



# **COURSE SPECIFICATIONS (CS)**

Atomic and Molecular Spectroscopy

**PHYS 456**

**June 2018**



## Course Specifications

Institution: <a href="#">King Saud University</a>	Date: 2018
College/Department: <a href="#">College of Science, Physics &amp; Astronomy Department</a>	

### A. Course Identification and General Information

1. Course title and code: <a href="#">Atomic and Molecular Spectroscopy (PHYS 456)</a>			
2. Credit hours: <a href="#">2(2+0+0)</a>			
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) <a href="#">Physics and other science and engineering programs</a>			
4. Name of faculty member responsible for the course <a href="#">Dr.</a>			
5. Level/year at which this course is offered: <a href="#">Eighth level</a>			
6. Pre-requisites for this course (if any): <a href="#">Modern physics (PHYS 353)</a>			
7. Co-requisites for this course (if any):			
8. Location if not on main campus <a href="#">1. Main campus in Diriyah, College of Science, Department of Physics &amp; Astronomy</a>			
9. Mode of Instruction (mark all that apply)			
a. traditional classroom	<input checked="" type="checkbox"/>	What percentage?	<input type="text" value="80%"/>
b. blended (traditional and online)	<input checked="" type="checkbox"/>	What percentage?	<input type="text" value="20%"/>
c. e-learning	<input type="checkbox"/>	What percentage?	<input type="text"/>
d. correspondence	<input type="checkbox"/>	What percentage?	<input type="text"/>
f. other	<input type="checkbox"/>	What percentage?	<input type="text"/>
Comments:			

## B Objectives

<p>1. What is the main purpose for this course?</p> <p>a) Introducing the laws and rules concepts that controls the atomic and molecular spectroscopy.</p> <p>b) Getting the basic knowledge about the Electronic, vibrational, and rotational energy levels.</p> <p>c) Getting acquainted with the spectroscopic techniques.</p>
<p>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)</p> <ul style="list-style-type: none"> <li>Assigning extra hours for solving selected problems that are of particular interest.</li> <li>The course material is discussed during tutorials</li> <li>Using the internet resources to access particular advanced topics</li> </ul>

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

<p>Course Description:</p> <p>Spin –Orbit Interaction in H-atom, Pauli Exclusion Principle. Electron configuration in many electron atoms, Atoms with a valance electron, Atoms with two valance electrons (<math>ll</math> coupling, <math>ss</math> coupling, <math>LS</math> coupling and <math>jj</math> coupling), Hand's Rule. The interaction of many-electron atoms with magnetic fields, Zeeman Effect, Pachen-Bach Effect, Stark Effect. Molecular Structure, Electronic, vibrational and rotational energy levels of a diatomic molecule. Spectroscopic techniques: Optical spectroscopy , IR spectroscopy, Raman spectroscopy, Magnetic Resonance , Excitation Sources, and data acquisition systems.</p>
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1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
Spin –Orbit Interaction in H-atom	1	2
Pauli Exclusion Principle, Electron configuration in many electron atoms	2	4
Atoms with a valance electron	1	2
Atoms with two valance electrons ( $ll$ coupling, $ss$ coupling, $LS$ coupling and $jj$ coupling)	2	4
Hand's Rule	1	2
The interaction of many-electron atoms with magnetic field	1	2
Zeeman Effect, Pachen-Bach Effect, Stark Effect	2	4
Molecular Structure	1	2
Electronic, vibrational and rotational energy levels of a diatomic molecule	2	4
Spectroscopic techniques: Optical spectroscopy , IR spectroscopy, Raman spectroscopy, Magnetic Resonance , Excitation Sources, and data acquisition systems.	2	4

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory	Practical	Other:	Total

			or Studio			
Contact Hours	30					30
Credit	30					30

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

2hours

#### 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	<b>Knowledge</b>		
	<ul style="list-style-type: none"> <li>- To recognise comprehensive Knowledge of molecular and atomic spectroscopy</li> <li>- Defining some rules and laws that control the molecular and atomic spectroscopy</li> <li>- To outline the basic knowledge about the Electronic, vibrational, and rotational energy levels.</li> <li>- To recognize the spectroscopic techniques.</li> </ul>	<ul style="list-style-type: none"> <li>- Lecturers and debates</li> <li>- Homework assignments</li> <li>- Lab demonstrations</li> <li>- small group work</li> </ul>	<ul style="list-style-type: none"> <li>- Exams</li> <li>-peer evaluations</li> <li>- analytical reports</li> <li>-long and short essays</li> <li>- group reports</li> </ul>
2.0	<b>Cognitive Skills</b>		
	<ul style="list-style-type: none"> <li>- To explain the daily life applications of the studied topics.</li> <li>- To explain the most famous and useful instruments build on the studied topics.</li> <li>- To recognize how technology is built from simple to advanced present states</li> <li>- To summarize some interesting experiments and applications in the field of the studied course.</li> </ul>	<ul style="list-style-type: none"> <li>- whole group and small group discussions</li> <li>- Case studies</li> <li>- individual presentation</li> <li>- brainstorming</li> </ul>	<ul style="list-style-type: none"> <li>-portfolios</li> <li>-discussion forums</li> <li>-interviews</li> <li>-debates</li> </ul>
3.0	<b>Interpersonal Skills &amp; Responsibility</b>		
	<ul style="list-style-type: none"> <li>- writing reports</li> <li>- To modify the English language</li> <li>- To demonstrate solving problems</li> <li>- To illustrate Searching on the internet</li> </ul>	<ul style="list-style-type: none"> <li>-Guest speakers</li> <li>-whole group and small group discussions</li> <li>- research activities</li> </ul>	<ul style="list-style-type: none"> <li>-Individual and group presentations</li> <li>-speeches</li> <li>- posters</li> </ul>

	- choosing the material of the course	-projects	-case studies
<b>4.0</b>	<b>Communication, Information Technology, Numerical</b>		
	- To illustrate how to Communicate with others: the lecturer – students in the class - To interpret Information Technology through the Internet and to assess the computer skills - To evaluate the Numerical skills through: solving problems- computation – data analysis – feeling physical reality of results.	- memorization - projects - whole group and small group discussions - brainstorming	- log books - analytical reports - graphic organizers - graphs and tables - group presentations
<b>5.0</b>	<b>Psychomotor</b>		
	Not applicable	Not applicable	Not applicable

#### 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	First Mid-term exam		15%
2	Second Mid-term exam		15%
3	Home works, assignments, and experimental		30%
4	Final Exam		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)

- Office hours 3 hr/ week

#### E Learning Resources

##### 1. List Required Textbooks

1- Physics of Atomic and Molecules, B.H. Bransden and C.J. Joachain, Prentice Hall, 2<sup>nd</sup> edition, 2003.

2-The Fundamentals of Atomic and Molecular Physics, Robert L Brooks, Springer; 2013 edition

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

1- Physics of Atomic and Molecules, B.H. Bransden and C.J. Joachain, Prentice Hall, 2<sup>nd</sup> edition,

2003. 2-The Fundamentals of Atomic and Molecular Physics, <a href="#">Robert L Brooks, Springer; 2013 edition</a>
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc) 1- Physics of Atomic and Molecules, B.H. Bransden and C.J. Joachain, Prentice Hall, 2 <sup>nd</sup> edition, 2003. 2-The Fundamentals of Atomic and Molecular Physics, <a href="#">Robert L Brooks, Springer; 2013 edition</a>
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc. <a href="#">Websites on the internet that are relevant to the course topics</a>
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software. <a href="#">Multimedia associated with the text book and the relevant websites</a>

#### 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.) <ul style="list-style-type: none"> <li>• <a href="#">Lecture room with at least 25 seats</a></li> </ul>
2. Computing resources (AV, data show, Smart Board, software, etc.) <ul style="list-style-type: none"> <li>• <a href="#">Computer room containing at least 15 systems</a></li> </ul>
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) <ul style="list-style-type: none"> <li>• <a href="#">Availability of demonstrative materials relevant to the course material</a></li> <li>• <a href="#">Safety facilities</a></li> </ul>

#### G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching <ul style="list-style-type: none"> <li>• <a href="#">Course evaluation by student</a></li> <li>• <a href="#">Students- faculty meetings</a></li> </ul>
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department <ul style="list-style-type: none"> <li>• <a href="#">Peer consultation on teaching</a></li> <li>• <a href="#">Departmental council discussions</a></li> <li>• <a href="#">Discussions within the group of faculty teaching the course</a></li> </ul>
3 Processes for Improvement of Teaching <ul style="list-style-type: none"> <li>• <a href="#">Conducting workshops given by experts on the teaching and learning Methodologies.</a></li> <li>• <a href="#">Periodical departmental revisions of its methods of teaching.</a></li> <li>• <a href="#">Monitoring of teaching activates by senior faculty members.</a></li> </ul>
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) <ul style="list-style-type: none"> <li>• <a href="#">Providing samples of all kinds of assessments in the departmental course portfolio of each course</a></li> </ul>

- Assigning group of faculty members teaching the same course to grade the same questions for various students.

5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- The course material and learning outcomes are periodically reviewed and the changes to be taken are approved in the departmental and higher councils.
- The head of department and faculty take the responsibility of implementing the proposed changes in the course materials.

Name of Instructor: \_\_\_\_\_

Signature: \_\_\_\_\_ Date Report Completed: \_\_\_\_\_

Name of Field Experience Teaching Staff \_\_\_\_\_

Program Coordinator: \_\_\_\_\_

Signature: \_\_\_\_\_ Date Received: \_\_\_\_\_