هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	Atomic and Molecular Spectroscopy
Course Code:	PHYS 456
Program:	B.Sc. in Physics
Department:	Department of Physics and astronomy
College:	College of Science
Institution:	King Saud University
Version:	2.0.0
Last Revision Date:	Sep 2023

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	2(2+0+0)				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☐	Elective☒			
3. Level/year at which this course is offered:	Eighth level / fourth year.				
4. Course general Description The course aims to introduce students to 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 (ℓℓ coupling, ss coupling, LS coupling and jj coupling), Hand'sRule. 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.					
5. Pre-requirements for this course (if any): PHYS 353					
6. Co- requirements for this course (if any):					
7. Course Main Objective(s) 1. Introducing the laws and rules concepts that controls the atomic and molecular spectroscopy. 2. Getting the basic knowledge about the Electronic, vibrational, and rotational energy levels. 3. Getting acquainted with the spectroscopic techniques.					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	27	90%
2.	E-learning	0	0
3.	Hybrid • Traditional classroom • E-learning	3	5%
4.	Distance learning	0	0

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	30
2.	Laboratory/Studio	0
3.	Field	0
4.	Tutorial	0
5.	Others (specify)	0
	Total	30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	recognize comprehensive Knowledge of molecular and atomic spectroscopy	K1	• Give extensive examples during lecture. • Give problem sheets to be discussed during lecture..	• Hold Class discussion, tutorial sessions. • Give quizzes, mid-term exam and final exam.
1.2	outline the basic knowledge about the Electronic, vibrational, and rotational energy levels.	K2		
2.0	Skills			
2.1	explain the daily life applications of the studied topics.	S1	• Give extensive examples during lecture • Give problem sheets to be discussed during lecture and labs. • assignments. • Discussions in the classes	• Hold Class discussion, tutorial and lab sessions. • Give quizzes, mid-term exam and final exam.
2.2	recognize how technology is built from simple to advanced present states	S2		
2.3	summarize some interesting experiments and applications in the field of the studied course.	S3		
3.0	Values, autonomy, and responsibility			
3.1	Write scientific reports on different	V1	• assignments. • Homework	Hold Class discussion

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	spectroscopic techniques			

C. Course Content

No	List of Topics	Contact Hours
1.	Spin –Orbit Interaction in H-atom	2
2.	Pauli Exclusion Principle, Electron configuration in many electron atoms	4
3.	Atoms with a valance electron	2
4.	Atoms with two valance electrons ($\ell\ell$ coupling, ss coupling, LS coupling and jj coupling)	4
5.	Hand's Rule	2
6.	The interaction of many-electron atoms with magnetic field	2
7	Zeeman Effect, Pachen-Bach Effect, Stark Effect	4
8.	Molecular Structure	2
9.	Electronic, vibrational and rotational energy levels of a diatomic molecule	4
10.	Spectroscopic techniques: Optical spectroscopy , IR spectroscopy, Raman spectroscopy, Magnetic Resonance , Excitation Sources, and data acquisition systems.	4
Total		

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First Midterm examination	Approx. 6	15%
2.	Second Midterm examination	Approx. 12	15%
3.	Home works and assignments	Weekly	30%
4.	Final examination	From 16 to 18	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Physics of Atomic and Molecules, B.H. Bransden and C.J. Joachain, Prentice Hall, 2nd edition, 2003.
Supportive References	Elementary modern physics, A. P. Arya, Publisher, Addison-Wesley, 1975.

	The Fundamentals of Atomic and Molecular Physics, Robert L Brooks, Springer; 2013 edition
Electronic Materials	Websites on the internet that are relevant to the course topics
Other Learning Materials	Multimedia associated with the text book and the relevant websites

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	A classroom which accommodates 25 students.
Technology equipment (projector, smart board, software)	Whiteboard and Smart board
Other equipment (depending on the nature of the specialty)	Computer room containing at least 15 systems Some Open source application for simulations

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students\ Peer Reviewer	Indirect \ direct
Effectiveness of students assessment	Students- Faculty	Direct
Quality of learning resources	students	Indirect
The extent to which CLOs have been achieved	Faculty	Indirect
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	Physics Department's council
REFERENCE NO.	9th (1st term/1445)
DATE	16/06/1445