# Double Major Bachelor of Science (Honours) Programme in Biological Sciences and Mathematical Sciences

## Home School: School of Physical and Mathematical Sciences

### Curriculum Overview

The core courses equip students with a firm foundation in their two majors. Students can then choose from a range of prescribed electives in their interests.

To graduate, students must complete three (3) categories of requirements, totalling at least 142 Academic Units (AUs):

- Major Requirements (103AUs)
- Interdisciplinary Collaborative Core (33AUs)
- Broadening & Deepening Electives (6AUs)

*Summary Table of Graduation Requirements*

| **Major** | **Major Requirement (AUs)** | | | | **Interdisciplinary Collaborative Core (AUs)** | | | **Broadening & Deepening Electives (AUs)** | **Total AUs** |
|---|---|---|---|---|---|---|---|---|---|
| | Major Core | Common Core | Major Prescribed Electives | Final Year Project | Common Core | Professional Series | Care, Serve & Learn | | |
| MATH | 43 | 0 | 7 | 8 | 14 | 16 | 3 | 6 | 142 |
| BS | 33 | | 12 | | | | | | |

| Students to take the following ICC courses | AU |
|---|---|
| CC0001 Inquiry & Communication in an Interdisciplinary World | 2 |
| CC0003 Ethics & Civics in a Multicultural World | 2 |
| ML0004 Career Design & Workplace Readiness in the V.U.C.A World | 2 |
| CC0015 Health & Wellbeing | 2 |
| CC0006 Sustainability: Society, Economy & Environment | 3 |
| CC0007 Science & Technology for Humanity | 3 |
| *CCXXXX Care, Serve, Learn* | *3* |
| *MLXXXX Profession Preparation* | *1* |
| PS0002 Introduction to Data Science and Artificial Intelligence | 3 |
| HW0218 Communication Across the Sciences | 2 |
| MH4912 Professional Internship | 10 |
| Total | **33** |

| Students to take the following Major Core courses | AU |
|---|---|
| Mathematical Sciences Major (43AUs) | |
| MH1100 Calculus I | 4 |
| MH1200 Linear Algebra I | 4 |
| MH1300 Foundations of Mathematics | 4 |
| MH1101 Calculus II | 4 |
| MH1201 Linear Algebra II | 4 |
| MH2100 Calculus III | 4 |
| PS0001 Introduction to Computational Thinking | 3 |
| MH2500 Probability | 4 |
| MH2510 Statistics I | 4 |
| MH3100 Real Analysis I | 4 |
| MH3110 Ordinary Differential Equations | 4 |
| Biological Sciences Major (33AUs) | |
| BS1012 Foundations of Chemistry I | 3 |
| BS1013 Foundations of Chemistry II | 3 |
| BS1016 Physiology | 3 |
| BS1005 Biochemistry I | 3 |
| BS1006 Principles of Genetics | 3 |
| BS1007 Molecular and Cell Biology I | 3 |
| BS1100 Molecular and Cell Biology Techniques Level 1 | 3 |
| BS2002 Microbiology | 3 |
| BS2003 Biochemistry II | 3 |
| BS2028 Biophysical methods applied to biological sciences | 3 |
| BS2004 Molecular & Cell Biology II | 3 |
| Total | **76** |

| Students to take the following Major Core and Common Core courses | | AU |
|---|---|---|
| Mathematical Sciences Major: To read 7AUs<br>(A specialisation area is fulfilled by completing at least 7 AU from the respective list of courses.) | | |
| Computational Mathematics and Modelling Specialisation | MH3101 Complex Analysis | 4 |
| | MH3300 Graph Theory | 4 |
| | MH3320 Dynamical System Theory with Chaos and Fractals (NEW) | 4 |
| | MH3400 Algorithms for the Real World | 4 |
| | MH3401 Signal and Noise in Biology | 3 |
| | MH3512 Stochastic Processes | 4 |
| | MH3515 Stochastic Geometry (NEW) | 4 |
| | MH3520 Mathematics of Deep Learning | 4 |
| | MH3700 Numerical Analysis I | 4 |
| | MH3701 Basic Optimization | 4 |
| | MH4100 Real Analysis II | 4 |
| | MH4110 Partial Differential Equations | 4 |
| | MH4302 Theory of Computing | 4 |
| | MH4310 Coding Theory | 4 |
| | MH4311 Cryptography | 4 |
| | MH4514 Financial Mathematics | 4 |
| | MH4517 Data Applications in Natural Sciences | 4 |
| | MH4518 Simulation Techniques in Finance | 4 |
| | MH4520 High Dimensional Probability | 4 |
| | MH4521 Reinforcement Learning | 4 |
| | MH4601 Differential Geometry | 4 |
| | MH4700 Numerical Analysis II | 4 |
| | MH4701 Mathematical Programming | 4 |
| | MH4712 Geometric Methods in Mathematical Physics (NEW) | 4 |
| Cryptography and Cybersecurity Specialisation | MH3400 Algorithms for the Real World | 4 |
| | MH3511 Data Analysis with Computer | 3 |
| | MH3701 Basic Optimization | 4 |
| | MH4110 Partial Differential Equations | 4 |
| | MH4300 Combinatorics | 4 |
| | MH4311 Cryptography | 4 |
| | MH4500 Time Series Analysis | 4 |
| | MH4700 Numerical Analysis II | 4 |
| Data Analytics and Statistical Learning Specialisation | MH3400 Algorithms for the Real World | 4 |
| | MH3510 Regression Analysis | 4 |
| | MH3511 Data Analysis with Computer | 3 |
| | MH3512 Stochastic Processes | 4 |
| | MH3515 Stochastic Geometry (NEW) | 4 |
| | MH3520 Mathematics of Deep Learning | 4 |

| | | |
|---|---|---|
| | MH4320 Computational Economics | 4 |
| | MH4500 Time Series Analysis | 4 |
| | MH4501 Multivariate Analysis | 4 |
| | MH4510 Statistical Learning and Data Mining | 4 |
| | MH4511 Sampling & Survey | 4 |
| | MH4512 Clinical Trials | 4 |
| | MH4513 Survival Analysis | 4 |
| | MH4514 Financial Mathematics | 4 |
| | MH4515 Applied Bayesian Statistics | 4 |
| | MH4516 Applied Categorical Data Analysis | 4 |
| | MH4517 Data Applications in Natural Sciences | 4 |
| | MH4518 Simulation Techniques in Finance | 4 |
| | MH4519 Financial Econometrics | 4 |
| | MH4520 High Dimensional Probability | 4 |
| | MH4701 Mathematical Programming | 4 |
| | MH4702 Probabilistic Methods in OR | 4 |
| Financial Technology with Quantitative Analysis Specialisation | MH3512 Stochastic Processes | 4 |
| | MH3520 Mathematics of Deep Learning | 4 |
| | MH3700 Numerical Analysis I | 3 |
| | MH3701 Basic Optimization | 4 |
| | MH4110 Partial Differential Equations | 4 |
| | MH4320 Computational Economics | 4 |
| | MH4500 Time Series Analysis | 4 |
| | MH4514 Financial Mathematics | 4 |
| | MH4518 Simulation Techniques in Finance | 4 |
| | MH4519 Financial Econometrics | 4 |
| | MH4520 High Dimensional Probability | 4 |
| | MH4700 Numerical Analysis II | 4 |
| | MH4702 Probabilistic Methods in OR | 4 |
| | MH4712 Geometric Methods in Mathematical Physics (NEW) | 4 |
| Pure Mathematics Specialisation | MH2220 Algebra I | 3 |
| | MH3101 Complex Analysis | 4 |
| | MH3210 Number Theory | 4 |
| | MH3220 Algebra II | 4 |
| | MH3300 Graph Theory | 4 |
| | MH3515 Stochastic Geometry (NEW) | 4 |
| | MH4100 Real Analysis II | 4 |
| | MH4200 Abstract Algebra II | 4 |
| | MH4300 Combinatorics | 4 |
| | MH4301 Set Theory and Logic | 4 |
| | MH4302 Theory of Computing | 4 |
| | MH4310 Coding Theory | 4 |

| | | |
|---|---|---|
| | MH4311 Cryptography | 4 |
| | MH4520 High Dimensional Probability | 4 |
| | MH4601 Differential Geometry | 4 |
| Biological Sciences Major: To read 12AUs | | |
| BS2010 Bioimaging | | 3 |
| BS2020 Mathematics and Physics for the Structural Biologist | | 3 |
| BS2021 RNA Structures & RNA based Drug Development | | 3 |
| BS2025 One Health | | 3 |
| BS2011 Equations of Life | | 3 |
| BS3001 Neurobiology | | 3 |
| BS3006 Bioentrepreneurship | | 3 |
| BS3008 Computer Aided Drug Discovery | | 3 |
| BS3013 Drug discovery & development, biotechnology | | 3 |
| BS3014 Biological foundations of behavior | | 3 |
| BS3022 Protein Trafficking | | 3 |
| BS3025 NMR in Structural Biology | | 3 |
| BS3028 Natural Products in Medicinal Chemistry | | 3 |
| BS3036 Fundamentals of Immunology- concepts and experiments | | 3 |
| BS3104 Pathology (病理学) | | 3 |
| BS3203 Reshaping Healthcare with Engineering and Digital Revolution | | 3 |
| BS3332 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series I) – Methods in Histology | | 3 |
| BS3335 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series I) – Protein behavior in health and disease – biophysical tools | | 3 |
| BS3340 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series I) – Science of aging and life extension in C. elegans | | 3 |
| BS4018 Biology of Aging and Neurodegeneration | | 3 |
| BS4019 Discovery and Development of Therapeutic Antibodies | | 3 |
| BS4206 Medical Device Related Requirements and Regulations | | 3 |
| BS1200 Understanding Singapore Healthcare System | | 3 |
| BS2023 Regulatory Control of Healthcare Products and Medical Devices | | 3 |
| BS2024 Evolution in Health and Disease | | 3 |
| BS2100 Molecular and Cell Biology Techniques Level 2 | | 3 |
| BS3003 Developmental biology | | 3 |
| BS3004 Cancer biology and Therapy | | 3 |
| BS3018 Plant biology | | 3 |
| BS3021 Bioimaging Techniques in EM | | 3 |
| BS3027 Light and Biomolecule Behavior in Health and Disease | | 3 |
| BS3037 Virology | | 23 |
| BS3038 Intellectual Property Rights Related to BioBusiness | | 3 |
| BS3202 Commercialization of Molecular and Cell Biology Techniques | | 3 |

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|---|---|
| BS3331 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series I) – Applied Immunology | 3 |
| BS3338 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series II) – Effect of Anti-mitotic Drugs on Cancer Cells | 3 |
| BS3342 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series II) – Role of Actin cytoskeleton regulators in metastasis | 3 |
| BS3344 Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series II) – Macromolecular X-ray Crystallography | 3 |
| BS3354 UAEB- New CRISPR-Cas systems for Precision Genome Engineering | 3 |
| BS4002 Current topics in cell biology | 3 |
| BS4010 Synthetic Biology | 3 |
| BS4014 Molecular Basis of Diseases | 3 |
| BS4015 Plant Biotechnology | 3 |
| BS4017 High-Throughput Bioinformatics | 3 |
| BS2901 Research Experience | 3 |
| Total | **19** |

- Specialisation can be fulfilled through Major Prescribed Electives and/or BDEs. FGO is not applicable to courses that count towards the requirement for specialisation. The same course cannot be used to count towards two different specialisations.

Detailed Curriculum Structure

| Course Code and Title | Course Type | No. of hours per week | | | | AUs | Prerequisite / Remarks |
|---|---|---|---|---|---|---|---|
| | | Lec | Tut | Lab | Total | | |
| **Year 1 Semester 1** | | | | | | | |
| MH1100 Calculus I | Core | 3 | 1 | - | 4 | 4 | |
| MH1200 Linear Algebra I | Core | 3 | 1 | - | 4 | 4 | |
| MH1300 Foundations of Mathematics | Core | 3 | 1 | - | 4 | 4 | |
| PS0001 Introduction to Computational Thinking | Core | - | 1 | 2 | | 3 | |
| CC0003 Ethics & Civics in a Multicultural World | ICC-CC | - | 2 | - | 2 | 2 | |
| BS1012 Foundations of Chemistry I | Core | 3 | 1 | 3 | | 3 | |
| BS1016 Physiology | Core | 1 | 2 | - | 3 | 3 | |
| HW0001 Introduction to Academic Communication | - | | | | | 0 | For students who fail QET |
| **Total** | | | | | | **23** | |
| **Year 1 Semester 2** | | | | | | | |
| MH1101 Calculus II | Core | 3 | 1 | - | 4 | 4 | MH1100 or CY1601 |
| MH1201 Linear Algebra II | Core | 3 | 1 | - | 4 | 4 | MH1200 |
| CC0001 Inquiry & Communication in an Interdisciplinary World | ICC-CC | - | 2 | - | 2 | 2 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CC0015 Health & Wellbeing | ICC-CC | - | 2 | - | 2 | 2 | |
| BS1013 Foundations of Chemistry II | Core | 3 | 1 | - | 4 | 3 | |
| BS1005 Biochemistry I | Core | 2 | 1 | 4 | | 3 | |
| BS1006 Principles of Genetics | Core | 2 | 1 | - | 3 | 3 | |
| BS1007 Molecular and Cell Biology I | Core | 2 | 1 | - | 3 | 3 | |
| **Total** | | | | | | **24** | |

| **Course Code and Title** | **Course Type** | **No. of hours per week** | | | | **AUs** | **Prerequisite / Remarks** |
|---|---|---|---|---|---|---|---|
| | | **Lec** | **Tut** | **Lab** | **Total** | | |
| **Year 2 Semester 1** | | | | | | | |
| MH2100 Calculus III | Core | 3 | 1 | - | 4 | 4 | MH1101 or MH1802 or MH1805 |
| MH2500 Probability | Core | 3 | 1 | - | 4 | 4 | MH1100 AND MH1101 or MH1802 or CY1601 or MH1805 |
| ML0004 Career Design & Workplace Readiness in the V.U.C.A World | ICC-CC | - | 2 | - | 2 | 2 | |
| CC0006 Sustainability: Society, Economy & Environment | ICC-CC | - | 3 | - | 3 | 3 | |
| BS2002 Microbiology | Core | 2 | 2 | - | 4 | 3 | |
| BS2003 Biochemistry II | Core | 2 | 1 | 4 | | 3 | BS1005 |
| BS2028 Biophysical methods applied to biological sciences | Core | 2 | 1 | 3 | | 3 | BS1012 & BS1013 |
| **Total** | | | | | | **22** | |
| **Year 2 Semester 2** | | | | | | | |
| MH2510 Statistics I | Core | 3 | - | 2 | | 4 | MH2500 |
| MH3110 Ordinary Differential Equations | Core | 3 | 1 | - | 4 | 4 | MH2100 or CY1602 |
| PS0002 Introduction to Data Science and Artificial Intelligence | ICC-PS | 2 | 1 | 1 | | 3 | PS0001 |
| CC0007 Science & Technology for Humanity | ICC-CC | - | 3 | - | 3 | 3 | |
| CCXXXX Care, Serve, Learn | ICC-CSL | | | | | 3 | |
| BS1100 Molecular and Cell Biology Techniques Level 1 | Core | - | 1 | 6 | | 3 | |
| BS2004 Molecular & Cell Biology II | Core | 2 | 1 | - | 3 | 3 | BS1007 |
| **Total** | | | | | | **23** | |

| **Course Code and Title** | | **No. of hours per week** | **AUs** | |
|---|---|---|---|---|

| | Course Type | Lec | Tut | Lab | Total | | Prerequisite / Remarks |
|---|---|---|---|---|---|---|---|
| **Year 3 Semester 1** | | | | | | | |
| MH3100 Real Analysis I | Core | 3 | 1 | - | 4 | 4 | MH1100 AND MH1101 or CY1601 or MH1802 |
| HW0218 Communication Across the Sciences | ICC-PS | | | | | 2 | |
| MLXXXX Profession Preparation | ICC-PS | | | | | 1 | |
| MPE | MPE | | | | | 3 | |
| BDE | BDE | | | | | 3 | |
| **Total** | | | | | | **13** | |
| **Year 3 Semester 2** | | | | | | | |
| MPE | MPE | | | | | 3 | |
| MPE | MPE | | | | | 3 | |
| MPE | MPE | | | | | 3 | |
| MPE | MPE | | | | | 3 | |
| BDE | BDE | | | | | 3 | |
| **Total** | | | | | | **15** | |

| Course Code and Title | Course Type | No. of hours per week | | | | AUs | Prerequisite / Remarks |
|---|---|---|---|---|---|---|---|
| | | Lec | Tut | Lab | Total | | |
| **Year 4 Semester 1** | | | | | | | |
| MH4912 Professional Internship | ICC-PS | | | | | 10 | |
| **Total** | | | | | | **10** | |
| **Year 4 Semester 2** | | | | | | | |
| MH4XXX Final Year Project | Core | | | | | 8 | |
| MPE | MPE | | | | | 4 | |
| **Total** | | | | | | **12** | |
| **Grand Total AU** | | | | | | **142** | |