

MA4A7-15 Quantum Mechanics: Basic Principles & Probabilistic Methods

26/27

Department

Warwick Mathematics Institute

Level

Undergraduate Level 4

Module leader

Vasily Gelfreykh

Credit value

15

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

Quantum mechanics is one of the most successful and most fundamental scientific theories. It provides mathematical tools capable of describing properties of microscopic structures of our World. It is fundamental to the understanding of a variety of physical phenomena, ranging from atomic spectra and chemical reactions to superfluidity and Bose-Einstein condensation.

[Module web page](#)

Module aims

To introduce the basic concepts and mathematical tools used in quantum mechanics, preparing students for areas which are at the forefront of current research.

The students should obtain a good understanding of the basic principles of quantum mechanics, and to learn the methods used in the analysis of quantum mechanical systems.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

In the lectures we will discuss mathematical foundations of quantum theory: This includes the concepts of mixed and pure states, observables and evolution operator, a wave function in Hilbert space, the stationary and time-dependent Schrödinger equations, the uncertainty principle and the connections with classical mechanics (Ehrenfest theorem).

We will give simple, exactly soluble examples of both time-dependent and time-independent Schrodinger equations. We will also touch some more advanced topics of the theory.

Learning outcomes

By the end of the module, students should be able to:

- Understand the basic structure of quantum mechanics, and the mathematics around it.

Subject specific skills

Basic knowledge of an important physical theory.

Transferable skills

Basic knowledge of an important physical theory.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 hours

Private study description

Review lectured material and work on set exercises

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B1

	Weighting	Study time	Eligible for self-certification
In-person Examination 3 hour exam, no books allowed	100%		No

- Answerbook Gold (24 page)

Assessment group R

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

- Answerbook Gold (24 page)

Feedback on assessment

Exam feedback

[Past exam papers for MA4A7](#)

Availability

Courses

This module is Optional for:

- TMAA-G1PE Master of Advanced Study in Mathematical Sciences
 - Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
 - Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)

This module is Option list A for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- Year 4 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 5 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list B for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)

This module is Option list C for:

- Year 3 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
 - Year 3 of G106 Mathematics (MMath) with Study in Europe
 - Year 4 of G106 Mathematics (MMath) with Study in Europe

This module is Option list E for:

- Year 5 of USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated