جامعة المجمعة
Majmaah University

Course Specifications

Institution:	College of Education Zulfi
Academic Department :	Physics
Programme :	B.Edu. Degree in Physics
Course :	Quantum Mechanics 2
Course Coordinator :	Dr. Rasha Abd Alhai
Programme Coordinator :	Dr. Fatima Z. Mohammed
Course Specification Approved Date :	1/ 1 / 1438 H

A. Course Identification and General Information

1 - Course title : Quantum Mechanics 2		Course Code: Phys 322	
2. Credit hours : (3)			
3 - Program(s) in which the course is offered: B.Edu. Degree in Physics			
4 – Course Language : Arabic			
5 - Name of faculty member responsible for the course: Dr. Rasha Abd Alhai			
6 - Level/year at which this course is offered : . 6th level			
7 - Pre-requisites for this course (if any) : • Phys 314			
8 - Co-requisites for this course (if any) : non •			
9 - Location if not on main campus : (.....)			
10 - Mode of Instruction (mark all that apply)			
A - Traditional classroom	√	What percentage?	100 %
B - Blended (traditional and online)		What percentage?	0 %
D - e-learning		What percentage?	10 %
E – Correspondence		What percentage?	0 %
F - Other		What percentage?	10 %
Comments :			

B Objectives

1. To derive methods, such as the Rayleigh-Ritz variational principle and perturbation theory, in order to obtain approximate solutions of the Schrödinger equation.
2. To introduce spin and the Pauli exclusion principle and hence explain the mathematical basis of the Periodic table of elements
3. To introduce the quantum theory of the interaction of electromagnetic radiation with matter using time dependent perturbation theory
4. To show how scattering theory is used to probe interactions between particles and hence to show how the probability or cross section for a scattering event to occur can be derived from quantum theory.

Briefly describe any plans for developing and improving the course that are being implemented :

C. Course Description

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
Angular momentum - angular momentum vector for a range of particle matrix representation	2	6
The electron's spin: the Eigen functions and eigenvalues of the spin operator. The Pauli exclusion principle. The periodic table of elements. Spin precession in an external magnetic field.	2	6
Variational principles in quantum mechanics: the Rayleigh-Ritz variational principle. Bounds on energy levels for quantum systems.	3	9
Perturbation theory: Rayleigh-Schrödinger time-independent perturbation theory. Perturbations of energy levels due to external electromagnetic fields.	3	9
Scattering theory: definition of the scattering cross-section and the scattering amplitude. Decomposition of the scattering am into partial waves. Phase shifts and the S-matrix. Integral represer of the scattering amplitude. The Born approximation. Potential sca	3	9
Approximate methods of quantum mechanics: semi-classical approximation and its applications		
Changing systems with time: the study of time-dependent Schrödinger equation The expected values of the physical quantities - change the mean values of the physical quantities with time Ferrell quantum theory - the law of conservation of energy		
Classical Poisson brackets and quantity - equation of motion for Heyznberg general theory of unitary transformations - unionist transfers corresponding to changing situations with time		
Various representations in quantum mechanics: Schrödinger representation - representation Heisenberg - representation Internal mutual influence - Dirac formats		
Angular momentum. Spin. Orbital angular momentum. Commutation relations. Eigenfunctions. Spin. Spinors. Addition of angular momentum. Spin in magnetic _eld. Bosons and fermions. Particle indistinguisha-		

bility and symmetry of the wave function. Many-particle systems. Second quantization.		

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

	Lecture	Tutorial	Laboratory	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

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Learning different approximate methods and their applications.	basic information and principles through lectures	Solve some example during the lecture.
1.2	Understanding the physics of Quantum mechanics and their applications mentioned in the text	Discussing phenomena with illustrating pictures and diagrams	Exams**:** -Quizzes -Short exams (mid term exams) -Long exams (final)
1.3	Improving logical thinking.	Lecturing method: -Blackboard -Power point e learning	Discussions with the students
1.4	To use mathematical formulation to describe the physical principle or phenomena	Tutorials Revisit concepts Discussions	Ask the student to clear the misunderstanding of mathematical
2.0	**Cognitive Skills**		
2.1	How to use physical laws and principles to understand the subject	Preparing main outlines for teaching	Midterm's exam. Exams, short quizzes
2.2	How to simplify problems and analyze phenomena	Define duties for each chapter	Asking about physical laws previously taught
2.3	Analyze and explain natural phenomena	Homework assignments	Writing reports On selected parts of the course
2.4	Represent the problems mathematically	Encourage t h e student to look for the information in different references.	Discussions of how to simplify or analyze some phenomena

	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
3.0	**Interpersonal Skills & Responsibility**		
3.1	Work independently	Learn how to search the internet and use	Quizzes on the previous lecture
3.2	The students learn independently and take Up responsibility	Learn how to cover missed lectures	Checking report on internet use and trips
3.3		Learn how to summarize lectures or to collect materials of the course	Presenting the required research on time and the degree of the quality will show the sense of responsibility
4.0	**Communication, Information Technology, Numerical**		
4.1	Problem solving.	Know the basic	Their interaction with the
4.2	Data analysis and interpretation.	Use the web for lectures and discussions	The reports of different
4.3	Feeling mathematical reality of asked tasks. Solving Problems	Discuss with the student	Problem solutions assignment and exam should focus
5.0	**Psychomotor**		
	None		

5. Schedule of Assessment Tasks for Students During the Semester:

	Assessment task	Week Due	Proportion of Total Assessment
1	**Attendance and Oral discussions**	From 1st	20%
2	**Midterm 1**	7th	10 %
3	**Midterm 2**	12 th	10 %
4	**Final exam**	16 th	60%
5			

D. Student Academic Counseling and Support

6 office hours per week
- Communicate, ask questions and inquiries through the site on the World Wide Web.
- To provide assistance and guidance to any inquiry or consulted regarding the article and given that
Include helping students understand the material and contribute to the process of academic guidance, And assist students in the face of any problems and academic scholarships in this cours.

E. Learning Resources

1. List Required Textbooks :

* Introduction to quantum mechanics, David J. Griffith, Printice Hall, 2004.
*"Quantum Mechanics" Volumes 1 & 2, by Claude Cohen-Tannoudji, Bernard Diu, and Franck Laloe (1977 John Wiley & Sons).
* Introductory Quantum Mechanics, R.L. Liboff, Addison-Wesley
* Principles of quantum mechanics. R. Shankar

Text book and References:

Quantum physics, Stephen Gasiorwics, John Wiley & Sons, 2003.

- Quantum mechanics, L. I. Shiff, Mc Grow Hill, 1986.

2. List Essential References Materials :

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3. List Recommended Textbooks and Reference Material :

Robert Scherrer, Quantum Mechanics, an accessible introduction, first edition (2006). Stephen Gasiorowicz, Quantum Physics, third edition (2003), Wiley

Journal of Physical B Journal of Physica E
4. List Electronic Materials : http://www-fourier.ujf-grenoble.fr/~faure/enseignement/meca_q/ index.html http://alain.escano.pagesperso-orange.fr/TDPh_EM_01_C.pdf • http://quantum-algorithms.com/
5. Other learning material : Wikipedia

F. Facilities Required

1. Accommodation • Lecture room for 30 students • Library • Laboratory for experimental solid state
2. Computing resources • Computer room • Scientific calculator.
3. Other resources • ..... • ..... • .....

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching: • Midterm and final exam. • Quiz.
2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor : • ..... • .....
3 Processes for Improvement of Teaching : • Fortification of the student learning. • Handling the weakness point.
4. Processes for Verifying Standards of Student Achievement • The instructors of the course are checking together and put a unique process of evaluation • Check marking of a sample of papers by others in the department. • **Feedback evaluation of teaching from independent organization.**
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement : 1- The following points may help to get the course effectiveness

- Student evaluation
- Course report
- Program report
- Program Self study

2- According to point 1 the plan of improvement should be given.

3- Contact the college to evaluate the course and the benefit it add to other courses.

4- Add some subject and cut off others depending on the new discoveries in physics.

Course Specification Approved
Department Official Meeting No (1) Date 1 / 1 / 1438 *H*

Course's Coordinator

Name : Dr . Rasha Abd Alhai
Signature : .....
Date : 27/ 12 / 1437 *H*

Department Head

Name : Dr Fatima Z. Mohammed
Signature : .....
Date : 27/ 12 / 1437 *H*