City University of Hong Kong
Course Syllabus

offered by College/School/Department of Physics
with effect from Semester A 2025/26

Part I Course Overview

Course Title:	**Introduction to Quantum Technology**
Course Code:	**PHY5503**
Course Duration:	**One semester**
Credit Units:	**3 credits**
Level:	**P5**
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	
Precursors: *(Course Code and Title)*	
Equivalent Courses: *(Course Code and Title)*	
Exclusive Courses: *(Course Code and Title)*	

Part II Course Details

1. Abstract

The Introduction to Quantum Technology course offers a captivating journey into the fascinating world of quantum mechanics and its ground-breaking applications. This course provides a comprehensive overview of quantum technology's fundamental principles and potential impact. Students will study quantum information science, exploring concepts such as qubits, quantum gates, and entanglement. They will uncover the mysteries of quantum computing, discovering powerful algorithms and the intricacies of quantum error correction. The course also covers quantum communication, cryptography, and secure communication protocols. Moreover, students will explore quantum sensing and metrology, unlocking the potential for precise measurements and imaging. Upon completion, students will possess a solid foundation in quantum technology, empowering them to pursue further studies or careers in this rapidly advancing field that promises to revolutionize industries worldwide.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Understand various quantum enabled technologies		√	√	
2.	Understand Quantum superposition, entanglement measurement		√	√	
3.	Understand Qubits and quantum states		√	√	
4.	Understand Quantum gates and circuits		√	√	
5.	Understand different physical platforms		√	√	
6.	Understand Quantum algorithms (e.g., Shor's algorithm, Grover's algorithm)		√	√	
7.	Understand Quantum cryptography and secure communication		√	√	
8.	Understand Quantum key distribution protocols		√	√	
9.	Understand Quantum teleportation and quantum networks		√	√	
10.	Understand Quantum-enhanced measurements		√	√	
11.	Understand Applications in precision measurement and imaging		√	√	
12.	Understand Quantum simulators and their applications		√	√	
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.											Hours/week(if applicable)
		1	2	3	4	5	6	7	8	9	10	11	12	
Lectures	Presentation of course material	√	√	√	√	√	√	√	√	√	√	√	√	3

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.												Weighting*	Remarks
	1	2	3	4	5	6	7	8	9	10	11	12		
Continuous Assessment: 70 %														
Assignments	√	√	√	√	√	√	√	√	√	√	√	√	40%	
Test	√	√	√	√	√	√	√	√	√	√	√	√	30%	
Examination: _30_% (duration: 2 hours, if applicable)														
** The weightings should add up to 100%.*													100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Tests	The student demonstrates an understanding of the principles of quantum physics for solving common quantum technology problems.	High (Outstanding achievement and accurate understanding)	Significant (Good achievement with largely accurate understanding)	Satisfied (Moderate achievement with some accurate understanding)	Basic (Essential achievement with a basic understanding)	Not reaching marginal level
2. Assignments	The student completes all the assignments and demonstrates a good understanding of the taught material by solving the given problems.	High (Outstanding achievement and accurate understanding)	Significant (Good achievement with largely accurate understanding)	Satisfied (Moderate achievement with some accurate understanding)	Basic (Essential achievement with a basic understanding)	Not reaching marginal level
3. Examination	The student demonstrates an understanding of the principles of quantum physics for solving common quantum technology problems.	High (Outstanding achievement and accurate understanding)	Significant (Good achievement with largely accurate understanding)	Satisfied (Moderate achievement with some accurate understanding)	Basic (Essential achievement with a basic understanding)	Not reaching marginal level

Applicable to students admitted in Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Tests	Capacity for using physics knowledge and theory to solve problems	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format
2. Assignments	Capacity for using physics knowledge and theory to solve problems	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format
3. Examination	Capacity for using physics knowledge and theory to solve problems	Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format	Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format	Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format

Part III Other Information

1. Keyword Syllabus

2.

- Introduction to Quantum Mechanics
  Wave-particle duality, uncertainty principle, quantum states, operators, measurement, observables

- Quantum Computing
  Qubits, quantum gates, quantum algorithms, Grover's algorithm, Shor's algorithm, quantum simulation, optimization, error correction, fault tolerance

- Quantum Communication
  Quantum key distribution, QKD, quantum teleportation, quantum networks, secure communication, quantum internet

- Quantum Sensing
  Quantum sensing, quantum metrology, precision measurements

- Technologies
  Sensing, measuring, imaging, communication, simulation and computing

- Platforms
  Superconducting qubits, Trapped ions, photonics, Nuclear magnetic resonance, Quantum dots, Diamond vacancies.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Michael A. Nielsen, Isaac L. Chuang Quantum Computation and Quantum Information CUP 2010. https://doi.org/10.1017/CBO9780511976667

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	R. Loudon, Quantum Theory of Light, 3rd Edition (Oxford University Press, 2000)