Al-Azhar University (Girls branch)
Faculty of science
Department of physics

جامعة الأزهر (فرع البنات)
كلية العلوم
قسم الفيزياء

Course Specification

Course title: Quantum mechanics **Code:** ph.303

Program on which the course is given: B.Sc. in special physics

Major or minor element of program: Single [√] [ ]

Department offering the program: department of physics

Department offering the course: department of physics

Academic year: [2015] **Level** [**3rd**] year

Date of specification approval: 1/2016

A- Basic information

Academic year: 3rd year	**Course Title:** Quantum mechanics	**Code:** ph303
Taught hours: Lecture 4 hr/wk **Practical 0** hr/wk		**Specialty:**

B- Professional Information

1- Overall aims of course	1.1. Produce graduates have practical, analytical and problem solving skills, which make them qualified for suitable jobs in the field of industry, teaching, research, professions and public service. 1.2. Ensure that students can manage their own learning and study a topic independently with the aid of appropriate sources.

2- Intended learning outcomes of course (ILOs)

2.1. Knowledge and Understanding	**By the end of the course, students should be able to:** a.1. Know the concept and theories of quantum physics and quantum mechanics. a.2. Describe the idea of wave packet and the uncertainty relations, observables and operators, the time independent Schrodinger equation and its applications
2.2. Intellectual Skills	**By the end of the course, students should be able to:** b.1. Select optimum solutions for physical problems based on analytical thinking. b.2. Consider a mathematical description of a physical system to investigate its behavior and properties
2.3. Professional and Practical Skills	**By the end of the course, students should be able to:** c.1. Apply mathematical tools and techniques to analyze and interpret physical phenomena c.2. Use modern scientific techniques
2.4. General and Transferable Skills	**By the end of the course, students should be able to:** d.1. Think independently, set tasks and solve problem on scientific basis. d.2. Apply scientific models, systems and tools effectively.

3. Contents

Topic	No. hours	Lecture (hours)	tutorial
3.1. The limits of classical mechanics. + problems	**2**	**2**	
3.2. Wave packets and the uncertainty relations. + problems	**4**	**4**	--
3.3. probability, statistical interpretation and normalization	**2**	**2**	-
3.4. The Schrodinger equation, operators, eigen states and eigen values. + problems	**4** **2**	**4** **2**	
3.5. Stationary states and momentum space.			
3.6. Solutions of one dimensional potentials:	**8**	**8**	
Step potential, finite potential barrier, infinite and finite square well, and the Delta function potential. + problems	**10**	**10**	
3.7. The linear harmonic oscillator, polynomial and operator method. + problems	**6**	**6**	
3.8. The Schrodinger equation in three dimensions. The angular momentum operators. Eigenvalues and normalized eigenfunctions of the angular momentum operator	**6**	**6**	
3.9. Hydrogenic atoms and the parity operator.	**4**	**4**	

4. Teaching and learning methods

4.1. Lectures and discussions 4.2. Solved problems and homework problems.

5- Student assessment

5.1. Methods	5.1.1. Written exam	To assess: Knowledge and Understanding and the other Skills
	5.1.2. Oral exam	-To assess: Knowledge and Understanding - Intellectual Skills
	5.1.3. Practical exam	To assess: Professional and Practical Skills
5.2. Assessment schedule	Assessment 1:	Week:
	Assessment 2:	Week:
	Assessment 3:	Week:
5.3. Weighting of assessments	Semester Work 14 %	
	Oral Examination 6 %	
	Practical Examination - %	
	Final Examination 80 %	
	Other Type of assessments%	
	Total %	

6- List of references

6.1. Course Note (if available)	----------
6.2. Recommended Book	1- Advances in Quantum Mechanics , Paul Bracken , InTech ,2013 2- Quantum Mechanics, Charles G. Torre , Utah State University, 2007 3- D. Griffiths, Introduction to quantum mechanics, Prentice- Hall, Engelwood cliffs, N.J.,1995. 4- Modern Physics and quantum mechanics, E. Anderson, The Macmillan comp. of India, 1979
6.4. Periodical journals,….. etc.	

7- Facilities required for teaching and learning:

Audiovisual aids (data show) in all lecture halls

Course coordinator

Name: 1- Prof. dr. Nashwa Hassan sheta **Signature_____ Date __/__/_____**

2- assist. Prof**.** Dr Sahar Abd Elghany **Signature_____ Date __/__/_____**

Head of Physics Department Prof .dr Azza Abdel Raouf

Signature_____ Date __/__/_____

Course ILO's Versus program ILO'S									
Course ILO's		**Knowledge and Understanding**		**Intellectual Skills**		**Professional and Practical Skills**	**General and Transferable Skills**		
		A.11	A.27	B.2	B.4	C.1	C.4	D.3	d.7
Knowledge and Understanding	a.1	x							
	a.2		x						
Intellectual Skills	b.1			x					
	b.2				x				
Professional and Practical Skills	c.1					x			
	c.2						x		
General and Transferable Skills	d.1							x	
	d.2								x

خريطة المنهج (مصفوفة المقرر)

Course title: Quantum mechanics **Code: ph. 302**

The aim of the course	Course content	Course Intended learning outcomes of course (ILOs)				Teaching and learning methods	Assessment tools	criteria
		Knowledge and Understanding	Intellectual Skills	Professional and Practical Skills	General and Transferable Skills			
1-Produce graduates have practical, analytical and problem solving skills, which make them qualified for suitable jobs in the field of industry, teaching, research, professions and public service. 2-Ensure that students can manage their own learning and study a topic independently with the aid of appropriate sources.	The limits of classical mechanics. + problems	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2	Lectures and discussions Solved problems and homework problems.	Written Exam Oral exam Practical exam	Course note and the final exam results
	Wave packets and the uncertainty relations. + problems	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			
	probability, statistical interpretation and normalization	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			
	The Schrodinger equation, operators, eigen states and eigen values. + problems	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			
	Stationary states and momentum space.	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			
	Solutions of one dimensional potentials: Step potential, finite potential barrier, infinite and finite square well, and the Delta function potential. + problems	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			
	The linear harmonic oscillator, polynomial and operator method. + problems	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			
	The Schrodinger equation in three dimensions. The angular momentum operators. Eigenvalues and normalized eigenfunctions of the angular momentum operator. Hydrogenic atoms and the parity operator.	a.1 a.2	b.1 b.2	c.1 c.2	d.1 d.2			