# University of Huddersfield

# Programme Specification

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| 1 | Awarding Institution | University of Huddersfield |
| 2 | **Teaching Institution**  | University of Huddersfield |
| 3 | **School and Department** | Computing and Engineering, Department of Computer Science |
| 4 | **Course Accredited by:** | Institute of Mathematics and its Applications (IMA) |
| 5 | Mode of Delivery | Full Time / Sandwich |
| 6 | Final Award | MMath, BSc (Hons) |
| 7 | Course Title | Mathematics  |
| 8 | UCAS Code | n/a |
| 9 | **Subject Benchmark Statement** | Mathematics, Statistics and Operational Research (2019) |
| 10 | Date of Programme Approval | January 2020, August 2020, June 2021, January 2022, March 2022 |

**11 Educational aims of the Programme**

This course is designed to blend together core topics in mathematics, statistics and operational research to provide students with a rich and diverse learning experience equipping them with the advanced skills and understanding needed to solve a wide range of complex real-world mathematical problems. Within a supportive teaching environment, the program will develop problem solving skills, individual and team-working skills and stimulate students’ interests in a wide range of modern applications of mathematics, statistics and operational research.

The course will develop highly numerate, professional mathematicians capable of applying both analytical and numerical skills to determine solutions to a diverse range of problems. By applying intellectual rigour and logical reasoning, alongside more generic skills such as team-working, organisation and communication skills, students will develop skills highly sought after by employers in a range of fields. Typical employment routes include the natural and physical sciences, economics, actuarial science, accountancy, informatics, computer science and engineering. Graduates will also find themselves well equipped to progress on to teacher training or further study at Masters or PhD level.

*The main aims of the programme, which are aligned to the QAA Subject Benchmark, are to:*

1. Instil into students an appreciation of the importance of mathematics, statistics and operational research in solving real-world problems and to prepare them for a career in industry.
2. Develop, through an education in mathematics, statistics and operational research, a range of transferable skills, including scientific computing and IT skills, project management and design skills, problem solving skills, logical thinking and communication skills of value in employment.
3. Develop, in students, an ability to apply their mathematical knowledge and skills to the solution of a wide range of theoretical and practical problems drawn from industry and from research.
4. Provide specialised knowledge in specific areas of mathematics, statistics and operational research that align with current, internationally-leading research within the Department.
5. Through alignment with current, internationally-leading research within the Department, produce students that have a critical awareness of current problems and new insights at the forefront of research. They should be able to evaluate current research and methodologies, develop critiques, show originality in the application of knowledge and, where appropriate, propose new hypotheses.
6. Provide graduates with the knowledge and skills required for further study and research in mathematics, computing and related areas.
7. Provide graduates with a high level of skills to identify and use the mathematical tools (including some advanced techniques) required to solve a problem in applications such as Data Science, Artificial Intelligence, Engineering, etc.
8. Develop, through the application of the mathematical and computational tools to the real-life problems the ability to plan, develop and evaluate the advanced and complex industrial and research projects.

**12** **Intended learning outcomes**

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| Knowledge and Understanding |
| Students will have basic knowledge and understanding of:1. Mathematical methods and techniques of key areas in a) mathematics, b) statistics, and c) operational research, including common ground topics, such as calculus and linear algebra.
2. Results from a range of major areas of a) mathematics, b) statistics and c) operational research
3. How and when mathematical methods from major areas of a) mathematics, b) statistics and c) operational research can be applied.
4. The role and use of assumptions; the power of generalisation and abstraction and how it can be applied to problem-solving
5. A range of modelling techniques, including model validation, model validation and revision, optimisation, and conditions and limitations
6. The role of numerical approximation and numerical computing, its application to a wide range of problems, including stability analysis, convergence and error rates and the effects of finite precision arithmetic on the computing process.

Students will have a systematic understanding of core knowledge (including advanced topics)  (M7) In a) statistics b) data science c) artificial intelligence d) logical reasoning and e) mathematical modelling. |

|  Professional, Practical and Subject Specific Skills |
| --- |
| Students will be able to:1. Demonstrate knowledge of key topics in areas of a) mathematics, b) statistics and c) operational research, including by application to solve real-life problems
2. Analyse a given problem, including real-world problems, in terms of its abstracted components, including any assumptions and constraints, and represent that problem mathematically using appropriate symbolic notation. Grasp how mathematical process may be applied to it.
3. Select appropriate solution methods to a range of analytically and numerically formulated problems, analyse the quality of the solutions found and present conclusions.
4. Create, design and execute practical investigations from the problem recognition stage through to the evaluation and appraisal of the results.
5. Interpret essential facts, concepts, principles and theories, develop arguments and make distinctions and design choices based upon this.
6. Describe solutions to qualitative and quantitative problems of a familiar and unfamiliar nature and discriminate between different methodologies and approaches.
7. Interpret experimental results in terms of their statistical significance and underlying theory; present mathematical arguments, using appropriate notation
8. Illustrate mathematical and statistical results and conclusions clearly and correctly, in writing and orally, to a variety of audiences and show an ability to both question and exemplify the results and present new hypothesis.
9. Use computers and software for data processing, problem design, retrieving and interpreting scientific information.
10. Critically evaluate novel problems and plan and deploy strategies for their solution using techniques which are at the forefront of the discipline. Apply comprehensive and deep understanding of solution processes and methodologies to unfamiliar situations.

Students will be able to:(M18) Effectively develop and apply mathematical and logical concepts to design and perform advanced modelling in applications such as a) data science, b) artificial intelligence and c) engineering.(M19) Show good judgement in the application of mathematical tools to solve unfamiliar and complex problems within the studied areas |

| Transferrable Skills |
| --- |
| Students will have:1. Interpersonal skills, including the ability to co-operate with others and work as part of a team and develop an awareness of group dynamics.
2. Information technology and scientific computational skills, including the use of general and specialist software.
3. Verbal and written communication skills which show the ability to summarise scientific information and statistical data, interpret results, and compose, present and justify arguments, making the presentation clear for either specialists or non-specialists.
4. Time management and organisational skills – the ability to initiate, co-ordinate and direct programmes of work and study, including a major research project.
5. Information retrieval skills, including on-line searches and primary literature research skills.
6. Study skills for continuing personal development including the ability to apply the above skills in a wide range of mathematical situations and adaptability
7. The ability to transfer knowledge from one context to another; the ability to assess problems logically

(M27) The ability to work independently, critically evaluate their own strength and weaknesses.(M28) The ability to plan and develop advanced projects in a) statistics, b) data science and c) operational research. |

###### 13 Programme structures and requirements, levels, modules, credits and awards:

**Course Structure**

The course has been designed to meet the QAA Benchmark Statement for Mathematics, Statistics and Operational Research

<https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-mathematics-statistics-and-operational-research.pdf?sfvrsn=e8f3c881_4>

Consolidation and development of the student’s fundamental mathematical skills is initiated in the first year where knowledge of the under-pinning mathematics and statistics is delivered. Subject-specific skills are developed in the context of a broad range of problem solving activities allowing students to develop knowledge of key mathematical concepts and topics both explicitly and by application to the solution of problems. Use of this knowledge is further amplified in the Applied Mathematics module with a focus on application to real world problems. Students are thus able to comprehend problems, abstract the essential elements and formulate solutions both mathematically and symbolically, so facilitating problem analysis and solution.

Throughout the course, students will gain the necessary knowledge and experience to develop logical mathematical arguments with clear appreciation of underlying assumptions and conclusions. Mathematical study will be reinforced throughout by the use of computers and relevant software packages appropriate to the level of study. Through individualised and collaborative analysis students will present their mathematical arguments and conclusions using appropriate mathematical notation.

The creative and innovative skills necessary for successful assessment of problems in a given field and the ability to transfer knowledge from one context to another, with logical appraisal and analytical approach are reinforced. Specific application of these skills is introduced in year one in the Introduction to Modelling and Problem Solving module and is further enhanced in Mathematical Programming and in Applied Mathematics. Year 2 modules build further on these problem solving skills in both Advanced Statistical Methods and in Mathematical Methods and Modelling’. The specific application of these skills is developed in the second year Mathematics Group Project. In addition, students will normally further apply their problem solving and analytical skills in the fourth year Individual Project.

Throughout the course, students will gain an appreciation of the social, environmental, ethical, economic and commercial considerations impacting on real world problem solving activities and will be able to place their activities within a broader picture. These aspects are embedded in a variety of modules but are explicitly addressed in the Year 1 Introduction to Modelling and Problem Solving module, the Year 2 Group Project and the Year 4 Individual Project.

A wide range of practical skills are delivered including advanced computer analysis practice and programming skills which form an integral part of the study and application process at all levels. Computer aided solutions are derived in Introduction to Modelling and Problem Solving, Mathematical Programming and Applied Mathematics in Year 1 as well as in the Group Project, Operational Research, and Advanced Statistical Analysis in Year 2. Analytical and transferable problem solving skills are further developed along with computer-based analysis in the final year of the course. Project-based assignments are incorporated in all years of the programme.

During Year 1 students will build an online PDP during the ‘Introduction to Modelling and Problem Solving’ module. This will be enhanced in the second year in the ‘Year 2 Group Project (Mathematics)’ and monitored through the interaction with placement unit in the Year 3 and Personal Academic Tutors in Year 2. During the final year, support will be given through final year project supervision sessions to maintain and further enhance the PDPs.

The modules on years 1, 2 and 4 of the course are delivered over a 24-week teaching period followed by a 3-week assessment period. Year 3 of the programme comprises a monitored Professional Placement with a minimum duration of 48 weeks. The professional placement does not contribute to the final degree classification but is recognised in the ‘Sandwich’ award.

Students on BSc (Hons) Mathematics course, who successfully complete Year 1/Year 2/the BSc (Hons) award with a minimum award of a 2:1 honours degree (i.e. a classification profile of at least 60%) will then be offered progression to the integrated master’s enhanced year of study.

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| --- | --- | --- | --- | --- | --- |
| **Module Code** | **Module Name** | **Level** | **Credits** | **Term (Block)** | **Type** |
| **CFM2101** | Introduction to Modelling and Problem Solving | F (FHEQ 4) | 20 | Term 1 | Core |
| **CFM2102** | Calculus | F (FHEQ 4) | 20 | Term 1 | Core |
| **CFM2106** | Probability Theory and Statistical Analysis | F (FHEQ 4) | 20 | Term 1 | Core |
| **CFM2103** | Mathematical Programming | F (FHEQ 4) | 20 | Term 2 | Core |
| **CFM2104** | Applied Mathematics | F (FHEQ 4) | 20 | Term 2 | Core |
| **CFM2105** | Linear Algebra | F (FHEQ 4) | 20 | Term 2 | Core |
| **CIM2201** | Real Analysis | I (FHEQ 5) | 20 | Term 1 | Core |
| **CIM2204** | Operational Research | I (FHEQ 5) | 20 | Term 1 | Core |
| **CIM2205** | Asymptotic and Perturbation Methods | I (FHEQ 5) | 20 | Term 1 | Core |
| **CIM2202** | Mathematical Methods and Modelling | I (FHEQ 5) | 20 | Term 2 | Core |
| **CIM2203** | Advanced Statistical Methods | I (FHEQ 5) | 20 | Term 2 | Core |
| **CIM2206** | Group Project | I (FHEQ 5) | 20 | Term 2 | Core |
| **CSP2010** | Personal Social and Technical Skills | S | 60 | Yearlong | Optional\* |
| **CSP2020** | Self-Assessment Skills | S | 60 | Yearlong | Optional\* |
| **CSP2025** | Enterprise in Action | S | 120 | Yearlong | Optional\* |
| **CHM2403** | Big Data Analytics | H (FHEQ 6) | 20 | Term 1 | Core |
| **CHM2402** | Partial Differential Equations | H (FHEQ 6) | 20 | Term 1 | Core |
| **CHM2404** | Numerical Analysis | H (FHEQ 6) | 20 | Term 2 | Core |
| **CHM2401** | Applied Data Analysis | H (FHEQ 6) | 20 | Term 2 | Core |
| **CHM2405** | Individual Project (Maths) | H (FHEQ 6) | 40 | Yearlong | Core |
| **CMI3416** | Effective Research and Professional Practice | M (FHEQ 7) | 15 | Term 1 (1) | Core |
| **CMI3505** | Knowledge Representation and Reasoning | M (FHEQ 7) | 15 | Term 1 (2) | Core |
| **CMM3501** | Advanced Mathematical Methods | M (FHEQ 7) | 30 | Term 1 (3)/ Term 1 (4) | Core |
| **CMI3506** | Case Studies in Data Analytics and Artificial Intelligence | M (FHEQ 7) | 15 | Term 2 (1) | Core |
| **CMI3504** | Artificial Intelligence Planning | M (FHEQ 7) | 15 | Term 2 (2) | Option-A\* |
| **CMS3505** | Data Visualisation | M (FHEQ 7) | 15 | Term 2 (2) | Option-A\* |
| **CMM3503** | Advanced Mathematical Modelling | M (FHEQ 7) | 30 | Term 2 (3)/ Term 2 (4) | Core |

\*Students take 1 from OPTION-A. Sandwich Year (Level S) is optional.

**Programme Level and Awards**

MMath Mathematics will be awarded upon successful completion of modules which give the student 480 academic credits at foundation, post-foundation and Integrated Master's degree levels. These credits must also include 120 credits at Integrated Master's level (consisting of 4 core modules and 2 optional modules).

BSc (Hons) Mathematics will be awarded upon successful completion of modules which give the student 360 academic credits at foundation and post-foundation level. These credits must include 120 at honours level, including the credits from the relevant Year 4 Individual Project module.

BSc Mathematics will be awarded upon successful completion of modules totalling 300 academic credits at foundation and post-foundation level. These credits must include 60 at honours level.

DipHE (Diploma of Higher Education) Mathematics will be awarded to students gaining 240 credits of which at least 120 must be I and/or H level.

CertHE (Certificate of Higher Education) Mathematics will be awarded to students gaining 120 foundation level credits

###### 14 Teaching, Learning and Assessment

A variety of teaching and learning strategies are used appropriate to the nature of the material being delivered. The nominal mean workload on students is 10 hours per credit.

Typically, lectures are used as a mechanism to deliver key facts, concepts, theories and methodologies. These may be backed up by tutorial and/or practical sessions. These sessions allow students to develop their skills, to receive feedback on their progress and to take ownership of their own learning.

In some subject areas, particularly the group-based module, teaching may be studio-based and/or delivered using group seminars.

Use is made of IT resources in teaching across the full range of subjects. This may be in the form of materials made available via the VLE, electronic forums, simulations and examples. Students are introduced to the University and Departmental systems for C&IT through induction and in the Introduction to Modelling and Problem Solving module.

Formative assessment will be provided in a variety of ways. Whenever practical, students will be given individual feedback on their progress prior to formal assessment. This may be in the form of oral feedback on work reviewed in a tutorial, seminar or studio session or written feedback on a piece of work submitted prior to assessment. Formative assessment is a student driven process.

Assessment is used to determine if students have achieved the learning outcomes of individual modules and hence, the learning outcomes of the programme. A number of forms of assessment are used. These may include portfolios of work, essays, reports on group work, audio-visual presentations (both individually and as a member of a group), computer-based tests, short tests and formal examinations. In all cases, assessment is governed the University’s Regulations for Awards as reproduced in the [Students’ Handbook of Regulations](https://www.hud.ac.uk/policies/registry/regs-taught/).

The assessment to be used in individual modules is indicated in appendix 2.

The University complies fully with the Special Educational Needs and Disabilities Act. The wide variety of delivery and assessment methods used makes the course accessible to students with a range of special educational needs and/or disabilities, for example a Personal Support Learning Plan (PSLP) or software designed to help the students with disabilities. The course materials go in line with accessibility statement.

###### 15 Support for students and their learning

**University Level**

A range of central facilities are provided to support students:

* Student Services provide specialist advice in the areas of counselling, disability, pastoral care and chaplaincy, accommodation, finance and careers; it also supports a day-care nursery and job shop for part-time work.
* The Learning Centre (library and computing facilities) provides induction and on-going support for students.
* The International Office provides help and support for overseas students.

**Programme Level**

* All students undertake an induction programme in year 1.
* All students have a Personal Academic Tutor. The Personal Academic Tutor role is seen as an important one, offering students a clearly identified and accessible ‘contact person’ for academic concerns. The Personal Academic Tutor is responsible for providing students with advice and guidance concerning academic performance and progress as well as supporting and advising students with personal difficulties by directing them to the appropriate School/University support services. Respecting student confidentiality, they report to the Course Leader or Guidance Team about any student whose progress is a cause for concern. Tutors advise students to make use of all of the University support services for T&L and pastoral support as well as the Students’ Union.
* Year Tutors are available to provide guidance on academic progress.
* Module Tutors are available to help with academic problems specific to the modules they deliver.
* An Academic Skills Tutor is available to provide assistance with generic study, and other, skills.
* A central computer-based attendance monitoring scheme is operated and students with poor attendance are contacted and advised.
* Student Guidance and Support Officers are available to help students who are experiencing difficulties with attendance and/or other aspects of their studies.
* Supporting documentation is provided in the form of student handbooks, module handbooks, programme specifications and module specifications.
* The virtual-learning environment, Brightspace, is used to support all modules and year groups.
* Lecture Capture is available for a large number of taught classes to aid student learning.
* The Placement Unit provide support throughout the application and placement process.

**Personal Development Planning (PDP)**

* All students are introduced to and encouraged to undertake PDP.
* Personal Tutors will meet their students at least five times: twice in term 1, twice in term 2 and once in term 3.
* Personal tutors are the Year Tutors for Years 1 and 2, and the Project Supervisor for Year 4
* PDP skills are covered throughout the course;

A brief outline of the main personal and professional competences and areas where addressed are listed in the tables below;

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| --- | --- | --- | --- |
| Competencies | Course Year | Areas where addressed | Evidence |
| PersonalCommunication SkillsGroup WorkWriting skillsProfessionalIT Skills (IT)Analytical Skills (AS)Problem Solving (PS1)Practical Skills(PS2)Technical KnowledgeManagerial | Year 1 | * CFM2101 Introduction to Modelling and Problem Solving
* CFM2103 Mathematical Programming
* CFM2106 Probability Theory and Statistical Analysis
* Personal Tutor (PT) PDP process
 | * Individual report for CFM2101
* Portfolio for CFM2103 and for CFM2106
* Completed PDP proforma from PT PDP process
 |
| PersonalTime Management andSelf OrganisationGroup WorkingWriting skills Communication skillsIndependent LearnerCareer PlanningProfessionalIT Skills (IT)Analytical Skills (AS)Problem Solving (PS1)Practical Skills(PS2)Technical KnowledgeManagerial | Year 2 | * CIM2203 Advanced Statistical Methods
* CIM2206 Group Project
* Personal Tutor PDP process
 | * Group report for CIM2203
* Individual report for CIM2206
* Completed PDP proforma from PT PDP process
 |
| PersonalSelf awareness/Reflective PracticeIndependent LearnerTime Management andSelf OrganisationWriting skillsPlanning skillsCommunication skillsPresentational skillsCareer PlanningProfessionalIT Skills (IT)Analytical Skills (AS)Problem Solving (PS1)Practical Skills(PS2)Technical KnowledgeManagerial | Year 4 | * CHM2401 Applied Data Analysis
* CHM2403 Big Data Analytics
* CHM2405 Individual Project
* Personal Tutor PDP process
 | * Individual report for CHM2401
* Portfolio for CHM2403
* Project plan report, individual report, poster/oral presentation for CHM2405
* Completed PDP proforma from PT PDP process
 |
| PersonalGroup WorkingSelf awareness/Reflective PracticeIndependent LearnerTime Management andSelf OrganisationWriting skillsPlanning skillsCommunication skillsPresentational skillsCareer PlanningProfessionalIT Skills (IT)Analytical Skills (AS)Problem Solving (PS1)Practical Skills(PS2)Technical KnowledgeManagerial | Year 5 | * CMI3504 Artificial Intelligence Planning
* CMI3505 Knowledge Representation and Reasoning
* CMI3506 Case Studies in Data Analytics and Artificial Intelligence
* CMS3505 Data Visualisation
* CMM3501 Advanced Mathematical Methods
* CMM3503 Advanced Mathematical Modelling
* CMI3416 Effective Research and Professional Practice
* Personal Tutor PDP process
 | * Individual report for CMI3504
* Group report and individual report for CMI3505
* Individual portfolio and poster/oral presentation for CMI3506
* Scholarly and practical solution reports for CMS3503
* Individual Essay for CMS3505
* Report for CMM3501
* Group report for CMM3503
* Individual literature review and proposal for CMI3416
* Completed PDP proforma from PT PDP process
 |

###### 16 Criteria for admission

The recruitment and admissions process endeavors to ensure a good match between the abilities and aptitudes of the applicants and the demands of the programme. The aim is to facilitate widening participation whilst ensuring that students can reasonably expect to succeed on their chosen course. Candidates must be able to satisfy the general admissions requirements of the University of Huddersfield <https://www.hud.ac.uk/policies/registry/awards-taught/section-d/> (section D2.1) and the specific requirements of the course which can be found on the University’s website [https://courses.hud.ac.uk/2020-21/undergraduate/sort:title](https://courses.hud.ac.uk/2020-21/undergraduate/sort%3Atitle)

Those students who wish to progress to the integrated master’s course, for a fifth year, will be considered on a case by case basis.

Candidates with non-standard qualifications and/or experience will be considered on a case by case basis. For candidates with supplementary qualifications and/or experience it may be possible to take this into account and offer these candidates exemption from specific modules, or entry onto a later year of the course.

The overriding consideration in admitting a student to any of these courses is evidence that the student is likely to be able to complete the course satisfactorily.

###### 17 Methods for evaluating and improving the quality and standards of teaching and learning

**Quality and Standards**

* The University’s Teaching and Learning Committee has ultimate responsibility for quality and standards of teaching and learning in the University.
* The School Board, via the School Teaching and Learning Committee has responsibility for implementing University policy through School-defined procedures.
* Periodic School and subject reviews take place on a rolling quinquennial programme and focus inter alia on the arrangements for quality management and enhancement, teaching, learning and assessment, C&IT strategies, the articulation and assurances of standards, external examiner reports and evaluation and links with professional bodies, employers and other external organisations.

**Monitoring, Development and Evaluation**

The Course Committee is responsible for the monitoring and development of the course or programme, taking account of feedback from staff, students and external examiners. Feedback is sought as follows:

* From students through annual course and module evaluation questionnaires, termly Student Panel meetings, input from student members of the Course Committee and the National Student Survey.
* From external examiners through annual reports, course assessment board minutes, assessment moderation reports and informal communication during the year.
* From Professional Standards and Review Bodies through quinquennial reaccreditation visits.

Annual evaluation of the programme is the responsibility of the School Board. The Course Committee prepares an annual evaluation report comprising reporting and evaluation, informed by feedback from staff, students and external examiners and by statistical data.

**Validation of Courses, Modules and Changes**

Course validation takes place under the University's [Quality Assurance Procedures for Taught Programmes](https://www.hud.ac.uk/registry/qualityassurance/). Amendments to programme and module documents are validated by the School Accreditation and Validation Panel.

**Teaching and Learning**

The School Teaching and Learning Committee is tasked with implementing the University's teaching and learning strategy and with fostering innovation in teaching and learning and the dissemination of good practice.

**Staff Development Priorities Include**

Staff Annual Appraisal and institutional staff development courses

Fellowship of the Higher Education Academy

Updating professional developments

Regular course meetings and annual review and planning for subsequent academic year

Engagement in subject specific research conferences, including pedagogical research.

###### 18 Regulation of assessment

The assessment regulations are as detailed in the University of Huddersfield Regulations for Awards, relevant sections of which are repeated in the Students' Handbook of Regulations. These regulations are not repeated here, since the University periodically changes the regulations.

Details of student regulations can be found in:

[www.hud.ac.uk/registry/regulationsandpolicies/studentregs/](https://www.hud.ac.uk/registry/regulationsandpolicies/studentregs/)

Course Specific Progression Requirements

* Year 2 to Year 3/4
* normally, a minimum average mark for the year of 60% or above.
* Year 4 to Year 5
* normally, a minimum average mark for the year of 60% or above,
* the Individual Project module to be passed at the first attempt.
* Year 4 students who are unable to progress to Year 5 or elect not to continue will be eligible for a Bachelor’s degree with honours award, as detailed in the University of Huddersfield Regulations for Awards.

Applicable for student entry from academic year 2020-2021

* The Integrated Master’s Degrees (second cycle award) receive classification awards, using the same system for the Bachelor’s degree (first cycle), namely First Class, Upper Second Class, Lower Second Class, or Third Class.

Master’s Award Classification Calculation

* On completion of a Master’s course the classification will be determined by the weighted numerical year credit average, as follows:

On Master’s courses where the Placement year is included and graded.

M-level: weighting of 3 - 120 credit average.

H-Level: weighting of 2 - ‘best’ 100 credit average.

S-level: weighting of 1 - 120 credit average.

I-Level: weighting of 1 - ‘best’ 100 credit average.

On completion of a Master’s course where the Placement year is not undertaken, the classification will be determined by the weighted numerical year credit average, as follows:

M-level: weighting of 3 - 120 credit average.

H-Level: weighting of 2 - ‘best’ 100 credit average.

I-Level: weighting of 1 - ‘best’ 100 credit average.

###### 19 Indicators of quality and standards

Reports of validation panels

Annual course reviews

Annual evaluation report

External examiners’ reports

Qualifications and experience of staff

Report on University Review

The program will be offered for accreditation by the Institution of Mathematics and its Applications (IMA). Accreditation will normally constitute quintennial external audit/review.

In the periods between professional institution accreditation visits, quality will be monitored and maintained via the external examining system. The teaching quality of staff responsible for delivering course modules will be assured by a mandatory FHEA requirement. An additional quality indicator will be the significant involvement in the delivery of the programme of staff contributing to Research Excellence Framework submissions.

**Please note: This specification provides a concise summary of the main features of the Programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the study module guide(s) and course handbook. The accuracy of the information contained in this document is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.**

**Key sources of information about the course can be found in:**

Student Handbook (Issued yearly)

University of Huddersfield Student Handbook of Regulations (issued yearly)

University of Huddersfield Prospectus (issued yearly)

[www.hud.ac.uk](http://www.hud.ac.uk/) - University website

http://compeng.hud.ac.uk/internal-student/ - the School of Computing and Engineering intranet contains Year Handbooks and Module Specifications.

# Appendix 1. Mapping of learning outcomes on to modules

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| Year 1 Full Time - Foundation Level |
| CFM2101 | Introduction to Modelling and Problem Solving | Core | 20 Credits |
| CFM2102 | Calculus | Core | 20 Credits |
| CFM2103 | Mathematical Programming | Core | 20 Credits |
| CFM2104 | Applied Mathematics | Core | 20 Credits |
| CFM2105 | Linear Algebra | Core | 20 Credits |
| CFM2106 | Probability Theory and Statistical Analysis | Core | 20 Credits |

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| --- | --- | --- | --- | --- | --- | --- |
| Learning Outcome | CFM2101 | CFM2102 | CFM2103 | CFM2104 | CFM2105 | CFM2106 |
| 1 | √a | √a | √a | √a | √ | √b |
| 2 |  | √ |  | √a | √ | √b |
| 3 | √a | √ |  |  |  | √b |
| 4 |  |  |  |  |  |  |
| 5 | √ |  |  | √ |  |  |
| 6 |  |  |  |  |  |  |
| M7 |  |  |  |  |  |  |
| 8 | √a |  |  | √a |  | √b |
| 9 | √ | √ | √ |  | √ |  |
| 10 |  | √ | √ |  | √ | √ |
| 11 |  |  | √ |  | √ | √ |
| 12 |  | √ | √ |  | √ | √ |
| 13 |  | √ |  |  | √ |  |
| 14 |  |  |  |  |  | √ |
| 15 |  |  |  |  |  | √ |
|  16 |  |  | √ |  | √ |  |
| 17 |  | √ |  |  |  |  |
| M18 |  |  |  |  |  |  |
| M19 |  |  |  |  |  |  |
| 20 | √ |  |  |  |  |  |
| 21 |  |  | √ |  | √ | √ |
| 22 |  | √ |  |  |  |  |
| 23 |  |  | √ |  |  |  |
| 24 |  |  | √ |  |  |  |
| 25 |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |
| M27 |  |  |  |  |  |  |
| M28 |  |  |  |  |  |  |

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| Year 2 Full Time - Intermediate Level |
| CIM2201 | Real Analysis | Core | 20 Credits |
| CIM2202 | Mathematical Methods and Modelling | Core | 20 Credits |
| CIM2203 | Advanced Statistical Methods | Core | 20 Credits |
| CIM2204 | Operational Research  | Core | 20 Credits |
| CIM2205 | Asymptotic and Perturbation Methods | Core | 20 Credits |
| CIM2206 | Group Project  | Core | 20 Credits |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Learning Outcome | CIM2201 | CIM2202 | CIM2203 | CIM2204 | CIM2205 | CIM2206 |
| 1 | √a | √a | √b | √c |  |  |
| 2 | √a |  | √b | √c | √a |  |
| 3 |  | √a | √b | √c | √a | √ |
| 4 | √ |  |  |  |  | √ |
| 5 | √ |  | √ | √ | √ | √ |
| 6 |  |  | √ |  |  | √ |
| M7 |  |  |  |  |  |  |
| 8 | √a | √a | √b | √c | √a | √ |
| 9 | √ | √ |  | √ | √ | √ |
| 10 | √ | √ |  |  | √ |  |
| 11 | √ |  | √ |  |  | √ |
| 12 | √ |  | √ |  |  | √ |
| 13 | √ |  |  |  |  | √ |
| 14 | √ |  | √ |  | √ |  |
| 15 | √ |  | √ |  |  | √ |
|  16 | √ |  | √ |  |  | √ |
| 17 | √ |  |  |  | √ | √ |
| M18 |  |  |  |  |  |  |
| M19 |  |  |  |  |  |  |
| 20 | √ |  |  |  |  | √ |
| 21 |  |  | √ |  |  | √ |
| 22 | √ | √ | √ |  |  | √ |
| 23 | √ |  | √ |  |  | √ |
| 24 | √ |  |  | √ |  | √ |
| 25 | √ |  |  |  |  | √ |
| 26 |  |  |  |  |  | √ |
| M27 |  |  |  |  |  |  |
| M28 |  |  |  |  |  |  |

|  |
| --- |
| Year 4 Full Time - Honours Level |
| CHM2401 | Applied Data Analysis | Core | 20 Credits |
| CHM2402 | Partial Differential Equations | Core | 20 Credits |
| CHM2403 | Big Data Analytics | Core | 20 Credits |
| CHM2404 | Numerical Analysis | Core | 20 Credits |
| CHM2405 | Individual Project | Core | 40 Credits |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Learning Outcome | CHM2401 | CHM2402 | CHM2403 | CHM2404 | CHM2405 |
| 1 |  |  |  |  |  |
| 2 | √c | √a | √c | √a |  |
| 3 | √c | √a | √c | √a | √ |
| 4 |  |  |  |  |  |
| 5 | √ | √ | √ |  |  |
| 6 | √ |  | √ | √ |  |
| M7 |  |  |  |  |  |
| 8 | √c | √a | √c | √a | √ |
| 9 |  | √ |  | √ |  |
| 10 |  | √ |  | √ |  |
| 11 | √ |  | √ |  | √ |
| 12 |  | √ |  |  | √ |
| 13 | √ |  | √ |  | √ |
| 14 | √ |  | √ |  | √ |
| 15 | √ |  | √ | √ |  |
|  16 | √ |  | √ | √ | √ |
| 17 | √ |  | √ | √ | √ |
| M18 |  |  |  |  |  |
| M19 |  |  |  |  |  |
| 20 |  | √ |  | √ |  |
| 21 | √ |  |  | √ |  |
| 22 | √ |  |  |  |  |
| 23 | √ |  |  |  |  |
| 24 | √ |  |  |  |  |
| 25 |  |  |  |  |  |
| 26 |  |  |  |  | √ |
| M27 |  |  |  |  |  |
| M28 |  |  |  |  |  |

|  |
| --- |
| Year 5 Full Time – Integrated Master's degree |
| CMI3416 | Effective Research and Professional Practice | Core | 15 | 1 |
| CMM3501 | Advanced Mathematical Methods | Core | 30 | 1 |
| CMI3505 | Knowledge Representation and Reasoning | Core | 15 | 2 |
| CMM3503 | Advanced Mathematical Modelling | Core | 30 | 2 |
| CMI3506 | Case Studies in Data Analytics and Artificial Intelligence | Core | 15 | 2 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Learning Outcome | CMI3416 | CMI3506 | CMM3501 | CMI3505 | CMM3503 |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  | √ | √ |  |  |
| 4 |  |  |  |  |  |
| 5 |  | √ | √ |  | √ |
| 6 |  |  |  |  |  |
| M7 |  | √ (b,c) | √ e | √ d | √ e |
| 8 |  | √ b | √ a |  | √ a |
| 9 |  |  | √ |  | √ |
| 10 |  |  | √ |  | √ |
| 11 |  |  |  |  | √ |
| 12 |  |  |  |  | √ |
| 13 |  | √ | √ |  | √ |
| 14 |  |  |  |  |  |
| 15 |  |  |  |  | √ |
|  16 |  | √ |  | √ |  |
| 17 |  | √ | √ | √ |  |
| M18 |  | √ (a,b) | √ c | √ a | √ c |
| M19 |  |  |  |  | √ |
| 20 |  |  |  |  | √ |
| 21 |  | √ |  |  |  |
| 22 | √ |  |  |  | √ |
| 23 | √ |  |  |  | √ |
| 24 | √ | √ | √ |  |  |
| 25 | √ |  | √ |  | √ |
| 26 | √ |  |  |  | √ |
| M27 | √ |  |  |  |  |
| M28 |  |  |  |  | √ c |

# Appendix 2: Course Assessment Board Example Structure:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course** | **Mode of Study** | **Course Start Month** | **Length before CAB** | **Expected Month for Main CAB** |
| MMath, BSc (Hons) Mathematics | UGT FT | September | 9 months | June |

# Appendix 3. Assessment strategies for modules

**YEAR ONE – FOUNDATION LEVEL MODULES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module** **Code** | **Module Title** | **Assessment Weighting** |  |
| **Exam** | **CW** |
| CFM2101 | Introduction to Modelling and Problem Solving |  | 100 |
| CFM2102 | Calculus |  | 100 |
| CFM2103 | Mathematical Programming |  | 100 |
| CFM2104 | Applied Mathematics | 50 | 50 |
| CFM2105 | Linear Algebra | 50 | 50 |
| CFM2106 | Probability Theory and Statistical Analysis | 50 | 50 |

**YEAR TWO – INTERMEDIATE LEVEL MODULES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module****Code** | **Module Title** | **Assessment Weighting** |  |
| **Exam** | **CW** |
| CIM2201 | Real Analysis | 50 | 50 |
| CIM2202 | Mathematical Methods and Modelling | 50 | 50 |
| CIM2203 | Advanced Statistical Methods | 50 | 50 |
| CIM2204 | Operational Research  | 50 | 50 |
| CIM2205 | Asymptotic and Perturbation Methods | 50 | 50 |
| CIM2206 | Group Project  |  | 100 |

**YEAR FOUR – HONOURS LEVEL MODULES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module****Code** | **Module Title** | **Assessment Weighting** |  |
| **Exam** | **CW** |
| CHM2401 | Applied Data Analysis  | 50 | 50 |
| CHM2402 | Partial Differential Equations | 50 | 50 |
| CHM2403 | Big Data Analytics |  | 100 |
| CHM2404 | Numerical Analysis | 50 | 50 |
| CHM2405 | Individual Project |  | 100 |

**YEAR FIVE – INTEGRATED MASTER'S DEGREE MODULES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module****Code** | **Module Title** | **Assessment Weighting** |  |
| **Exam** | **CW** |
| CMM3501 | Advanced Mathematical Methods | 50 | 50 |
| CMI3505 | Knowledge Representation and Reasoning |  | 100 |
| CMM3503 | Advanced Mathematical Modelling |  | 100 |
| CMI3416 | Effective Research and Professional Practice |  | 100 |
| CMI3504 | Artificial Intelligence Planning |  | 100 |
| CMS3505 | Data Visualisation |  | 100 |
| CMI3506 | Case studies in Data Analytics and AI |  | 100 |

OUTLINE ASSESSMENT SCHEDULE (SAMPLE) MMath Year 1

**These are sample dates and would need to be adjusted to fit with other classes for shared modules within the undergraduate framework.**

|  |  |  |
| --- | --- | --- |
| **Week** | **Module(s)** | **Summative Assessment** |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |
| **5** |  |  |
| **6** |  |  |
| **7** | CFM2102 | Calculus Coursework 50% |
| **8** | CFM2103 | Mathematical Programming Component 1: Portfolio 30% |
| **9** | CFM2101 | Introduction to Modelling and Problem Solving Component 1: Coursework 30% |
| **10** | CFM2104 | Applied Mathematics-Component 1: Course Assessment 50% |
| **11** |  |  |
| **12** |  |  |
|  |  |  |
| **13** | CFM2102 | Calculus ICtest 50% |
| **14** |  |  |
| **15** | CFM2101 | Introduction to Modelling and Problem Solving Component 2: Coursework 30% |
| **16** | CFM2103 | Mathematical Programming Component 2: Portfolio 30% |
| **17** | CFM2201 | Linear Algebra Component 1:Coursework 50% |
| **18** | CFM2106 | Probability Theory and Statistical Analysis Component 1: Coursework 50% |
| **19** |  |  |
| **20** |  |  |
| **21** |  |  |
| **22** |  |  |
| **23** | CFM2101 | Introduction to Modelling and Problem Solving Component 3: Coursework 40% |
| **24** | CFM2103 | Mathematical Programming Component 3: Portfolio 30% |

Additionally, CFM2101, CFM2104, CFM2105 and CFM2106 have a summer examination, each contributing 50% towards the relevant module mark, which will take place in weeks 37 to 39 (inclusive).

# OUTLINE ASSESSMENT SCHEDULE (SAMPLE) MMath Year 2

**These are sample dates and would need to be adjusted to fit with other classes for shared modules within the undergraduate framework.**

|  |  |  |
| --- | --- | --- |
| **Week** | **Module(s)** | **Summative Assessment** |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |
| **5** |  |  |
| **6** |  |  |
| **7** |  |  |
| **8** | CIM2206 | Group Project-Component 1: Coursework 30% |
| **9** | CIM2201 | Real Analysis-Component 1: Coursework 50% |
| **10** | CIM2202 | Mathematical Methods and Modelling-Component 1: Coursework 50% |
| **11** | CIM2204 | Operational Research-Component 1: Course assessment 50% |
| **12** | CIM2205 | Asymptotic and Perturbation Methods-Component 1: Coursework 50% |
|  |  |  |
| **13** |  |  |
| **14** |  |  |
| **15** |  |  |
| **16** | CIM2206 | Group Project-Component 2: Coursework 30% |
| **17** |  |  |
| **18** |  |  |
| **19** |  |  |
| **20** |  |  |
| **21** | CIM2203 | Advanced statistical methods- Component 1: Coursework 50% |
| **22** |  |  |
| **23** |  |  |
| **24** | CIM2206 | Group Project-Component 3: Coursework 40% |

Additionally, CIM2201, CIM2202, CIM2203, CIM2204, CIM2205, CIM2105 and CIM2106 have a summer examination, each contributing 50% towards the relevant module mark, which will take place in weeks 37 to 39 (inclusive).

# OUTLINE ASSESSMENT SCHEDULE (SAMPLE) MMath Year 4

**These are sample dates and would need to be adjusted to fit with other classes for shared modules within the undergraduate framework.**

|  |  |  |
| --- | --- | --- |
| **Week** | **Module(s)** | **Summative Assessment** |
| **1** |  |  |
| **2** |  |  |
| **3** | CHM2405 | Year 4 Individual Project-Coursework Component 1 |
| **4** |  |  |
| **5** |  |  |
| **6** |  |  |
| **7** |  |  |
| **8** | CHM2405 | Year 4 Individual Project- Component 1: Coursework 10% |
| **9** | CHM2403 | Big Data Analytics-Component 1: Coursework 30% |
| **10** | CHM2402 | Partial Differential Equations-Component 1: Coursework 50% |
| **11** | CHM2401 | Applied Data Analysis-Component 1: Coursework 50% |
| **12** | CHM2404 | Numerical Analysis –Component1: Coursework 50% |
|  |  |  |
| **13** |  |  |
| **14** | CHM2403 | Big Data Analytics- Component 2: Coursework 30% |
| **15** | CHM2405 | Year 4 Individual Project- Component 2: Coursework 10% |
| **16** |  |  |
| **17** |  |  |
| **18** | CHM2403 | Applied Data Analysis – Summative Case Study Coursework. |
| **19** |  |  |
| **20** |  |  |
| **21** |  |  |
| **22** |  |  |
| **23** |  CHM2403 | Big Data Analytics- Component 3: Coursework 40% |
| **24** | CHM2405 | Year 4 Individual Project- Component 3: Coursework 80% |

Additionally, CHM2401, CHM2402, CHM2404 have a summer examination, each contributing 50% towards the relevant module mark, which will take place in weeks 37 to 39 (inclusive).

# OUTLINE ASSESSMENT SCHEDULE (SAMPLE) MMath Year 5

**These are sample dates and would need to be adjusted to fit with other classes for shared modules within the postgraduate framework.**

|  |  |  |
| --- | --- | --- |
| **Week** | **Module(s)** | **Summative Assessment** |
| **1** |  |  |
| **2** |  |  |
| **3** | CMI3416 | Effective Research and Professional Practice-Component 1: Coursework 50% |
| **4** | CMI3505 | Knowledge Representation and Reasoning-Component 1: Coursework 50% |
| **5** | CMI3416 | Effective Research and Professional Practice-Component 2: Coursework 50% |
| **6** | CMI3505 | Knowledge Representation and Reasoning-Component 2: Coursework 50% |
| **7** |  |  |
| **8** |  |  |
| **9** |  |  |
| **10** | CMM3501 | Advanced Mathematical Methods-Course Assessment 50% |
| **11** |  |  |
| **12** | CMM3501 | Advanced Mathematical Methods-Exam 50% |
|  |  |  |
| **13** |  |  |
| **14** |  |  |
| **15** | CMI3506 | Case Studies in Data Analytics and Artificial Intelligence-Component 1: Coursework 50% |
| **16** | CMI3504 orCMS3505 | Artificial Intelligence Planning-Component 1: Coursework 50% orData Visualisation-Component 1: Coursework 50% |
| **17** | CMI3506 | Case Studies in Data Analytics and Artificial Intelligence-Component 1: Coursework 50% |
| **18** | CMI3504 orCMS3505 | Artificial Intelligence Planning-Component 1: Coursework 50% orData Visualisation-Component 1: Coursework 50% |
| **19** |  |  |
| **20** |  |  |
| **21** |  |  |
| **22** | CMM3503 | Advanced Mathematical Modelling-Component 1: Coursework 50% |
| **23** |  |  |
| **24** | CMM3503 | Advanced Mathematical Modelling-Component 2: Coursework 50% |

# Appendix 4. Subject Benchmark Standards: Mathematics, Statistics and Operational Research

**Benchmark standards for Honours Degree.**

**A graduate who has reached the bachelor's degree with honours threshold level should be able to demonstrate:**

**1.** a reasonable understanding of the basic body of knowledge for the course of study, normally including calculus and linear algebra

2. a reasonable level of skill in calculation and manipulation within this basic body of knowledge and some capability to solve problems formulated within it

3. application of core concepts and principles in well-defined contexts, showing judgement in the selection and application of tools and techniques

4. an understanding of logical arguments, identifying the assumptions made and the conclusions drawn

5. a familiarity with the notion of mathematical modelling and a reasonable level of skill in comprehending problems, formulating them mathematically and obtaining solutions by appropriate methods

6. an ability to communicate straightforward arguments and conclusions reasonably accurately and clearly

7. competent use of appropriate computer technology in mathematics

8. the ability to manage their own learning and make use of appropriate resources.

**A graduate who has reached the integrated master's degree threshold level should be able to demonstrate:**

9. a good understanding of the main body of knowledge for the course of study, including some advanced topics

10. a very good level of skill in calculation and manipulation of the material within this body of knowledge, and be capable of solving complex problems formulated within it

11. application of a range of concepts and principles in loosely defined contexts, showing good judgement in the selection and application of tools and techniques

12. a high level of capability in developing and evaluating logical arguments

13. a familiarity with the notion of mathematical modelling, and ability to abstract the essentials of problems, formulating them mathematically, obtaining solutions by appropriate methods and interpreting these solutions

14. confident communication of arguments and effective and accurate conveyance of conclusions

15. effective use of appropriate computer technology in mathematics

16. the ability to work competently and independently, to be aware of own strengths and to understand when help is needed

17. competence in planning and developing an advanced project themed in mathematics, statistics and operational research

|  |
| --- |
| Year 1 Full Time - Foundation Level |
| CFM2101 | Introduction to Modelling and Problem Solving | Core | 20 Credits |
| CFM2102 | Calculus | Core | 20 Credits |
| CFM2103 | Mathematical Programming | Core | 20 Credits |
| CFM2104 | Applied Mathematics | Core | 20 Credits |
| CFM2105 | Linear Algebra | Core | 20 Credits |
| CFM2106 | Probability Theory and Statistical Analysis | Core | 20 Credits |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Learning Outcome | CFM2101 | CFM2102 | CFM2103 | CFM2104 | CFM2105 | CFM2106 |
| 1 | √ | √ | √ | √ | √ | √ |
| 2 | √ | √ | √ | √ | √ | √ |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 | √ |  |  |  |  |  |
| 7 |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |

|  |
| --- |
| Year 2 Full Time - Intermediate Level |
| CIM2201 | Real Analysis | Core | 20 Credits |
| CIM2202 | Mathematical Methods and Modelling | Core | 20 Credits |
| CIM2203 | Advanced Statistical Methods | Core | 20 Credits |
| CIM2204 | Operational Research  | Core | 20 Credits |
| CIM2205 | Asymptotic and Perturbation Methods | Core | 20 Credits |
| CIM2206 | Group Project  | Core | 20 Credits |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Learning Outcome | CIM2201 | CIM2202 | CIM2203 | CIM2204 | CIM2205 | CIM2206 |
| 1 | √ |  |  | √ | √ |  |
| 2 |  |  |  |  |  |  |
| 3 | √ | √ | √ | √ | √ | √ |
| 4 | √ | √ | √ | √ | √ |  |
| 5 |  |  |  | √ |  |  |
| 6 |  | √ |  |  | √ | √ |
| 7 |  |  | √ |  |  |  |
| 8 |  |  |  |  |  | √ |
| 9 |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |

|  |
| --- |
| Year 4 Full Time - Honours Level |
| CHM2401 | Applied Data Analysis | Core | 20 Credits |
| CHM2402 | Partial Differential Equations | Core | 20 Credits |
| CHM2403 | Big Data Analytics | Core | 20 Credits |
| CHM2404 | Numerical Analysis | Core | 20 Credits |
| CHM2405 | Individual Project | Core | 40 Credits |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Learning Outcome | CHM2401 | CHM2402 | CHM2403 | CHM2404 | CHM2405 |
| 1 |  | √ |  | √ |  |
| 2 |  |  |  |  |  |
| 3 | √ | √ | √ | √ | √ |
| 4 |  | √ | √ |  | √ |
| 5 |  |  |  |  |  |
| 6 |  |  |  | √ | √ |
| 7 | √ |  | √ |  |  |
| 8 |  |  | √ |  | √ |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| 11 |  |  |  |  |  |
| 12 |  |  |  |  |  |
| 13 |  |  |  |  |  |
| 14 |  |  |  |  |  |
| 15 |  |  |  |  |  |
| 16 |  |  |  |  |  |
| 17 |  |  |  |  |  |

|  |
| --- |
| Year 5 Full Time – Integrated Master's degree |
| CMM3501 | Advanced Mathematical Methods | Core | 30 |
| CMI3505 | Knowledge Representation and Reasoning | Core | 15 |
| CMM3503 | Advanced Mathematical Modelling | Core | 30 |
| CMI3416 | Effective Research and Professional Practice | Core | 15 |
| CMI3506 | Case studies in Data Analytics and AI | Core | 15 |
| CMI3504 | Artificial Intelligence Planning | Optional | 15 |
| CMS3505 | Data Visualisation | Optional | 15 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Learning Outcome | CMM3501 | CMI3505 | CMM3503 | CMI 3416 | CMI3504 | CMS3505 | CMI3506 |
| 1 |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |  |
| 9 | √ | √ | √ | √ | √ | √ | √ |
| 10 | √ | √ |  |  |  | √ | √ |
| 11 | √ |  | √ |  |  |  |  |
| 12 |  | √ | √ | √ | √ |  |  |
| 13 | √ |  | √ |  |  |  | √ |
| 14 |  |  | √ | √ |  | √ | √ |
| 15 |  | √ |  |  | √ | √ | √ |
| 16 | √ | √ |  | √ |  | √ |  |
| 17 |  |  | √ |  |  |  | √ |