

Course Numbering	TEI-QTM301J
Year	Second semester 2025
Subject (J)	Quantum Mechanics A
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Credit(s)	2Credits
Instructor	GREAVES SIMON JOHN
Media Class Subjects	
Essential Subjects	○
Language of Instruction	This class is taught in English. Presentation materials will be provided in English and Japanese. Homework and exams can be completed in English or Japanese.
Course Objectives and Summary/ Learning Goals (J)	<p>Google Classroomのクラスコードは工学部Webページにて確認すること。 学部シラバス・時間割(<a href="https://www.eng.tohoku.ac.jp/edu/syllabus-ug.html">https://www.eng.tohoku.ac.jp/edu/syllabus-ug.html</a>)</p> <ol style="list-style-type: none"> <li>1. 目的 古典論とは異なる量子力学特有の概念を習得し、最も簡単なポテンシャルに対する解法を学ぶことが主目的である。</li> <li>2. 概要 量子力学の初歩から始めて、シュレディンガー方程式を使って各種のポテンシャル中の1次元の運動までを扱う。</li> <li>3. 達成目標等 電子工学で必要になる量子力学の概念を修得すること。</li> </ol>
Course Objectives and Summary/ Learning Goals	<p>The class code for Google Classroom can be found on the Web site of the School of Engineering: <a href="https://www.eng.tohoku.ac.jp/edu/syllabus-ug.html">https://www.eng.tohoku.ac.jp/edu/syllabus-ug.html</a> (JP Only)</p> <p>Beginning with a review of early 20th century experiments, this course aims to develop an understanding of the basic concepts of quantum mechanics and how they differ from classical mechanics. The Schroedinger equation will be used to solve one-dimensional problems and we will learn how the results relate to physical phenomena such as quantum mechanical tunneling and energy band gaps in solids.</p>
Relevance to Other Subjects/Considerations for Taking the Class (J)	古典力学、古典電磁気学、ベクトル解析、フーリエ解析、線形代数などの知識を持っていることが要求される。量子力学Bを履修する前に履修することは必須であり、さらに固体物理学、電子物性工学を履修する前に履修する必要あり。
Relevance to Other Subjects/Considerations for Taking the Class	Students are assumed to have introductory college-level physics, calculus, and linear algebra.
Course Description (J)	<ol style="list-style-type: none"> <li>1. 量子力学 対 古典力学、2スリットの実験</li> <li>2. 黒体輻射、光電効果</li> <li>3. コンプトン散乱、フランクとヘルツ実験</li> <li>4. ボーア原子モデル、ド・ブロイ理論</li> <li>5. シュレディンガー方程式、波動関数、重ね合せ</li> <li>6. 演算子、固有値方程式、期待値</li> <li>7. 一次元井戸形ポテンシャル中の粒子</li> <li>8. パウリの排他原理、箱の中の粒子</li> <li>9. デルタ関数ポテンシャル、トンネル効果</li> <li>10. 一次元階段ポテンシャル、一次元箱形ポテンシャル</li> <li>11. 固体の電子状態、ハイゼンベルグの不確定性原理</li> <li>12. 調和振動子、二原子分子</li> <li>13. 自由粒子、波束運動</li> <li>14. まとめ</li> </ol>
Course Description	<ol style="list-style-type: none"> <li>1. Introduction, quantum mechanics vs. classical mechanics, double slit experiments</li> <li>2. Blackbody radiation, the photoelectric effect</li> <li>3. Compton scattering, the Franck and Hertz experiment</li> <li>4. Bohr's model of the hydrogen atom, de Broglie theory</li> <li>5. Schroedinger equation and wave functions, superposition, measurement</li> <li>6. Operators, eigenvalue equations, expectation values</li> <li>7. The infinite potential well</li> <li>8. Pauli exclusion principle, particle in a box</li> <li>9. The delta function potential, scattering and tunneling</li> <li>10. One dimensional barrier problems</li> <li>11. Solids, band gaps, the Heisenberg uncertainty principle</li> <li>12. The harmonic oscillator, diatomic molecules</li> <li>13. Free particles and wave packets</li> <li>14. Conclusion</li> </ol>
Preparation and Review(J)	レポート（5－6回）の作成。

Preparation and Review	5-6 written reports (homework).				
Evaluation methods and criteria (J)	宿題 25% 中間試験 30% 期末試験 45%				
Evaluation methods and criteria	Homework 25% Mid-term exam 30% Final exam 45%				
Textbooks and references					
Title	Author	Publisher	Year	ISBN/ISSN	Classification
Quantum mechanics	B.H. Bransden and C.J. Joachain	Prentice Hall		582356911	
Introduction to quantum mechanics	D.J. Griffiths	Prentice Hall International		0131118927	
Introductory quantum mechanics	R.L. Liboff	Addison Wesley		0805387145	
量子力学基礎	末光真希・枝松圭一	朝倉書店		9784254228854	
URL					
Attached File					
Office Hours(J)	By appointment				
Office Hours	予約制				
Contact : Please insert '@' in the email address.	クラスルームで連絡可能 / Contact via Google Classroom page				
Notes					
Practical Skill/Hands-on Class					
Other Comments/Instructions	The class code is / クラスコードは : Not available at time of writing The course code is / コースコードは : TB24064				
Last Update	2024/02/07 15:56:35				

One-credit courses require 45 hours of study. In lecture and exercise-based classes, one credit consists of 15-30 hours of class time and 30-15 hours of preparation and review outside of class. In laboratory, practical skill classes, one credit consists of 30-45 hours of class time and 15-0 hours of preparation and review outside of class.