# PHYC30020 Quantum Systems

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| **Credit Points:** | 12.50 |
| **Level:** | 3 (Undergraduate) |
| **Dates & Locations:** | 2010, Parkville<br>This subject commences in the following study period/s:<br>Semester 2, Parkville - Taught on campus.<br>Lectures and problem-solving classes |
| **Time Commitment:** | Contact Hours: 2 to 4 hours per week, 36 in total, lectures and problem-solving classes Total Time Commitment: Estimated total time commitment of 120 hours |
| **Prerequisites:** | Physics<br>One of<br># **640-331 Quantum Physics (../../view/2010/640-331)**<br># 640-321 Quantum Mechanics Advanced (prior to 2010)<br># 640-341 Quantum Mechanics (prior to 2010)<br>Plus one of<br># **640-384 Statistical Physics (../../view/2010/640-331)** (may be taken concurrently)<br># 640-342 Statistical Physics (prior to 2009)<br>And Mathematics<br>Either both of<br># **620-231 Vector Calculus (../../view/2010/620-231)**<br># **620-295 Real Analysis with Applications (../../view/2010/620-295)**<br>Or<br># 620-296 Multivariable & Vector Calculus (prior to 2010)<br>For students who commenced second year level mathematics prior to 2009:<br>One of<br># 620-231 Vector Analysis (prior to 2009)<br># 620-233 Vector Analysis Advanced (prior to 2009)<br># **620-231 Vector Calculus (../../view/2010/620-231)**<br>And one of<br># 620-232 Mathematical Methods (prior to 2010)<br># 620-234 Mathematical Methods Advanced (prior to 2009). |
| **Corequisites:** | None |
| **Recommended Background Knowledge:** | None |
| **Non Allowed Subjects:** | Students may only gain credit for one of<br># 640-382 Condensed Matter Physics<br># 620-353 Atomic, Molecular & Solid State Physics (prior to 2010) |
| **Core Participation Requirements:** | It is University policy to take all reasonable steps to minimise the impact of disability upon academic study and reasonable steps will be made to enhance a student's participation in the University's programs. Students who feel their disability may impact upon their active and safe participation in a subject are encouraged to discuss this with the relevant subject coordinator and the Disability Liaison Unit. |
| **Coordinator:** | Prof Les J. Allen |

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| **Contact:** | **Email: c640382@physics.unimelb.edu.au (mailto:c640382@physics.unimelb.edu.au)** |
| **Subject Overview:** | Quantum mechanics governs the structure of atomic, molecular and condensed matter state systems, the nature of light and charge, and the interactions between these systems. Whereas earlier subjects detailed the principles and foundations of quantum mechanics, this subject details properties of real systems and discusses applications of this fundamental field of enquiry. The necessary use of quantum ideas in developing an understanding of the structure of matter is emphasised.<br>Topics covered include:<br># the one-electron approximation, diatomic molecules<br># basic crystal structures and bonding, reciprocal lattices<br># the microcanonical ensemble: 1-D spin systems, macrostates and microstates, the number of states function<br># periodic systems, phonons, free-electron model, band structure, insulators, conductors and semi-conductors<br># the variational method, helium atom, basic density functional theory<br># superconductivity. |
| **Objectives:** | To challenge students to expand their knowledge of fundamental physics principles and develop their capacity to:<br># explain the role that quantum mechanics plays in a range of real physical systems<br># apply quantum mechanics to solve problems in a variety of physical systems<br># interpret the solutions to these problems. |
| **Assessment:** | Two tests of 1 hour (5% each) and two assignments each totalling up to an equivalent of 1500 words during the semester (5% each); a 3-hour written examination in the examination period (80%). |
| **Prescribed Texts:** | C Kittel, Introduction to Solid State Physics. 8th Ed, Wiley |
| **Breadth Options:** | This subject potentially can be taken as a breadth subject component for the following courses:<br># **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2010/B-COM)**<br># **Bachelor of Environments (https://handbook.unimelb.edu.au/view/2010/B-ENVS)**<br># **Bachelor of Music (https://handbook.unimelb.edu.au/view/2010/B-MUS)**<br>You should visit **learn more about breadth subjects (http://breadth.unimelb.edu.au/breadth/info/index.html)** and read the breadth requirements for your degree, and should discuss your choice with your student adviser, before deciding on your subjects. |
| **Fees Information:** | Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees |
| **Generic Skills:** | A student who completes this subject should be able to:<br># analyse how to solve a problem by applying simple fundamental laws to more complicated situations<br># apply abstract concepts to real-world situations<br># solve relatively complicated problems using approximations<br># participate as an effective member of a group in tutorial discussions<br># manage time effectively in order to be prepared for tutorial classes, undertake the written assignments and the examination. |
| **Notes:** | This subject is available for science credit to students enrolled in the BSc (both pre-2008 and new degrees), BASc or a combined BSc course. |
| **Related Course(s):** | Bachelor of Science |
| **Related Majors/Minors/ Specialisations:** | Physics<br>Physics |