# COURSE SPECIFICATION FORM

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| **DEPARTMENT OF: Mathematics** | | | | **Academic Session: 2018-19** | |
| **Course Code:** | MT3200 | **Course Value:** | 0.5 | **Status:** *(ie:Core, or Optional)* | Optional |
| **Course Title:** | Quantum Theory I | | | **Availability:** *(state which teaching terms)* | Term 1 |
| **Prerequisites:** | | | | **Recommended:** | |
| **Co-ordinator:** | | | | | |
| **Course Staff** | | | | | |
| **Aims:** | To provide a complete introduction to the major methods and concepts of quantum theory at a level suitable for third year students. The course will stress applications and will cover many of the classic problems of quantum theory. The probabilistic theory of measurement is explained and its philosophical implications are touched upon. | | | | |
| **Learning Outcomes:** | On completion of the course students should be able to:<br>• show whether a given operator is linear and hermitian<br>• to understand the probabilistic interpretation of quantum theory<br>• write down the Schrödinger equation for an arbitrary dynamical system<br>• obtain the expectation value of a hermitian operator for a given wavefunction<br>• to solve the Schrödinger equation and obtain the eigenenergies and energy eigenfunctions for a constant potential, the harmonic oscillator and the hydrogen atom<br>• to write down the uncertainty relationship between two conjugate hermitian operators. | | | | |
| **Course Content:** | **Historical origins of quantum theory and formal background:** Linear Hermitian operators; Dirac delta functions. Closure, orthogonality; postulates of quantum mechanics.<br>**Applications:** Schrödinger equation: free particle, particle in an infinite well, particle in a box. potential barriers, quantum tunnelling. Particle in a finite well, quantum parity. Simple harmonic oscillator. Angular momentum. The hydrogen atom. The momentum representation.<br>**More basic principles:** Heisenberg uncertainty principle. Connections with classical physics, Ehrenfest's theorem. Measurement theory. | | | | |
| **Teaching & Learning Methods:** | 33 hours of lectures and examples classes.<br>117 hours of private study, including work on problem sheets and examination preparation. This may include discussions with the course leader if the student wishes. | | | | |
| **Key Bibliography:** | Quantum Physics – S Gasiorowicz (John Wiley). *Library Ref. 530.12 GAS*<br>An Introduction to Quantum Mechanics – B H Bransden and C J Joacham (Longmans). *Library Ref. 530.12 BRA* | | | | |
| **Formative Assessment & Feedback:** | Formative assignments in the form of 8 problem sheets. The students will receive feedback as written comments on their attempts. | | | | |
| **Summative Assessment:** | **Exam** (%) A two-hour paper: 100%<br>**Coursework** (%) None | | | | |

Updated September 2017