COURSE SPECIFICATIONS
(CS)

Quantum Mechanics

PHYS 452

June 2018

Course Specifications

Institution: King Saud University	Date: 12/2017
College/Department: Science/Physics and Astronomy	

A. Course Identification and General Information

1. Course title and code:Quantum Mechanics – PHYS 452
2. Credit hours: 3(3+0+0)
3. Program(s) in which the course is offered:B.Sc. in Physics (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course: Dr. Maien Yahya Binjonaid
5. Level/year at which this course is offered: Level 7
6. Pre-requisites for this course (if any): PHYS 353
7. Co-requisites for this course (if any): None
8. Location if not on main campus: NA

9. Mode of Instruction (mark all that apply)

a. traditional classroom	*	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?

1. To familiarize the student with the concept of the wavefunction in Quantum Mechanics and its statistical interpretation.
2. The student should understand the concept of quantum operator and the Uncertainty Principle.
3. The student should learn the Time-dependent and –independent Schrodinger equation.
4. The student should understand the formal aspects of quantum mechanics including Dirac notation.
5. The student should how quantum mechanics describes the physical world in three dimensions, including the Hydrogen atom

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).

The content of the course will be made available via Blackboard.

Using computational packages such as Mathematica and Matlabin solving some known problems in quantum mechanics

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

Course Description:
The wave function, The statistical interpretation of the wavefunction, operators, expectation values, the uncertainty principle. Time-dependent Schrodinger equation. Time-independent Schrodinger equation, binding potentials, free potentials, the quantum harmonic oscillator. Hilbert space, Eigenvalue problems, Dirac notation. Quantum mechanics in three dimensions, Hydrogen atom, spin and angular momentum.

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
The wavefunction and its statistical interpretation	1	3
Operators, expectation values, and the uncertainty principle	2	6
Time Dependent Schrodinger equation and stationary solutions.	1	3
Time Independent Schrodinger equation and binding potentials	3	6
Time Independent Schrodinger equation and free potentials	3	9
The quantum harmonic oscillator	1	3
Hilbert Space, Eigenvalue problem, Hermitian operators, and Dirac notation	2	6
Schrodinger equation in three dimensions and the Hydrogen atom	2	6

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 postulates of quantum mechanics	Lecture, Smart Board	Exams and homework
1.2	Recognize the differences between quantum mechanics and classical mechanics	Lecture, Smart Board	Exams and homework
2.0	**Cognitive Skills**		
2.1	Explain the statistical interpretation of the wavefunction	Lecture, Discussion	Discussion
2.2	Analyze quantum mechanical systems using the Schrodinger equation	Lecture, Discussion	Discussion
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate ability to handle calculations of quantum mechanical properties	Role playing / inverted class	Presentation / discussion
3.2			
4.0	**Communication, Information Technology, Numerical**		
4.1	Illustrate the way quantum mechanics predicts the statistical outcome of measuring dynamical quantities	Group presentation	Presentation
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	Midterm 1	5	15%
2	Midterm 2	11	15%
3	Quiz	Throughout	10%
4	Homework	Throughout	10%
5	In-class discussion	Throughout	10%
6	Final	End of	40%

		term	
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) 2 hours per week of office hours

E Learning Resources

1. List Required Textbooks Introduction to Quantum Mechanics, David Griffiths, Second Edition, 2016, Cambridge University Press Quantum Mechanics Concepts and Applications, NouredineZettilli, Second Edition, 2009, Wiley
2. List Essential References Materials (Journals, Reports, etc.) Quantum Mechanics, R. Shankar, Second Edition, 2011, Plenum Press
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

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.) Lecture hall for 30 students
2. Computing resources (AV, data show, Smart Board, software, etc.) Smart Board
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 Feedback to be taken at the end of each class
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department Peer consultation

3 Processes for Improvement of Teaching Developing teaching based on regular feedback and peer consultation
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) Double-checking by independent peers
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. Creating a table for the course to ensure that the goals are achieved, and taking into account feedback and peer consultation

Name of Instructor: _____

Signature:_____Date Report Completed:_____

Name of Field Experience Teaching Staff _____

Program Coordinator:_____

Signature: _____ Date Received:_____