# Courses in English
## Course Description

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| **Department** | 06 Applied Sciences and Mechatronics |
| **Course title** | **Quantum Physics 1** |
| **Hours per week (SWS)** | 6 |
| **Number of ECTS credits** | 8 |
| **Course objective** | ENTRY for the master degree program MNT / conveys physical fundamentals and mathematical concepts for the other modules of the program.<br><br>Upon successful completion of the module, students have the following skills:<br>They possess the essential physical and mathematical foundations of the other modules of the program.<br>They have a deep understanding of the physical and chemical properties of micro-and nanoscale systems.<br>They can capture and describe micro-and nanoscale systems quantitatively.<br>They have the basics for modeling micro-and nanoscale systems and have knowledge of different modeling methods and their applications and limitations. |
| **Prerequisites** | Solid State Physics |
| **Recommended reading** | R.P. Feynman, R.B. Leighton, M. Sands: The Feynman Lectures on Physics, I - III.<br>A.A. Sokolow, J.M. Loskutow, L.M. Ternow: Quantenmechanik, Akademie-Verlag, Berlin, 1964.<br>D.I. Blochinzew: Grundlagen der Quantenmechanik, Verlag Harri Deutsch, FFM, 1972.<br>L.D. Landau, E.M. Lifschitz: Lehrbuch der theoretischen Physik III, Akademie-Verlag, Berlin, 1974.<br>G.M. Barrow: Introduction to Molecular Spectroscopy, McGraw Hill, New York, 1962.<br>C. Kittel: Introduction to Solid State Physics, 4th ed., J. Wiley \& Sons, New York.<br>J.N. Murrell, S.F.A. Kettle, J.M. Tedder: Valence Theory, 2nd edition, J. Wiley & Sons, Ltd., London/New York, 1970.<br>F. Seitz: The Modern Theory of Solids, McGraw-Hill, Inc. New York, N.Y., 1940.<br>J.C. Slater: Solid-State and Molecular Theory: A Scientific Biography, J. Wiley & Sons, New York, N.Y., 1975.<br>J.M. Ziman: Einfuehrung in die Festkoerpertheorie, Verlag Harri Deutsch, Frankfurt am Main und Zuerich. |
| **Teaching methods** | lecture, exercises, lab class |
| **Assessment methods** | 100% written exam |
| **Language of instruction** | English |
| **Name of lecturer** | Prof. Dr. Katjy Beha |
| **Email** | katja.beha@hm.edu |
| **Link** | https://www.fb06.fh-muenchen.de/fk/modulbeschreibungen.php?lang_nr=&id=1527 |

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| **Course content** | 1. Quantum Mechanics<br>Quantum effects: radiation of the black body, Einstein photoelectric effect, the uncertainty principle of a harmonic wave group, wave nature of the electron, uncertainty of a matter wave, Compton effect.<br>Bohr model: data history, postulates, calculating the innermost orbit, computing the spectrum, quantization for higher atoms, stability of atoms, correspondence principle.<br>Axioms of quantum mechanics: vector and Hilbertraum, abelian groups, wave functions in configuration and momentum space<br>Wave Mechanics: Classical and quantum mechanical systems, Schrödinger equation (time dependent and time independent), operators, electron in the box, perturbation theory, interaction with radiation, selection rules.<br>Tunnel effect: limitations of transport, quantum particles in the potential well: WKB method, energy eigenvalues for a quantum particle in the finite potential well, alpha-particles in the potential well, statistical interpretation of the uncertainty relation, uncertainty principle and tunneling.<br>Eigenvalue problems: potential energy curves of molecules, Harmonic Oscillator<br>Antisymmetry principle and Pauli exclusion principle<br>Atomic orbital function and Orbital, radial and angular-dependent part of the wave function.<br><br>2. Solid State Physics<br>Lattice models: the real and reciprocal lattice, formalism of the reciprocal lattice<br>Metals: The free electron model, Mean energy of the electrons, the distribution function of the free electron gas, degeneracy, band structure, electrical conductivity, contact potentials.<br>Solids: The almost free electron model, unit cells in the reciprocal lattice: Brillouin zones, Bragg reflection and reciprocal lattice, band and zone boundaries, effective mass.<br>Semiconductors: Electrical behavior, the Fermi energy in semiconductors, electrical conductance, p-n-transitions, effective mass, excitons |
| **Remarks** | |