of particles

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)

1. Lecture notes.
2. Use of IT by incorporating applets to demonstrate physics concepts.
3. Use of power point and both online and book references.
4. The material should be available on the instructor webpage.

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

Course Description:

Equipartition of energy: equipartition theorem, Brownian motion.
The partition function: Its expression, the function of state, combining partition functions.
Statistical mechanics of ideal gases: Density of states, quantum concentration, distinguishability, functions of states of ideal gases, Gibbs paradox, heat capacity of a diatomic gas.
Chemical potential: definition, grand partition function, relation to Gibbs function, particle number conservation.
Photons: radiation pressure, statistical mechanics of a gas of photons, Black body distribution.
Phonons: the Einstein model, the Debye model.
Overview of: real gases, phase transitions, Bose-Einstein and Fermi-Dirac distributions, and quantum gases.

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
Equipartition of energy: equipartition theorem, Brownian motion. The partition function: Its expression, the function of state, combining partition functions.	**3**	**9**
Statistical mechanics of ideal gases: Density of states, quantum concentration, distinguishability, functions of states of ideal gases, Gibbs paradox, heat capacity of a diatomic gas.	**3**	**9**
Chemical potential: definition, grand partition function, relation to Gibbs function, particle number conservation.	**3**	**9**
Photons: radiation pressure, statistical mechanics of a gas of photons, Black body distribution. **Phonons: the Einstein model, the Debye model.**	**3**	**9**
Overview of: real gases, phase transitions, Bose-Einstein and Fermi-Dirac distributions, and quantum gases.	**3**	**9**

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	45					45
Credit	45					45

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

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	To outline the main concepts of statistical mechanics	Lecture, Smart Board	Exams and homework
1.2	To recognize the importance of statistical mechanics in describing physical phenomena	Lecture, Smart Board	Exams and homework
2.0	**Cognitive Skills**		
2.1	Calculate the relevant properties of physical systems using the methods of statistical mechanics	Lecture, Discussion	Discussion
2.2			
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate mastery of the techniques used in statistical mechanics	Group discussion, Inverted class	Presentation / discussion
3.2			
4.0	**Communication, Information Technology, Numerical**		
4.1	Illustrate how to solve problems in statistical mechanics	Presentation	Group presentations
4.2			
5.0	**Psychomotor**		
5.1			
5.2			

6. 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 /Presentation	Weekly homework	20%
2	Midterm2	2 midterms: week 6 and week 12.	40%
3	Final	Final Exam Period.	40%
4			

5			
6			
7			
8			

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)

E Learning Resources

1. List Required Textbooks Concepts in Thermal Physics by S. J Blundell and K M Blundell, Second Edition, Oxford University Press, 2009 Introduction to Statistical Mechanics, J. Walecka, World Scientific Publishing Company, 2011
2. List Essential References Materials (Journals, Reports, etc.) Reif F. (1985): Fundamentals of Statistical and Thermal Physics, Mc Graw-Hill, Int. Edition, Physics Series, USA. Statistical Physics, by: F. Mandl Publisher: John Wiley & Sons. W. Rosser, An Introduction to Statistical Mechanics (2nd edition.), 1985, John Wiley and Sons
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc. There are huge number of web sites that provide so much information and of great interest for thermodynamics.There are also a number of more websites that we alternate, as some are upgraded others deleted.
5. Other learning material such as computer-based programs/CD, professional standards or

regulations and software. software. There are so many computer programs that can be used for Statistical Mechanics calculations such as Mathematica, Maple, Matlab,…etc.

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.) C classroom -with a projector.
2. Computing resources (AV, data show, Smart Board, software, etc.) Smart board and data show
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching Termly Questionnaires
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department Assessment Techniques as described above, as well as meeting with students during office hours for any concerns and discussing with level leaders any issues
3 Processes for Improvement of Teaching By writing a course report each term and setting targets.
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) Suggestions: Provide Samples of all kind of assessment in the departmental course portfolio of each course Assigning a group of faculty members marking some homework samples Setting standardized exams: approved by internal and external faculty members specialized in the specific field.

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. There are not yet any fixed arrangements.

Name of Instructor: _____

Signature: _____ Date Report Completed: _____

Name of Field Experience Teaching Staff _____

Program Coordinator:_____

Signature: _____ Date Received: _____