Tamkang University Academic Year 111, 1st Semester Course Syllabus

Course Title	QUANTUM MECHANICS(I)	Instructor	WU, JUNYI
Course Class	TSPBB4A DEPARTMENT OF PHYSICS (SECTION OF APPLIED PHYSICS), 4A	Details	◆ General Course ◆ Required ◆ One Semester
Relevance to SDGs	SDG4 Quality education		

Departmental Aim of Education

Ⅰ. Conveying professional knowledge: Teach the students to learn the core knowledge of physics, to obtain the basic skills needed for physics research, and to apply the professional knowledge to physics related technologies.

Ⅱ. Analyzing and solving problems: Guide the students to analyze problems, and to acquire the mathematical ability to quantify conceptual models and also the capability needed to think and to innovate in solving various scientific and engineering problems.

Ⅲ. Training for experimental techniques: Teach the students on how to carry out and to verify various experiments, and at the same time to have the mentality of working cautiously and the awareness in operating safely.

Ⅳ. Expressing personal characteristics: Help the students to use their personal characteristics, like resolution, sincerity, and concentration, plus their professional skills to gain recognition among the executives and their peers.

Ⅴ. Cultivating team spirit: Train the students to have the organizational ability and the communicational skills to let them have the adaptability to integrate into a professional team, and to obtain the ability to bring out and to put to use the strength of the team to solve professional problems.

Ⅵ. Building international views: Comply to the trends of globalization to build an international learning environment and opportunities in order to educate the students to continue in their self-advancements, to absorb new worldwide knowledge, and to become a professional with international views in their future perspective careers.

Subject Departmental core competences

A. To acquire the core basic knowledge in the field of physics.(ratio:30.00)

B. To understand the overall features of specific fields of physics.(ratio:25.00)

C. To obtain the mathematical ability to quantify concepts, models, and practical problems. (ratio:5.00)

D. To cultivate the basic ability to discover, to analyze, and to solve problems.(ratio:20.00)

E. To practice the actual handling of physics problems, and to have the ability to analyze and to interpret experimental data.(ratio:5.00)

F. To have the mentality to work cautiously and the awareness to operate safely.(ratio:5.00)

G. To comprehend the trend of technological development and to acquire the knowledge and skills of other fields needed in their professional career.(ratio:5.00)

H. To have the spirit and capability in team cooperation.(ratio:5.00)

Subject Schoolwide essential virtues

1. A global perspective. (ratio:5.00)

2. Information literacy. (ratio:10.00)

3. A vision for the future. (ratio:30.00)

4. Moral integrity. (ratio:10.00)

5. Independent thinking. (ratio:30.00)

6. A cheerful attitude and healthy lifestyle. (ratio:5.00)

7. A spirit of teamwork and dedication. (ratio:5.00)

8. A sense of aesthetic appreciation. (ratio:5.00)

Course Introduction	In this course, we will learn the mathematical treatment of quantum mechanics from basic to applications. We will derive Schrodinger equation from wave mechanics, and summarize the formalism of quantum mechanics in Hilbert space. We will then exploit the application of the formalism of quantum mechanics in 1D, followed by the extension to 3D systems.

The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.

II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.

III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

No.	Teaching Objectives	objective methods
1	Master the mathematical tools in quantum mechanics	Cognitive

2	Applications of quantum mechanics in 1D to 3D single-particle systems.		Cognitive

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment				
No.	Core Competences	Essential Virtues	Teaching Methods	Assessment
1	ABCDEFGH	12345678	Lecture, Discussion	Testing, Study Assignments
2	ABCDEFGH	12345678	Lecture, Discussion	Testing, Study Assignments

Course Schedule

Week	Date	Course Contents	Note
1	111/09/05 ~ 111/09/11	01 Wavefunction and its interpretation: Black-body radiation and Planck law	
2	111/09/12 ~ 111/09/18	01 Wavefunction and its interpretation: Bohr's model and Rydberg formula	
3	111/09/19 ~ 111/09/25	01 Wavefunction and its interpretation: Schrodinger equation	
4	111/09/26 ~ 111/10/02	01 Wavefunction and its interpretation: Interpretation of wave functions	
5	111/10/03 ~ 111/10/09	01 Wavefunction and its interpretation: Uncertainty relation	
6	111/10/10 ~ 111/10/16	02 Hilbert-space formalism: Quantum states in Hilbert space	
7	111/10/17 ~ 111/10/23	02 Hilbert-space formalism: Measurement and statistical interpretation	
8	111/10/24 ~ 111/10/30	02 Hilbert-space formalism: Observables	
9	111/10/31 ~ 111/11/06	02 Hilbert-space formalism: Identity operator and unitary transformations	
10	111/11/07 ~ 111/11/13	Midterm Exam Week	
11	111/11/14 ~ 111/11/20	03 Quantum mechanics in 1D system: Stationary states (Energy eigenstates)	
12	111/11/21 ~ 111/11/27	03 Quantum mechanics in 1D system: Infinite/finite square well	
13	111/11/28 ~ 111/12/04	03 Quantum mechanics in 1D system: Harmonic Oscillators	

14	111/12/05 ~ 111/12/11	04 Quantum mechanics in 3D: Schrödinger equation in 3D	
15	111/12/12 ~ 111/12/18	04 Quantum mechanics in 3D: The Hydrogen atom	
16	111/12/19 ~ 111/12/25	04 Quantum mechanics in 3D: Angular momentum	
17	111/12/26 ~ 112/01/01	04 Quantum mechanics in 3D: Spin	
18	112/01/02 ~ 112/01/08	Final Exam Week	

Requirement	
Teaching Facility	Computer, Other (Whiteboard/blackboard)
Textbooks and Teaching Materials	Introduction to Quantum Mechanics (David J. Griffiths)
References	A Modern Approach to Quantum Mechanics (John S. Townsend) Quantum Mechanics (Volume I, Claude Cohen-Tannoudji, Bernard Diu, Franck Laloë) Principles of Quantum Mechanics (Shankar)
Number of Assignment(s)	(Filled in by assignment instructor only)
Grading Policy	◆ Attendance： 　 %　 ◆ Mark of Usual：10.0 %　 ◆ Midterm Exam： 45.0 % ◆ Final Exam： 45.0 % ◆ Other〈 〉： 　 %
Note	This syllabus may be uploaded at the website of Course Syllabus Management System at http://info.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/CS/main.php . ※ **Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.**