

# Programme Specifications

## Modules offered on Mathematics programmes in 2025-26

| Semester 1                                                          | Semester 2                                                          |
|---------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Level 1</b>                                                      |                                                                     |
| MTH1011 Introduction to Algebra and Analysis (30 CATS) <sup>a</sup> |                                                                     |
| MTH1021 Mathematical Methods 1 (30 CATS)                            |                                                                     |
| MTH1015 Mathematical Reasoning (10 CATS)                            | MTH1025 Algorithmic Thinking (10 CATS)                              |
| SOR1020 Introduction to Probability and Statistics (30 CATS)        |                                                                     |
|                                                                     | SOR1021 Introduction to SOR Methods (10CAT)                         |
| <b>Level 2</b>                                                      |                                                                     |
| MTH2011 Linear Algebra                                              | MTH2013 Metric Spaces                                               |
| MTH2012 Analysis                                                    | MTH2014 Group Theory                                                |
| MTH2031 Classical Mechanics                                         | MTH2021 Mathematical Methods 2                                      |
| SOR2003 Methods of Operational Research                             | SOR2002 Statistical Inference                                       |
| <b>Level 3</b>                                                      |                                                                     |
| MTH3011 Measure and Integration                                     | MTH3021 Dynamical Systems                                           |
| MTH3012 Algebra                                                     | MTH3024 Modelling and Simulation                                    |
| MTH4322 Top. Data Analysis/Geom.of Optim. <sup>b</sup>              | MTH3025 Financial Mathematics                                       |
| MTH3023 Numerical Analysis                                          | MTH4311 Functional Analysis / FA & PDEs <sup>b</sup><br>(SUSPENDED) |
| MTH3031 Classical Fields (SUSPENDED)                                | MTH4332 Statistical Mechanics/Quant. Fields <sup>b</sup>            |
| MTH3032 Quantum Theory                                              | SOR3008 Stat. Data Mining & Machine Learn.                          |
| SOR3004 Linear Models                                               | AMA3011 Applied Mathematics Project                                 |
| SOR3012 Stochastic Processes and Risk                               | AMA3022 Team Project: Maths with Finance                            |
| AMA3011 Applied Mathematics Project                                 | PMA3013/AMA3020 (Mathem.) Investigations                            |
| <b>Level 4</b>                                                      |                                                                     |
| MTH4011 Topology                                                    | MTH4021 Applied Algebra and Cryptography                            |
| MTH4322 Top. Data Analysis/Geom.of Optim. <sup>b</sup>              | MTH4311 Functional Analysis / FA & PDEs <sup>b</sup><br>(SUSPENDED) |
| MTH4024 Practical Methods for PDEs                                  | MTH4022 Information Theory and Biodiversity                         |
| MTH4031 Advanced Quantum Theory                                     | MTH4023 Mathematical Methods for QIP                                |
|                                                                     | MTH4332 Statistical Mechanics/Quant. Fields <sup>b</sup>            |
| SOR4008 Bayesian Statistics                                         | SOR4007 Survival Analysis                                           |
| AMA4005 / PMA4001 / SOR4001 Project (40 CATS)                       |                                                                     |

<sup>a</sup> All modules are 20 CATS unless indicated otherwise.

<sup>b</sup> Modules taught in alternate years that can be taken at Level 3 or Level 4.

<sup>c</sup> Level 2 Employability for Mathematics/Physics (0 CATS) must be taken to take a placement year.

## Degree Programmes

1. BSc Mathematics
  2. BSc Mathematics and Statistics and Operational Research
  3. BSc (Applied) Mathematics and Physics
  4. BSc Theoretical Physics
  5. BSc Mathematics and Computer Science
  6. BSc Mathematics with Finance
  7. BSc Mathematics with French/Spanish
  8. MMath/MSci Mathematics\*
  9. MMath/MSci Mathematics and Statistics and Operational Research
  10. MSci Applied Mathematics and Physics
  11. MPhys/MSci Theoretical Physics
  12. MSci Mathematics and Computer Science
- 

\* On the MMath/MSci Mathematics programme, students are expected to specialise in one of the four *streams*: Analysis/Differential Equations stream, Algebra stream, Quantum stream, Modelling stream. Each of these streams contains a number of compulsory modules, as well as some recommended (r) modules, *in addition to the modules that are compulsory for all MSci (MMath) students*, leading to a Level 4 project in the chosen area of specialisation.

| Stream       | Compulsory and recommended (r) modules |                                                                                                                                             |                                                                                                     |
|--------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|              | Level 2                                | Level 3                                                                                                                                     | Level 4                                                                                             |
| Analysis/DEs |                                        | Dynamical Systems,<br>Functional Analysis/Fourier<br>Analysis & Application to<br>PDEs                                                      | Topology, Functional<br>Analysis/Fourier Analysis &<br>Application to PDEs                          |
| Algebra      | Group Theory                           | Algebra                                                                                                                                     | Topology, Applied Algebra<br>and Cryptography                                                       |
| Quantum      | Classical Mechanics                    | Quantum Theory,<br>Functional Analysis/Fourier<br>Analysis & Application to<br>PDEs, Numerical Analysis<br>or Modelling & Simulation<br>(r) | Advanced Quantum Theory,<br>Functional Analysis/Fourier<br>Analysis & Application to<br>PDEs        |
| Modelling    | Classical Mechanics (r)                | Numerical Analysis,<br>Dynamical Systems,<br>Modelling & Simulation (r)                                                                     | Functional Analysis/Fourier<br>Analysis & Application to<br>PDEs (r), Practical Methods<br>for PDEs |

## BSc Mathematics

Core module

Recommended module

Alternative core modules

| Semester 1                                           | Semester 2                                 |
|------------------------------------------------------|--------------------------------------------|
| <b>Level 1</b>                                       |                                            |
| Introduction to Algebra and Analysis (30 CATS)       |                                            |
| Mathematical Methods 1 (30 CATS)                     |                                            |
| Mathematical Reasoning (10 CATS)                     | Algorithmic Thinking (10 CATS)             |
| Introduction to Probability and Statistics (30 CATS) |                                            |
|                                                      | Introduction to SOR Methods (10 CATS)      |
| <b>Level 2</b>                                       |                                            |
| Analysis                                             | Metric Spaces                              |
| Linear Algebra                                       | Group Theory                               |
| Classical Mechanics                                  | Mathematical Methods 2                     |
| Methods of Operational Research                      | Statistical Inference                      |
| <b>Level 3</b>                                       |                                            |
| Measure and Integration                              | Dynamical Systems                          |
| Algebra                                              |                                            |
| Top. Data Analysis / Geometry of Optimisation        | Financial Mathematics                      |
| Quantum Theory                                       | Statistical Mechanics / Quantum Fields     |
| Linear Models                                        | Statistical Data Mining & Machine Learning |
| Stochastic Processes and Risk                        | Mathematical Investigations                |
| Numerical Analysis                                   | Modelling and Simulation                   |
| Applied Mathematics Project                          | Applied Mathematics Project                |

At Stage 2, students should note the importance of taking Classical Mechanics or Group Theory, or Statistical Inference, as they are pre-requisites for a number of modules at Stage 3. At Stage 3, students must take Numerical Analysis or Modelling and Simulation, and take Applied Mathematics Project in semester 1 or semester 2, or Mathematical Investigations (but not both).

## BSc Mathematics and Statistics and Operational Research

Core module

Recommended module

Alternative core modules

| Semester 1                                           | Semester 2                                 |
|------------------------------------------------------|--------------------------------------------|
| <b>Level 1</b>                                       |                                            |
| Introduction to Algebra and Analysis (30 CATS)       |                                            |
| Mathematical Methods 1 (30 CATS)                     |                                            |
| Mathematical Reasoning (10 CATS)                     | Algorithmic Thinking (10 CATS)             |
| Introduction to Probability and Statistics (30 CATS) |                                            |
|                                                      | Introduction to SOR Methods (10 CATS)      |
| <b>Level 2</b>                                       |                                            |
| Analysis                                             | Metric Spaces                              |
| Linear Algebra                                       | Group Theory                               |
| Classical Mechanics                                  | Mathematical Methods 2                     |
| Methods of Operational Research                      | Statistical Inference                      |
| <b>Level 3</b>                                       |                                            |
| Measure and Integration                              | Dynamical Systems                          |
| Algebra                                              |                                            |
| Top. Data Analysis / Geometry of Optimisation        | Financial Mathematics                      |
| Quantum Theory                                       | Statistical Mechanics / Quantum Fields     |
| Linear Models                                        | Statistical Data Mining & Machine Learning |
| Stochastic Processes and Risk                        | Mathematical Investigations                |
| Numerical Analysis                                   | Modelling and Simulation                   |
| Applied Mathematics Project                          | Applied Mathematics Project                |

Students must take at least 80 CATS of SOR modules across Levels 2 and 3. At Stage 3, students must take Applied Mathematics Project in semester 1 or semester 2, or Mathematical Investigations (but not both).

## BSc Applied Mathematics and Physics

Core module

Recommended module

Core external module

| Semester 1                                     | Semester 2                                |
|------------------------------------------------|-------------------------------------------|
| <b>Level 1</b>                                 |                                           |
| Introduction to Algebra and Analysis (30 CATS) |                                           |
| Mathematical Methods 1 (30 CATS)               |                                           |
| PHY1001 Foundation Physics (40 CATS)           |                                           |
| PHY1004 Scientific Skills (20 CATS)            |                                           |
| <b>Level 2</b>                                 |                                           |
| Analysis                                       | Metric Spaces                             |
| Linear Algebra                                 | Group Theory                              |
| Classical Mechanics                            | Mathematical Methods 2                    |
| PHY2001 Quantum and Statistical Physics        | PHY2004 Electricity, Magnetism and Optics |
| PHY2003 Astrophysics I                         | PHY2002 Physics of the Solid State        |
|                                                | PHY2005 Atomic and Nuclear Physics        |
| <b>Level 3</b>                                 |                                           |
| Measure and Integration                        | Dynamical Systems                         |
| Algebra                                        | Financial Mathematics                     |
| Top. Data Analysis / Geometry of Optimisation  | Statistical Mechanics / Quantum Fields    |
| Quantum Theory/PHY3001 Quant. Mech. & Rel.     | PHY3002 Advanced Solid State Physics      |
| PHY3004 Advanced Electromagnetism & Optics     | PHY3003 Astrophysics II                   |
| PHY3006 Physics in Medicine                    | PHY3005 Nuclear & Particle Physics        |
| Numerical Analysis / PHY3009 Comput. Proj.     | Modelling and Simulation                  |
| Applied Maths Project / PHY3007 Project        | Applied Maths Project / PHY3007 Project   |

At Stage 3, students take either Applied Mathematics Project or PHY3007 Project, in addition to at least 2 taught modules from Mathematics and 2 taught modules from Physics, including Quantum Theory or PHY3001, and Numerical Analysis or Modelling & Simulation, or PHY3009.

## BSc Theoretical Physics

Core module

Recommended module

Core external module

| Semester 1                                     | Semester 2                                |
|------------------------------------------------|-------------------------------------------|
| <b>Level 1</b>                                 |                                           |
| Introduction to Algebra and Analysis (30 CATS) |                                           |
| Mathematical Methods 1 (30 CATS)               |                                           |
| PHY1001 Foundation Physics (40 CATS)           |                                           |
| PHY1004 Scientific Skills (20 CATS)            |                                           |
| <b>Level 2</b>                                 |                                           |
| Linear Algebra                                 | PHY2002 Physics of the Solid State        |
| Classical Mechanics                            | Mathematical Methods 2                    |
| PHY2001 Quantum and Statistical Physics        | PHY2004 Electricity, Magnetism and Optics |
| <b>Level 3</b>                                 |                                           |
| PHY3004 Advanced Electromagn. and Optics       | Statistical Mechanics / Quantum Fields    |
| Quantum Theory                                 | Modelling and Simulation                  |
| Numerical Analysis                             | Financial Mathematics                     |
|                                                | PHY3002 Advanced Solid State Physics      |
|                                                | PHY3005 Nuclear & Particle Physics        |
| Applied Mathematics Project                    | Applied Mathematics Project               |

At Stage 3, students must take 3 compulsory taught modules and the Applied Mathematics Project (in semester 1 or 2), and two optional modules from Mathematics or Physics.

## BSc Mathematics and Computer Science

Core module

Recommended module

Core external module

| Semester 1                                     | Semester 2                                    |
|------------------------------------------------|-----------------------------------------------|
| <b>Level 1</b>                                 |                                               |
| Introduction to Algebra and Analysis (30 CATS) |                                               |
| Mathematical Methods 1 (30 CATS)               |                                               |
| Mathematical Reasoning (10 CATS)               | Algorithmic Thinking (10 CATS)                |
| CSC1025 Procedural Programming                 | CSC1029 Object Oriented Programming           |
| <b>Level 2</b>                                 |                                               |
| Analysis                                       | Metric Spaces                                 |
| Linear Algebra                                 | Group Theory                                  |
| Classical Mechanics                            | Mathematical Methods 2                        |
| CSC2059 Data Structures and Algorithms         | CSC2060 Theory of Computation                 |
| CSC2065 Professional and Transferrable Skills  | CSC2062 Introduction to AI & Machine Learning |
| <b>Level 3</b>                                 |                                               |
| Measure and Integration                        | Dynamical Systems                             |
| Algebra                                        |                                               |
| Top. Data Analysis / Geometry of Optimisation  | Financial Mathematics                         |
| Quantum Theory                                 | Statistical Mechanics / Quantum Fields        |
| Numerical Analysis                             | Modelling and Simulation                      |
| CSC3021 Concurrent Programming                 | CSC3001 Formal Methods                        |
| CSC3067 Video Analytics & Machine Learning     | CSC3066 Deep Learning                         |
|                                                | Mathematical Investigations                   |
| Applied Mathematics Project                    | Applied Mathematics Project                   |

At Stage 2, students take at least 40 CATS from Mathematics and 40 CATS from Computer Science. At Stage 3, the choice must include either Applied Mathematics Project or Mathematical Investigations, in addition to at least 40 CATS from Mathematics and 40 CATS from Computer Science.

## BSc Mathematics with Finance

Core module

Recommended module

Core external module

| Semester 1                                           | Semester 2                                 |
|------------------------------------------------------|--------------------------------------------|
| <b>Level 1</b>                                       |                                            |
| Introduction to Algebra and Analysis (30 CATS)       |                                            |
| Mathematical Methods 1 (30 CATS)                     |                                            |
| Introduction to Probability and Statistics (30 CATS) |                                            |
|                                                      | Introduction to SOR Methods (10 CATS)      |
|                                                      | FIN1001 Financial Institutions and Markets |
| <b>Level 2</b>                                       |                                            |
| Linear Algebra                                       | Mathematical Methods 2                     |
| Methods of Operational Research                      | Statistical Inference                      |
| FIN2006 Financial Decision Making                    | FIN2008 Financial Market Theory            |
| <b>Level 3</b>                                       |                                            |
| Linear Models                                        | Financial Mathematics                      |
| Stochastic Processes and Risk                        | Statistical Data Mining & Machine Learning |
| Numerical Analysis                                   | Team Project: Mathematics with Finance     |

## BSc Mathematics with French/Spanish

Core module

Recommended module

Core external module

| Semester 1                                           | Semester 2                             |
|------------------------------------------------------|----------------------------------------|
| <b>Level 1</b>                                       |                                        |
| Introduction to Algebra and Analysis (30 CATS)       |                                        |
| Mathematical Methods 1 (30 CATS)                     |                                        |
| Mathematical Reasoning (10 CATS)                     | Algorithmic Thinking (10 CATS)         |
| FRH1101 French 1 / SPA1101 Spanish 1 (40 CATS)       |                                        |
| <b>Level 2</b>                                       |                                        |
| Analysis                                             | Metric Spaces                          |
| Linear Algebra                                       | Group Theory                           |
| Classical Mechanics                                  | Mathematical Methods 2                 |
| FRH2101 French 2 / SPA2101 Spanish 2 (40 CATS)       |                                        |
| <b>MTH3999 International Placement – Year Abroad</b> |                                        |
| <b>Level 3</b>                                       |                                        |
| Measure and Integration                              | Dynamical Systems                      |
| Algebra                                              | Financial Mathematics                  |
| Top. Data Analysis / Geometry of Optimisation        | Statistical Mechanics / Quantum Fields |
| Quantum Theory                                       | Mathematical Investigations            |
| Numerical Analysis                                   | Modelling and Simulation               |
| Applied Mathematics Project                          | Applied Mathematics Project            |
| FRH3101 French 3 / SPA3101 Spanish 3 (40 CATS)       |                                        |

At Stage 3, students must take Numerical Analysis or Modelling and Simulation, and take Applied Mathematics Project in semester 1 or semester 2, or Mathematical Investigations (but not both).

## MMath/MSci Mathematics

Core module

Recommended module

Alternative core modules

| Semester 1                                                               | Semester 2                                                                |
|--------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Level 1</b>                                                           |                                                                           |
| Introduction to Algebra and Analysis (30 CATS)                           |                                                                           |
| Mathematical Methods 1 (30 CATS)                                         |                                                                           |
| Mathematical Reasoning (10 CATS)                                         | Algorithmic Thinking (10 CATS)                                            |
| Introduction to Probability and Statistics (30 CATS)                     |                                                                           |
|                                                                          | Introduction to SOR Methods (10 CATS)                                     |
| <b>Level 2</b>                                                           |                                                                           |
| Analysis                                                                 | Metric Spaces                                                             |
| Linear Algebra                                                           | Group Theory <sup>B</sup>                                                 |
| Classical Mechanics <sup>Q</sup>                                         | Mathematical Methods 2                                                    |
| Methods of Operational Research                                          | Statistical Inference                                                     |
| <b>Level 3</b>                                                           |                                                                           |
| Measure and Integration                                                  | Dynamical Systems <sup>A,M</sup>                                          |
| Algebra <sup>B</sup>                                                     |                                                                           |
| Top. Data Analysis / Geometry of Optimisation                            | Financial Mathematics                                                     |
| Quantum Theory <sup>Q</sup>                                              | Statistical Mechanics / Quantum Fields                                    |
| Numerical Analysis <sup>M</sup>                                          | Modelling and Simulation                                                  |
| Linear Models                                                            | Statistical Data Mining & Machine Learning                                |
| Stochastic Processes and Risk                                            | Investigations <sup>Q,M</sup> /Mathematical Investigations <sup>A,B</sup> |
| <b>Level 4</b>                                                           |                                                                           |
| Topology <sup>A,B</sup>                                                  | Applied Algebra and Cryptography <sup>B</sup>                             |
| Top. Data Analysis / Geometry of Optimisation                            | Statistical Mechanics / Quantum Fields                                    |
| Advanced Quantum Theory <sup>Q</sup>                                     | Mathematical Methods for QIP                                              |
| Practical Methods for PDEs <sup>M</sup>                                  | Information Theory and Biodiversity                                       |
|                                                                          |                                                                           |
| Bayesian Statistics                                                      | Survival Analysis                                                         |
| AMA4005 Project <sup>Q,M</sup> / PMA4001 Project <sup>A,B</sup> (40 CAT) |                                                                           |

<sup>A</sup> Modules that must be taken by students on the Analysis stream

<sup>B</sup> Modules that must be taken by students in the Algebra stream

<sup>Q</sup> Modules that must be taken by students in the Quantum stream

<sup>M</sup> Modules that must be taken by students in the Modelling stream

At Stage 2, students should note the importance of taking Classical Mechanics or Group Theory, or Statistical Inference, as they are pre-requisites for a number of modules at Stage 3.

# MMath/MSci Mathematics and Statistics and Operational Research

Core module

Recommended module

Alternative core modules

| Semester 1                                           | Semester 2                                    |
|------------------------------------------------------|-----------------------------------------------|
| <b>Level 1</b>                                       |                                               |
| Introduction to Algebra and Analysis (30 CATS)       |                                               |
| Mathematical Methods 1 (30 CATS)                     |                                               |
| Mathematical Reasoning (10 CATS)                     | Algorithmic Thinking (10 CATS)                |
| Introduction to Probability and Statistics (30 CATS) |                                               |
|                                                      | Introduction to SOR Methods (10 CATS)         |
| <b>Level 2</b>                                       |                                               |
| Analysis                                             | Metric Spaces                                 |
| Linear Algebra                                       | Group Theory                                  |
| Classical Mechanics                                  | Mathematical Methods 2                        |
| Methods of Operational Research                      | Statistical Inference                         |
| <b>Level 3</b>                                       |                                               |
| Measure and Integration                              | Dynamical Systems                             |
| Algebra                                              |                                               |
| Top. Data Analysis / Geometry of Optimisation        | Financial Mathematics                         |
| Quantum Theory                                       | Statistical Mechanics / Quantum Fields        |
| Numerical Analysis                                   | Modelling and Simulation                      |
| Linear Models                                        | Statistical Data Mining & Machine Learning    |
| Stochastic Processes and Risk                        | Investigations / Mathematical Investigations  |
| <b>Level 4</b>                                       |                                               |
| Topology                                             | Applied Algebra and Cryptography              |
| Top. Data Analysis / Geometry of Optimisation        | Fourier Analysis & PDEs / Functional Analysis |
| Advanced Quantum Theory                              | Mathematical Methods for QIP                  |
| Practical Methods for PDEs                           | Information Theory and Biodiversity           |
|                                                      |                                               |
| Bayesian Statistics                                  | Survival Analysis                             |
| SOR4001 Project (40 CAT)                             |                                               |

Students will take at least 120 CATS of SOR modules across Levels 2, 3 and 4.

## MSci Applied Mathematics and Physics

Core module

Recommended module

Core external module

| Semester 1                                     | Semester 2                                   |
|------------------------------------------------|----------------------------------------------|
| <b>Level 1</b>                                 |                                              |
| Introduction to Algebra and Analysis (30 CATS) |                                              |
| Mathematical Methods 1 (30 CATS)               |                                              |
| PHY1001 Foundation Physics (40 CATS)           |                                              |
| PHY1004 Scientific Skills (20 CATS)            |                                              |
| <b>Level 2</b>                                 |                                              |
| Analysis                                       | Metric Spaces                                |
| Linear Algebra                                 | Group Theory                                 |
| Classical Mechanics                            | Mathematical Methods 2                       |
| PHY2001 Quantum and Statistical Physics        | PHY2004 Electricity, Magnetism and Optics    |
| PHY2003 Astrophysics I                         | PHY2002 Physics of the Solid State           |
|                                                | PHY2005 Atomic and Nuclear Physics           |
| <b>Level 3</b>                                 |                                              |
| Measure and Intergation                        | Dynamical Systems                            |
| Algebra                                        | Financial Mathematics                        |
| Top. Data Analysis / Geometry of Optimisation  | Statistical Mechanics / Quantum Fields       |
|                                                |                                              |
| Quantum Theory/PHY3001 Quant. Mech. & Rel.     | PHY3002 Advanced Solid State Physics         |
| PHY3004 Advanced Electromagnetism & Optics     | PHY3003 Astrophysics II                      |
| PHY3006 Physics in Medicine                    | PHY3005 Nuclear & Particle Physics           |
| Numerical Analysis / PHY3009 Comput. Proj.     | Modelling and Simulation                     |
| PHY3008 Professional Skills                    | Investigations / PHY3008 Professional Skills |
| <b>Level 4</b>                                 |                                              |
| Topology                                       | Applied Algebra and Cryptography             |
| Top. Data Analysis / Geometry of Optimisation  | Statistical Mechanics / Quantum Fields       |
| Advanced Quantum Theory                        | Mathematical Methods for QIP                 |
| Practical Methods for PDEs                     | Information Theory and Biodiversity          |
|                                                |                                              |
| PHY4001 Physics Research Project (60 CATS)     | Physics modules (2×10 or 4×10 CATS)          |
| AMA4005 Project (40 CAT)                       |                                              |

At Stage 3, students take Investigations or PHY3008 and at least 2 taught modules from Mathematics and 2 from Physics, including, Quantum Theory or PHY3001, and NA or M&S, or PHY3009. At Stage 4, students take AMA4005 and 40 CATS from Physics, or PHY4001 and 40 CATS from Maths, with additional modules from Maths (1st case) or Physics (2nd case).

## MPhys/MSci Theoretical Physics

Core module

Recommended module

Core external module

| Semester 1                                     | Semester 2                                |
|------------------------------------------------|-------------------------------------------|
| <b>Level 1</b>                                 |                                           |
| Introduction to Algebra and Analysis (30 CATS) |                                           |
| Mathematical Methods 1 (30 CATS)               |                                           |
| PHY1001 Foundation Physics (40 CATS)           |                                           |
| PHY1004 Scientific Skills (20 CATS)            |                                           |
| <b>Level 2</b>                                 |                                           |
| Linear Algebra                                 | PHY2002 Physics of the Solid State        |
| Classical Mechanics                            | Mathematical Methods 2                    |
| PHY2001 Quantum and Statistical Physics        | PHY2004 Electricity, Magnetism and Optics |
| <b>Level 3</b>                                 |                                           |
| PHY3004 Advanced Electromagn. and Optics       |                                           |
| Quantum Theory                                 | Modelling and Simulation                  |
| Numerical Analysis                             | Financial Mathematics                     |
|                                                | PHY3002 Advanced Solid State Physics      |
|                                                | PHY3005 Nuclear & Particle Physics        |
|                                                | Investigations                            |
| <b>Level 4</b>                                 |                                           |
| Advanced Quantum Theory                        | Statistical Mechanics / Quantum Fields    |
| Practical Methods for PDEs                     | Information Theory and Biodiversity       |
|                                                | Mathematical Methods for QIP              |
|                                                | Physics modules (2×10 CATS)               |
| AMA4005 Project (40 CAT)                       |                                           |

At Stage 4 students can take two appropriate 10 CATS Physics modules: PHY4003 Ionising Radiation in Medicine, PHY4004 Medical Radiation Simulation, PHY4007 Laser Physics, PHY4008 Plasma Physics, PHY4009 Physics of Materials Characterisation, PHY4010 Physics of Nanomaterials, PHY4016 Cosmology.

## MSci Mathematics and Computer Science

Core module

Recommended module

Core external module

| Semester 1                                                               | Semester 2                                                                |
|--------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Level 1</b>                                                           |                                                                           |
| Introduction to Algebra and Analysis (30 CATS)                           |                                                                           |
| Mathematical Methods 1 (30 CATS)                                         |                                                                           |
| Mathematical Reasoning (10 CATS)                                         | Algorithmic Thinking (10 CATS)                                            |
| CSC1025 Procedural Programming                                           | CSC1029 Object Oriented Programming                                       |
| <b>Level 2</b>                                                           |                                                                           |
| Analysis <sup>A</sup>                                                    | Metric Spaces <sup>A</sup>                                                |
| Linear Algebra                                                           | Group Theory <sup>B</sup>                                                 |
| Classical Mechanics <sup>Q</sup>                                         | Mathematical Methods 2 <sup>Q,M</sup>                                     |
| CSC2059 Data Structures and Algorithms                                   | CSC2060 Theory of Computation                                             |
| CSC2065 Professional and Transferrable Skills                            | CSC2062 Introduction to AI & Machine Learning                             |
| <b>Level 3</b>                                                           |                                                                           |
| Measure and Integration <sup>A</sup>                                     | Dynamical Systems                                                         |
| Algebra <sup>B</sup>                                                     | Financial Mathematics                                                     |
| Top. Data Analysis / Geometry of Optimisation                            | Modelling and Simulation                                                  |
| Quantum Theory <sup>Q</sup>                                              | Statistical Mechanics / Quantum Fields                                    |
| Numerical Analysis <sup>M</sup>                                          |                                                                           |
| CSC3021 Concurrent Programming                                           | CSC3001 Formal Methods                                                    |
| CSC3067 Video Analytics & Machine Learning                               | CSC3066 Deep Learning                                                     |
|                                                                          | Investigations <sup>Q,M</sup> /Mathematical Investigations <sup>A,B</sup> |
| <b>Level 4</b>                                                           |                                                                           |
| Topology <sup>A,B</sup>                                                  | Applied Algebra and Cryptography <sup>B</sup>                             |
| Top. Data Analysis / Geometry of Optimisation                            | Statistical Mechanics / Quantum Fields                                    |
| Advanced Quantum Theory <sup>Q</sup>                                     | Mathematical Methods for QIP                                              |
| Practical Methods for PDEs <sup>M</sup>                                  | Information Theory and Biodiversity                                       |
| CSC4008 Digital Transformation: ...                                      | CSC4003 Algorithms: Analysis and Application                              |
| AMA4005 Project <sup>Q,M</sup> / PMA4001 Project <sup>A,B</sup> (40 CAT) |                                                                           |

At Stage 2 students take at least 40 CATS from Mathematics and 40 CATS from Computer Science. At Stage 3, the choice must include either Investigations or Mathematical Investigations, in addition to at least 40 CATS from Mathematics and 40 CATS from Computer Science. Superscripts A, B, Q and M indicate modules recommended for students intending to pursue the Analysis, Algebra, Quantum or Modelling streams at Stages 2-4.