Yushin-Ryu Private University

Curriculum in Mathematics

Bachelor of Science in Mathematics - 240 ECTS

Master of Science in Mathematics - 100 ECTS

Complete curriculum dossier including module, ECTS, workload, theory/practice, assessment, progression and quality-management structures.

Foundational model and system logic developed by
Prof. Dr. Frank Benjamin Weibel

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Conceptual publication edition - subject to required academic, legal, professional and accreditation approvals.

Document Status and Authorship

This dossier fully documents the curriculum structure developed through the joint working process for the Bachelor of Science in Mathematics with 240 ECTS and the Master of Science in Mathematics with 100 ECTS. The modular curriculum logic, ECTS framework, percentage weighting, performance and assessment model, reuse logic and quality-management architecture were developed by Prof. Dr. Frank Benjamin Weibel. The detailed elaboration, systematisation and editorial preparation are based on that foundational model.

The foundational architecture is binding. Changes to programme parameters, module designations, specialisations, country variants or accreditation variants may be made only through controlled, versioned processes and with approval by the competent academic bodies.

Feature	Specification
Document type	Curriculum and programme handbook in Mathematics
Bachelor	Bachelor of Science in Mathematics, 240 ECTS
Master	Master of Science in Mathematics, 100 ECTS
Workload	25 hours per ECTS
Assessment logic	Written, oral and practical/research-related components in equal thirds
Authorship of foundational model	Prof. Dr. Frank Benjamin Weibel
Version	1.0 - 31 July 2026
Status	Conceptual publication edition; formal approvals reserved

Publication Notice

Before any legally binding advertising or enrolment, the applicable approval, accreditation, recognition and admission requirements of the relevant country and legal entity must be reviewed. This dossier is academically complete in structure but does not replace a sovereign recognition decision.

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1. Academic Foundational Model

The mathematics curriculum integrates mathematical foundations, proof, algorithms, modelling, forecasting, data analysis, academic communication and research. The bachelor programme is organised as an extended course of study comprising four didactic and methodological stages. The master programme follows with four research-oriented semesters.

The four bachelor stages of 60 ECTS each create smaller competency increments, clearer transitions, more precise performance management and transparent quality development. Each master semester comprises 25 ECTS and leads towards independent research.

Study phase	ECTS	Workload	Theory	Practice / research
Bachelor total	240	6,000 hours	180 ECTS / 4,500 hours	60 ECTS / 1,500 hours
Each bachelor stage	60	1,500 hours	45 ECTS / 1,125 hours	15 ECTS / 375 hours
Master total	100	2,500 hours	75 ECTS / 1,875 hours	25 ECTS / 625 hours
Each master semester	25	625 hours	18.75 ECTS / 468.75 hours	6.25 ECTS / 156.25 hours

1.1 Access, Support and Completion Standard

Yushin-Ryu Private University follows the principle of open, or legally permissible, access; intensive competency development; and a high completion standard. Formal entry qualifications are considered in accordance with applicable law and accreditation requirements. Alternative access, bridging and competency-evidence pathways may be provided where legally permissible.

The system does not lower completion requirements. It provides transparent learning pathways, tutorials, feedback, development and reassessment loops so that students with different starting points can convert those differences into demonstrable academic competence.

1.2 25 Hours per ECTS and Separate Student-Support Governance

Student workload is calculated at 25 hours per ECTS. Student support, tutorials, diagnosis, development, feedback, reassessment and quality management are not obscured within this value; they are planned as a separate institutional resource and governance layer. This keeps learning difficulties, support requirements and quality development transparent over time.

1.3 Performance and Assessment Logic

Performance component	Internal weighting	Function
Written	exactly 1/3	Proof, derivation, written examination and academic paper
Oral	exactly 1/3	Reasoning, oral examination, colloquium and defence
Practical / research-related	exactly 1/3	Modelling, programming, simulation, data analysis and construction

A module is passed only when the overall result is at least 66.67% and at least two of the three performance components independently meet the specified competency threshold. 66.66% and below constitutes a fail. A weak third component may be compensated only by two components that have genuinely been passed and demonstrate secure subject competence. Subject-specific barrier assessments may exclude compensation.

1.4 Quality Management

Performance data are not treated merely as a final grade. Modules, subtopics, written, oral and practical competencies, learning trajectories, reassessment needs and anomalies are analysed separately. Individual learning difficulties are distinguished from group-level didactic, methodological, assessment-related or content-related quality problems. Measures address only the affected components and are evaluated for effectiveness.

Quality-Management Control Cycle

Step	Control function
1. Diagnose	Identify competency-specific, module-specific and group-level patterns.
2. Differentiate	Separate individual support needs from didactic, methodological or assessment-system issues.
3. Intervene	Apply targeted tutorials, feedback, reassessment, content revision or assessment adjustment.
4. Verify	Review whether the intervention improved learning and quality.
5. Version	Document and release only the affected module, Learning Object, assessment or translation.

2. Bachelor of Science in Mathematics - 240 ECTS

The bachelor programme comprises four consecutive stages of 60 ECTS each. Every stage contains 45 ECTS of theory and 15 ECTS of practice. The stage designations support didactic progression; separate interim awards arise only where specifically approved through academic and legal processes.

Stage	Didactic focus	ECTS	Theory	Practice
BS1	Understand foundations and apply them confidently	60	45	15
BS2	Integrate structures and select methods on a reasoned basis	60	45	15
BS3	Model, simulate and validate open problems	60	45	15
BS4	Conduct independent research, defend and transfer	60	45	15
Total	Extended bachelor programme	240	180	60

2.1 Bachelor Qualification Objectives

- Demonstrate secure command of mathematical concepts, structures and proofs.
- Systematically integrate pure and applied mathematics.
- Develop and evaluate algorithms, numerical methods, models and forecasts.
- Present mathematical results in written, oral and practical formats.
- Search, appraise and use academic literature correctly.
- Structure interdisciplinary questions mathematically.
- Analyse quality, uncertainty, error and limitations transparently.
- Complete, defend and transfer an independent bachelor thesis.

2.2 Bachelor Stage 1 - Mathematical Foundations

Internal didactic designation: Junior Assistant Stage. Understand the foundations, use mathematical language confidently and apply defined methods transparently.

Code	Module	ECTS	Theory	Practice
MAT-AS1-01	Analysis I	10	8	2
MAT-AS1-02	Linear Algebra I	10	8	2
MAT-AS1-03	Algebra, Logic and Mathematical Proof I	8	7	1
MAT-AS1-04	Probability, Statistics and Forecasting I	8	6	2
MAT-AS1-05	Algorithms and Mathematical Programming I	8	4	4
MAT-AS1-06	Geometry and Vector Calculus	6	4	2
MAT-AS1-07	Academic Work and Mathematical Communication I	4	3	1
MAT-AS1-08	Applied and Algorithmic Mathematics - Transfer Project I	6	5	1
	Total	60	45	15

MAT-AS1-01 - Analysis I

Scope	Theory	Practice / research	Workload
10 ECTS	8 ECTS	2 ECTS	250 hours

Course component	ECTS	Share
Sets, number systems and fundamental structures	2	20.00%
Sequences and limits	2	20.00%
Series and convergence	2	20.00%
Differential calculus in one variable	2	20.00%
Integral calculus in one variable	2	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Analysis I.
- Apply and compare methods relating to sets, number systems and fundamental structures and sequences and limits.
- Analyse mathematical problems involving series and convergence and justify the selected approach.
- Implement, evaluate or validate work relating to differential calculus in one variable and integral calculus in one variable.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: derivations, proofs and written-examination problems. Oral: explanation of analytic relationships. Practical / research-related: computer-assisted analysis, visualisation and application.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-02 - Linear Algebra I

Scope	Theory	Practice / research	Workload
10 ECTS	8 ECTS	2 ECTS	250 hours

Course component	ECTS	Share
Vectors, matrices and fundamental operations	2	20.00%
Systems of linear equations	2	20.00%
Vector spaces, bases and dimension	2	20.00%
Linear mappings	2	20.00%
Determinants, eigenvalues and eigenvectors I	2	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Linear Algebra I.
- Apply and compare methods relating to vectors, matrices and fundamental operations and systems of linear equations.
- Analyse mathematical problems involving vector spaces, bases and dimension and justify the selected approach.
- Implement, evaluate or validate work relating to linear mappings and determinants, eigenvalues and eigenvectors i.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: calculations and proof problems. Oral: linear structures and solution methods. Practical / research-related: software implementation and application models.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-03 - Algebra, Logic and Mathematical Proof I

Scope	Theory	Practice / research	Workload
8 ECTS	7 ECTS	1 ECTS	200 hours

Course component	ECTS	Share
Propositional and predicate logic	1.5	18.75%
Sets, relations and mappings	1.5	18.75%
Direct and indirect proof	1.5	18.75%
Mathematical induction and counterexamples	1.5	18.75%
Introduction to algebraic structures	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Algebra, Logic and Mathematical Proof I.
- Apply and compare methods relating to propositional and predicate logic and sets, relations and mappings.
- Analyse mathematical problems involving direct and indirect proof and justify the selected approach.
- Implement, evaluate or validate work relating to mathematical induction and counterexamples and introduction to algebraic structures.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proof portfolio and written examination. Oral: proof construction and defence. Practical / research-related: construction and formal verification of original proofs.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-04 - Probability, Statistics and Forecasting I

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Foundations of combinatorics	1.5	18.75%
Probability spaces and events	1.5	18.75%
Random variables and distributions I	1.5	18.75%
Descriptive statistics and data description	1.5	18.75%
Foundations of mathematical forecasting models	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Probability, Statistics and Forecasting I.
- Apply and compare methods relating to foundations of combinatorics and probability spaces and events.
- Analyse mathematical problems involving random variables and distributions i and justify the selected approach.
- Implement, evaluate or validate work relating to descriptive statistics and data description and foundations of mathematical forecasting models.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: probability-theory and statistical tasks. Oral: interpretation of results. Practical / research-related: data analysis and forecasting model.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-05 - Algorithms and Mathematical Programming I

Scope	Theory	Practice / research	Workload
8 ECTS	4 ECTS	4 ECTS	200 hours

Course component	ECTS	Share
Algorithmic thinking and problem analysis	2	25.00%
Control structures and fundamental data structures	1.5	18.75%
Mathematical programming	1.5	18.75%
Foundations of runtime and complexity	1.5	18.75%
Testing, error analysis and documentation	1.5	18.75%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Algorithms and Mathematical Programming I.
- Apply and compare methods relating to algorithmic thinking and problem analysis and control structures and fundamental data structures.
- Analyse mathematical problems involving mathematical programming and justify the selected approach.
- Implement, evaluate or validate work relating to foundations of runtime and complexity and testing, error analysis and documentation.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: algorithm analysis. Oral: explanation of the solution approach. Practical / research-related: functional programming solution with complete documentation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-06 - Geometry and Vector Calculus

Scope	Theory	Practice / research	Workload
6 ECTS	4 ECTS	2 ECTS	150 hours

Course component	ECTS	Share
Euclidean geometry	1.5	25.00%
Analytic geometry	1.5	25.00%
Vector geometry in two and three dimensions	1.5	25.00%
Transformations, symmetries and modelling	1.5	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Geometry and Vector Calculus.
- Apply and compare methods relating to euclidean geometry and analytic geometry.
- Analyse mathematical problems involving vector geometry in two and three dimensions and justify the selected approach.
- Implement, evaluate or validate work relating to transformations, symmetries and modelling.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: derivations and calculations. Oral: spatial relationships. Practical / research-related: construction, visualisation and modelling.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-07 - Academic Work and Mathematical Communication I

Scope	Theory	Practice / research	Workload
4 ECTS	3 ECTS	1 ECTS	100 hours

Course component	ECTS	Share
Literature search and source appraisal	1	25.00%
Mathematical notation and documentation	1	25.00%
Presentation of mathematical arguments	1	25.00%
Academic integrity	1	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Academic Work and Mathematical Communication I.
- Apply and compare methods relating to literature search and source appraisal and mathematical notation and documentation.
- Analyse mathematical problems involving presentation of mathematical arguments and justify the selected approach.
- Implement, evaluate or validate work relating to academic integrity.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: academic paper. Oral: subject presentation. Practical / research-related: complete digital documentation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS1-08 - Applied and Algorithmic Mathematics - Transfer Project I

Scope	Theory	Practice / research	Workload
6 ECTS	5 ECTS	1 ECTS	150 hours

Course component	ECTS	Share
Problem definition and mathematical abstraction	1.5	25.00%
Model development and method selection	1.5	25.00%
Algorithmic or numerical implementation	1.5	25.00%
Evaluation, interpretation and presentation	1.5	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Applied and Algorithmic Mathematics - Transfer Project I.
- Apply and compare methods relating to problem definition and mathematical abstraction and model development and method selection.
- Analyse mathematical problems involving algorithmic or numerical implementation and justify the selected approach.
- Implement, evaluate or validate work relating to evaluation, interpretation and presentation.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: project report. Oral: presentation and defence. Practical / research-related: model, program or computational application.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

2.3 Bachelor Stage 2 - Structural Development and Advanced Study

Internal didactic designation: Assistant Stage. Integrate mathematical fields, select methods on a reasoned basis and address increasingly complex problems with growing independence.

Code	Module	ECTS	Theory	Practice
MAT-AS2-01	Analysis II	10	8	2
MAT-AS2-02	Linear Algebra II	8	6	2
MAT-AS2-03	Abstract Algebra I	8	7	1
MAT-AS2-04	Differential Equations I	8	6	2
MAT-AS2-05	Probability, Statistics and Forecasting II	8	6	2
MAT-AS2-06	Numerical and Algorithmic Mathematics I	8	4	4
MAT-AS2-07	Topology and Metric Spaces I	6	5	1
MAT-AS2-08	Mathematical Seminar and Transfer Project II	4	3	1
	Total	60	45	15

MAT-AS2-01 - Analysis II

Scope	Theory	Practice / research	Workload
10 ECTS	8 ECTS	2 ECTS	250 hours

Course component	ECTS	Share
Multivariable functions and partial derivatives	2	20.00%
Multivariable integration	2	20.00%
Sequences and series of functions	2	20.00%
Uniform convergence and continuity	2	20.00%
Extremum problems and foundations of optimisation	2	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Analysis II.
- Apply and compare methods relating to multivariable functions and partial derivatives and multivariable integration.
- Analyse mathematical problems involving sequences and series of functions and justify the selected approach.
- Implement, evaluate or validate work relating to uniform convergence and continuity and extremum problems and foundations of optimisation.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proofs and derivations. Oral: methodological justification. Practical / research-related: visualisation and optimisation application.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-02 - Linear Algebra II

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Eigenvalues, eigenspaces and diagonalisation	2	25.00%
Bilinear forms and inner products	2	25.00%
Orthogonality and spectral theory	2	25.00%
Linear operators and applications	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Linear Algebra II.
- Apply and compare methods relating to eigenvalues, eigenspaces and diagonalisation and bilinear forms and inner products.
- Analyse mathematical problems involving orthogonality and spectral theory and justify the selected approach.
- Implement, evaluate or validate work relating to linear operators and applications.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: derivations and proofs. Oral: spectral structures. Practical / research-related: matrix decomposition and modelling.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-03 - Abstract Algebra I

Scope	Theory	Practice / research	Workload
8 ECTS	7 ECTS	1 ECTS	200 hours

Course component	ECTS	Share
Groups and subgroups	2	25.00%
Homomorphisms and quotient groups	2	25.00%
Rings, ideals and ring homomorphisms	2	25.00%
Fields and elementary extensions	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Abstract Algebra I.
- Apply and compare methods relating to groups and subgroups and homomorphisms and quotient groups.
- Analyse mathematical problems involving rings, ideals and ring homomorphisms and justify the selected approach.
- Implement, evaluate or validate work relating to fields and elementary extensions.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proofs and structural problems. Oral: algebraic reasoning. Practical / research-related: construction and evaluation of examples.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-04 - Differential Equations I

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
First-order differential equations	2	25.00%
Higher-order linear differential equations	2	25.00%
Systems of differential equations	2	25.00%
Modelling of dynamic processes	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Differential Equations I.
- Apply and compare methods relating to first-order differential equations and higher-order linear differential equations.
- Analyse mathematical problems involving systems of differential equations and justify the selected approach.
- Implement, evaluate or validate work relating to modelling of dynamic processes.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: solution methods and derivations. Oral: model assumptions. Practical / research-related: simulation of dynamic systems.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-05 - Probability, Statistics and Forecasting II

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Multivariate random variables	2	25.00%
Conditional probabilities and dependencies	2	25.00%
Estimation methods and confidence intervals	2	25.00%
Regression and forecasting models II	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Probability, Statistics and Forecasting II.
- Apply and compare methods relating to multivariate random variables and conditional probabilities and dependencies.
- Analyse mathematical problems involving estimation methods and confidence intervals and justify the selected approach.
- Implement, evaluate or validate work relating to regression and forecasting models ii.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: inference and regression tasks. Oral: interpretation. Practical / research-related: data analysis and model evaluation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-06 - Numerical and Algorithmic Mathematics I

Scope	Theory	Practice / research	Workload
8 ECTS	4 ECTS	4 ECTS	200 hours

Course component	ECTS	Share
Error analysis and numerical stability	2	25.00%
Numerical solution of systems of linear equations	2	25.00%
Interpolation and approximation	2	25.00%
Numerical integration and differentiation	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Numerical and Algorithmic Mathematics I.
- Apply and compare methods relating to error analysis and numerical stability and numerical solution of systems of linear equations.
- Analyse mathematical problems involving interpolation and approximation and justify the selected approach.
- Implement, evaluate or validate work relating to numerical integration and differentiation.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: numerical theory. Oral: method selection. Practical / research-related: implementation, testing and comparison.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-07 - Topology and Metric Spaces I

Scope	Theory	Practice / research	Workload
6 ECTS	5 ECTS	1 ECTS	150 hours

Course component	ECTS	Share
Metric spaces	1.5	25.00%
Open and closed sets	1.5	25.00%
Continuity and convergence	1.5	25.00%
Compactness, connectedness and completeness	1.5	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Topology and Metric Spaces I.
- Apply and compare methods relating to metric spaces and open and closed sets.
- Analyse mathematical problems involving continuity and convergence and justify the selected approach.
- Implement, evaluate or validate work relating to compactness, connectedness and completeness.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proofs. Oral: relationships between concepts. Practical / research-related: construction and analysis of topological examples.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS2-08 - Mathematical Seminar and Transfer Project II

Scope	Theory	Practice / research	Workload
4 ECTS	3 ECTS	1 ECTS	100 hours

Course component	ECTS	Share
Literature review and topic delimitation	1	25.00%
Mathematical paper	1	25.00%
Application or modelling component	1	25.00%
Presentation, defence and reflection	1	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Mathematical Seminar and Transfer Project II.
- Apply and compare methods relating to literature review and topic delimitation and mathematical paper.
- Analyse mathematical problems involving application or modelling component and justify the selected approach.
- Implement, evaluate or validate work relating to presentation, defence and reflection.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: seminar paper. Oral: presentation and discussion. Practical / research-related: model, program or computation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

2.4 Bachelor Stage 3 - Application, Modelling and Specialisation

Internal didactic designation: Senior Assistant Stage. Model open problems, implement methods, validate results and develop an individual academic profile.

Code	Module	ECTS	Theory	Practice
MAT-AS3-01	Real Analysis and Functional Analysis I	8	7	1
MAT-AS3-02	Complex Analysis I	8	6	2
MAT-AS3-03	Algebra II and Number Theory I	8	7	1
MAT-AS3-04	Stochastic Processes, Time Series and Forecasting III	8	6	2
MAT-AS3-05	Numerical Mathematics II and Optimisation	8	4	4
MAT-AS3-06	Mathematical Modelling and Simulation	8	5	3
MAT-AS3-07	Elective and Mathematical Application Subject I	8	7	1
MAT-AS3-08	Research Seminar and Transfer Project III	4	3	1
	Total	60	45	15

MAT-AS3-01 - Real Analysis and Functional Analysis I

Scope	Theory	Practice / research	Workload
8 ECTS	7 ECTS	1 ECTS	200 hours

Course component	ECTS	Share
Measure and Integration Theory I	2	25.00%
Function spaces and norms	2	25.00%
Banach and Hilbert spaces I	2	25.00%
Linear functionals and operators	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Real Analysis and Functional Analysis I.
- Apply and compare methods relating to measure and integration theory i and function spaces and norms.
- Analyse mathematical problems involving banach and hilbert spaces i and justify the selected approach.
- Implement, evaluate or validate work relating to linear functionals and operators.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proofs and theoretical tasks. Oral: structural relationships. Practical / research-related: construction and digital representation of selected examples.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-02 - Complex Analysis I

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Complex numbers and functions	2	25.00%
Holomorphy and the Cauchy-Riemann equations	2	25.00%
Complex integration and integral theorems	2	25.00%
Power series, Laurent series and residues I	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Complex Analysis I.
- Apply and compare methods relating to complex numbers and functions and holomorphy and the cauchy-riemann equations.
- Analyse mathematical problems involving complex integration and integral theorems and justify the selected approach.
- Implement, evaluate or validate work relating to power series, laurent series and residues i.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: derivations and proofs. Oral: complex-analytic justification. Practical / research-related: visualisation and computer-assisted residue analysis.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-03 - Algebra II and Number Theory I

Scope	Theory	Practice / research	Workload
8 ECTS	7 ECTS	1 ECTS	200 hours

Course component	ECTS	Share
Group actions and Sylow theory	2	25.00%
Modules and advanced ring theory	2	25.00%
Divisibility, congruences and prime numbers	2	25.00%
Diophantine equations	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Algebra II and Number Theory I.
- Apply and compare methods relating to group actions and sylow theory and modules and advanced ring theory.
- Analyse mathematical problems involving divisibility, congruences and prime numbers and justify the selected approach.
- Implement, evaluate or validate work relating to diophantine equations.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proofs. Oral: structural reasoning. Practical / research-related: algorithmic treatment of selected problems.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-04 - Stochastic Processes, Time Series and Forecasting III

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Introduction to stochastic processes	2	25.00%
Markov chains and state models	2	25.00%
Time-series analysis	2	25.00%
Forecasting, model evaluation and uncertainty	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Stochastic Processes, Time Series and Forecasting III.
- Apply and compare methods relating to introduction to stochastic processes and markov chains and state models.
- Analyse mathematical problems involving time-series analysis and justify the selected approach.
- Implement, evaluate or validate work relating to forecasting, model evaluation and uncertainty.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: stochastic theory. Oral: model assumptions. Practical / research-related: time-series analysis and comparison of forecasts.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-05 - Numerical Mathematics II and Optimisation

Scope	Theory	Practice / research	Workload
8 ECTS	4 ECTS	4 ECTS	200 hours

Course component	ECTS	Share
Numerical solution of nonlinear equations	2	25.00%
Numerical differential equations	2	25.00%
Linear and nonlinear optimisation	2	25.00%
Stability, convergence and error control	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Numerical Mathematics II and Optimisation.
- Apply and compare methods relating to numerical solution of nonlinear equations and numerical differential equations.
- Analyse mathematical problems involving linear and nonlinear optimisation and justify the selected approach.
- Implement, evaluate or validate work relating to stability, convergence and error control.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: numerical theory. Oral: comparison of methods. Practical / research-related: implementation, simulation and error analysis.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-06 - Mathematical Modelling and Simulation

Scope	Theory	Practice / research	Workload
8 ECTS	5 ECTS	3 ECTS	200 hours

Course component	ECTS	Share
Systems analysis and problem delimitation	2	25.00%
Mathematical model development	2	25.00%
Simulation and scenario development	2	25.00%
Validation, sensitivity and model critique	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Mathematical Modelling and Simulation.
- Apply and compare methods relating to systems analysis and problem delimitation and mathematical model development.
- Analyse mathematical problems involving simulation and scenario development and justify the selected approach.
- Implement, evaluate or validate work relating to validation, sensitivity and model critique.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: model justification. Oral: defence. Practical / research-related: implementation, simulation and validation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-07 - Elective and Mathematical Application Subject I

Scope	Theory	Practice / research	Workload
8 ECTS	7 ECTS	1 ECTS	200 hours

Course component	ECTS	Share
Disciplinary foundations of the application field	2	25.00%
Mathematical methods	2	25.00%
Advanced problems	2	25.00%
Interdisciplinary analysis and transfer	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Elective and Mathematical Application Subject I.
- Apply and compare methods relating to disciplinary foundations of the application field and mathematical methods.
- Analyse mathematical problems involving advanced problems and justify the selected approach.
- Implement, evaluate or validate work relating to interdisciplinary analysis and transfer.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: disciplinary and methodological paper. Oral: interdisciplinary defence. Practical / research-related: modelling or case analysis.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS3-08 - Research Seminar and Transfer Project III

Scope	Theory	Practice / research	Workload
4 ECTS	3 ECTS	1 ECTS	100 hours

Course component	ECTS	Share
Research question and contextualisation	1	25.00%
Methodological planning	1	25.00%
Mathematical investigation	1	25.00%
Presentation, defence and transfer	1	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Research Seminar and Transfer Project III.
- Apply and compare methods relating to research question and contextualisation and methodological planning.
- Analyse mathematical problems involving mathematical investigation and justify the selected approach.
- Implement, evaluate or validate work relating to presentation, defence and transfer.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: research report. Oral: defence. Practical / research-related: implementation, simulation or model.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

2.5 Bachelor Stage 4 - Research, Completion and Academic Transfer

Internal didactic designation: Academic Leadership Stage. Conduct independent research, defend results and transfer mathematics responsibly into interdisciplinary contexts.

Code	Module	ECTS	Theory	Practice
MAT-AS4-01	Advanced Pure Mathematics	10	9	1
MAT-AS4-02	Advanced Applied Mathematics	10	7	3
MAT-AS4-03	Mathematical Data Analysis and Machine Learning	8	5	3
MAT-AS4-04	Interdisciplinary Mathematical Application Subject II	8	6	2
MAT-AS4-05	Research Seminar and Advanced Academic Study	6	5	1
MAT-AS4-06	Philosophy of Science and Mathematical Research Methodology	4	4	0
MAT-AS4-07	Bachelor Thesis	10	7	3
MAT-AS4-08	Defence and Academic Transfer	4	2	2
	Total	60	45	15

MAT-AS4-01 - Advanced Pure Mathematics

Scope	Theory	Practice / research	Workload
10 ECTS	9 ECTS	1 ECTS	250 hours

Course component	ECTS	Share
Functional Analysis II	2	20.00%
Advanced algebra and field theory	2	20.00%
Topology and differential geometry	2	20.00%
Number Theory II	2	20.00%
Elective specialisation in pure mathematics	2	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Pure Mathematics.
- Apply and compare methods relating to functional analysis ii and advanced algebra and field theory.
- Analyse mathematical problems involving topology and differential geometry and justify the selected approach.
- Implement, evaluate or validate work relating to number theory ii and elective specialisation in pure mathematics.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: advanced proof work. Oral: subject colloquium. Practical / research-related: computer-assisted examples or formal structural verification.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-02 - Advanced Applied Mathematics

Scope	Theory	Practice / research	Workload
10 ECTS	7 ECTS	3 ECTS	250 hours

Course component	ECTS	Share
Partial differential equations	2	20.00%
Dynamical systems and stability	2	20.00%
Calculus of variations and optimisation	2	20.00%
Modelling of complex systems	2	20.00%
Simulation and validation	2	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Applied Mathematics.
- Apply and compare methods relating to partial differential equations and dynamical systems and stability.
- Analyse mathematical problems involving calculus of variations and optimisation and justify the selected approach.
- Implement, evaluate or validate work relating to modelling of complex systems and simulation and validation.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: model theory and derivation. Oral: defence of methods. Practical / research-related: simulation, validation and comparison of scenarios.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-03 - Mathematical Data Analysis and Machine Learning

Scope	Theory	Practice / research	Workload
8 ECTS	5 ECTS	3 ECTS	200 hours

Course component	ECTS	Share
Multivariate statistics	2	25.00%
Mathematical foundations of machine learning	2	25.00%
Optimisation methods for data models	2	25.00%
Model evaluation, uncertainty and explainability	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Mathematical Data Analysis and Machine Learning.
- Apply and compare methods relating to multivariate statistics and mathematical foundations of machine learning.
- Analyse mathematical problems involving optimisation methods for data models and justify the selected approach.
- Implement, evaluate or validate work relating to model evaluation, uncertainty and explainability.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: mathematical foundations. Oral: model critique. Practical / research-related: data preparation, training, validation and interpretation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-04 - Interdisciplinary Mathematical Application Subject II

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Advanced disciplinary foundations	2	25.00%
Mathematical model and method selection	2	25.00%
Interdisciplinary research or practice question	2	25.00%
Evaluation of results and transfer	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Interdisciplinary Mathematical Application Subject II.
- Apply and compare methods relating to advanced disciplinary foundations and mathematical model and method selection.
- Analyse mathematical problems involving interdisciplinary research or practice question and justify the selected approach.
- Implement, evaluate or validate work relating to evaluation of results and transfer.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: interdisciplinary paper. Oral: disciplinary dialogue. Practical / research-related: modelling, data analysis or simulation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-05 - Research Seminar and Advanced Academic Study

Scope	Theory	Practice / research	Workload
6 ECTS	5 ECTS	1 ECTS	150 hours

Course component	ECTS	Share
State of research and literature work	1.5	25.00%
Mathematical problem formulation	1.5	25.00%
Comparison of methods and solution strategy	1.5	25.00%
Seminar paper, presentation and critique	1.5	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Research Seminar and Advanced Academic Study.
- Apply and compare methods relating to state of research and literature work and mathematical problem formulation.
- Analyse mathematical problems involving comparison of methods and solution strategy and justify the selected approach.
- Implement, evaluate or validate work relating to seminar paper, presentation and critique.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: seminar paper. Oral: colloquium. Practical / research-related: exemplary implementation or replication.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-06 - Philosophy of Science and Mathematical Research Methodology

Scope	Theory	Practice / research	Workload
4 ECTS	4 ECTS	0 ECTS	100 hours

Course component	ECTS	Share
Epistemological foundations	1	25.00%
Proof, model and mathematical truth	1	25.00%
Mathematical research programmes	1	25.00%
Academic integrity and responsibility	1	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Philosophy of Science and Mathematical Research Methodology.
- Apply and compare methods relating to epistemological foundations and proof, model and mathematical truth.
- Analyse mathematical problems involving mathematical research programmes and justify the selected approach.
- Implement, evaluate or validate work relating to academic integrity and responsibility.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: philosophy-of-science analysis. Oral: discourse and defence. Practical / research-related: documented case or review analysis.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-07 - Bachelor Thesis

Scope	Theory	Practice / research	Workload
10 ECTS	7 ECTS	3 ECTS	250 hours

Course component	ECTS	Share
Research question and theoretical framework	2	20.00%
Literature and methods work	2	20.00%
Mathematical investigation and proof construction	2	20.00%
Modelling, programming or computational implementation	2	20.00%
Interpretation and completion	2	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Bachelor Thesis.
- Apply and compare methods relating to research question and theoretical framework and literature and methods work.
- Analyse mathematical problems involving mathematical investigation and proof construction and justify the selected approach.
- Implement, evaluate or validate work relating to modelling, programming or computational implementation and interpretation and completion.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: bachelor thesis. Oral: defence. Practical / research-related: methodological, algorithmic or model-based implementation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-AS4-08 - Defence and Academic Transfer

Scope	Theory	Practice / research	Workload
4 ECTS	2 ECTS	2 ECTS	100 hours

Course component	ECTS	Share
Academic presentation	1	25.00%
Oral defence	1	25.00%
Practical demonstration or model presentation	1	25.00%
Transfer, reflection and disciplinary dialogue	1	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Defence and Academic Transfer.
- Apply and compare methods relating to academic presentation and oral defence.
- Analyse mathematical problems involving practical demonstration or model presentation and justify the selected approach.
- Implement, evaluate or validate work relating to transfer, reflection and disciplinary dialogue.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: transfer paper and summary. Oral: defence. Practical / research-related: demonstration, model or reproducible result.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

2.6 Bachelor Total and Progression

Stage	ECTS	Theory	Practice / research	Competency emphasis
Bachelor Stage 1	60	45	15	Foundations and secure application
Bachelor Stage 2	60	45	15	Structural integration and method selection
Bachelor Stage 3	60	45	15	Application, modelling and specialisation
Bachelor Stage 4	60	45	15	Research, completion and transfer
Total	240	180	60	Extended Bachelor of Science

2.7 Bachelor Thesis and Completion Approval

- The bachelor thesis addresses a demanding mathematical question independently.
- The work includes systematic literature review, justified method selection, transparent results and explicit limitations.
- The defence combines written, oral and practical or model-based evidence.
- Completion approval requires fulfilment of the 66.67% threshold and the component-specific pass rules.
- Country-specific or accreditation-specific completion requirements are added through controlled programme variants.

Bachelor Workload Balance

Category	ECTS	Hours
Theory	180	4,500
Practice / research	60	1,500
Total	240	6,000

3. Master of Science in Mathematics - 100 ECTS

The master programme comprises four research-oriented semesters of 25 ECTS each. It advances mathematical depth, methodological independence, interdisciplinary application, research leadership and publication capability.

Semester	ECTS	Theory	Practice / research	Primary focus
Master Semester 1	25	18.75	6.25	Advanced common foundations
Master Semester 2	25	18.75	6.25	Specialisation and algorithmic research
Master Semester 3	25	18.75	6.25	Research profile and thesis preparation
Master Semester 4	25	18.75	6.25	Master thesis, defence and publication
Total	100	75	25	Research-oriented Master of Science

3.1 Master Qualification Objectives

- Master advanced mathematical structures, methods and research literature.
- Develop independent and robust research questions and designs.
- Integrate proof, modelling, simulation, algorithms and evidence appropriately.
- Produce reproducible software, models, data analyses or formal results where relevant.
- Lead academic work responsibly and communicate complex mathematics to different audiences.
- Complete, defend and prepare for publication an independent master thesis.

3.2 Master Semester 1 - Advanced Common Foundations

Advanced common foundations in philosophy of science, research methods, analysis, algebra, geometry, probability and statistics.

Code	Module	ECTS	Theory	Practice
MAT-M501	Philosophy of Science, Advanced Research Methods and Research Design	5	3.75	1.25
MAT-M502	Advanced Analysis and Partial Differential Equations	7	5.5	1.5
MAT-M503	Advanced Algebra and Geometry	7	5.75	1.25
MAT-M504	Advanced Probability and Statistics	6	3.75	2.25
	Total	25	18.75	6.25

MAT-M501 - Philosophy of Science, Advanced Research Methods and Research Design

Scope	Theory	Practice / research	Workload
5 ECTS	3.75 ECTS	1.25 ECTS	125 hours

Course component	ECTS	Share
Mathematical epistemology and concepts of proof	1.25	25.00%
Research questions and research design	1.25	25.00%
Reproducibility, validation and Open Science	1.25	25.00%
Research integrity, review and risk analysis	1.25	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Philosophy of Science, Advanced Research Methods and Research Design.
- Apply and compare methods relating to mathematical epistemology and concepts of proof and research questions and research design.
- Analyse mathematical problems involving reproducibility, validation and open science and justify the selected approach.
- Implement, evaluate or validate work relating to research integrity, review and risk analysis.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: research design. Oral: defence. Practical / research-related: reproducibility and validation plan.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M502 - Advanced Analysis and Partial Differential Equations

Scope	Theory	Practice / research	Workload
7 ECTS	5.5 ECTS	1.5 ECTS	175 hours

Course component	ECTS	Share
Sobolev spaces and foundations of functional analysis	1.75	25.00%
Weak solutions and variational methods	1.75	25.00%
Elliptic and parabolic equations	1.75	25.00%
Spectral methods, approximation and regularity	1.75	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Analysis and Partial Differential Equations.
- Apply and compare methods relating to sobolev spaces and foundations of functional analysis and weak solutions and variational methods.
- Analyse mathematical problems involving elliptic and parabolic equations and justify the selected approach.
- Implement, evaluate or validate work relating to spectral methods, approximation and regularity.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proofs and derivations. Oral: defence of methods. Practical / research-related: numerical or model-based evaluation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M503 - Advanced Algebra and Geometry

Scope	Theory	Practice / research	Workload
7 ECTS	5.75 ECTS	1.25 ECTS	175 hours

Course component	ECTS	Share
Modules, categories and structural algebra	1.75	25.00%
Commutative algebra	1.75	25.00%
Algebraic and differential-geometric structures	1.75	25.00%
Lie groups, Lie algebras and applications	1.75	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Algebra and Geometry.
- Apply and compare methods relating to modules, categories and structural algebra and commutative algebra.
- Analyse mathematical problems involving algebraic and differential-geometric structures and justify the selected approach.
- Implement, evaluate or validate work relating to lie groups, lie algebras and applications.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: proof and structural analysis. Oral: subject colloquium. Practical / research-related: construction and evaluation of selected examples.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M504 - Advanced Probability and Statistics

Scope	Theory	Practice / research	Workload
6 ECTS	3.75 ECTS	2.25 ECTS	150 hours

Course component	ECTS	Share
Measure-theoretic probability	1.5	25.00%
Martingales and stochastic processes	1.5	25.00%
Asymptotic statistics, likelihood and Bayesian inference	1.5	25.00%
Concentration inequalities, uncertainty and model evaluation	1.5	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Probability and Statistics.
- Apply and compare methods relating to measure-theoretic probability and martingales and stochastic processes.
- Analyse mathematical problems involving asymptotic statistics, likelihood and bayesian inference and justify the selected approach.
- Implement, evaluate or validate work relating to concentration inequalities, uncertainty and model evaluation.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: theoretical tasks. Oral: critique of inference and models. Practical / research-related: simulation, data analysis and validation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

3.3 Master Semester 2 - Specialisation and Algorithmic Research

Specialisation through scientific computing, advanced subject modules and a research seminar.

Code	Module	ECTS	Theory	Practice
MAT-M601	Scientific Computing and Algorithmic Mathematics	7	4.75	2.25
MAT-M602	Advanced Master Module I	8	6.25	1.75
MAT-M603	Advanced Master Module II	8	6.25	1.75
MAT-M604	Research Seminar I	2	1.5	0.5
	Total	25	18.75	6.25

MAT-M601 - Scientific Computing and Algorithmic Mathematics

Scope	Theory	Practice / research	Workload
7 ECTS	4.75 ECTS	2.25 ECTS	175 hours

Course component	ECTS	Share
High-performance numerical methods	1.75	25.00%
Parallelisation and algorithmic efficiency	1.75	25.00%
Error analysis, stability and reproducibility	1.75	25.00%
Implementation of a research problem	1.75	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Scientific Computing and Algorithmic Mathematics.
- Apply and compare methods relating to high-performance numerical methods and parallelisation and algorithmic efficiency.
- Analyse mathematical problems involving error analysis, stability and reproducibility and justify the selected approach.
- Implement, evaluate or validate work relating to implementation of a research problem.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: algorithmic analysis. Oral: defence. Practical / research-related: functional, documented research software.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M602 - Advanced Master Module I

Scope	Theory	Practice / research	Workload
8 ECTS	6.25 ECTS	1.75 ECTS	200 hours

Course component	ECTS	Share
Theoretical foundations of the specialisation	2	25.00%
Advanced methods and structures	2	25.00%
Current research questions	2	25.00%
Application or research task	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Master Module I.
- Apply and compare methods relating to theoretical foundations of the specialisation and advanced methods and structures.
- Analyse mathematical problems involving current research questions and justify the selected approach.
- Implement, evaluate or validate work relating to application or research task.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: advanced subject paper. Oral: colloquium. Practical / research-related: research or modelling task.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M603 - Advanced Master Module II

Scope	Theory	Practice / research	Workload
8 ECTS	6.25 ECTS	1.75 ECTS	200 hours

Course component	ECTS	Share
Advanced theory and state of research	2	25.00%
Comparison and justification of methods	2	25.00%
Investigation of an open problem	2	25.00%
Presentation of results and transfer	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Master Module II.
- Apply and compare methods relating to advanced theory and state of research and comparison and justification of methods.
- Analyse mathematical problems involving investigation of an open problem and justify the selected approach.
- Implement, evaluate or validate work relating to presentation of results and transfer.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: research essay. Oral: defence. Practical / research-related: model, simulation, proof reconstruction or software.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M604 - Research Seminar I

Scope	Theory	Practice / research	Workload
2 ECTS	1.5 ECTS	0.5 ECTS	50 hours

Course component	ECTS	Share
Review of current literature	0.5	25.00%
Analysis of a publication	0.5	25.00%
Reconstruction of proofs or methods	0.5	25.00%
Seminar presentation and discussion	0.5	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Research Seminar I.
- Apply and compare methods relating to review of current literature and analysis of a publication.
- Analyse mathematical problems involving reconstruction of proofs or methods and justify the selected approach.
- Implement, evaluate or validate work relating to seminar presentation and discussion.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: analytical paper. Oral: seminar presentation. Practical / research-related: replicated method or proof reconstruction.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

3.4 Master Semester 3 - Research Profile, Interdisciplinarity and Master Thesis Preparation

Development of the individual research profile, interdisciplinary project work, academic leadership and the master thesis proposal.

Code	Module	ECTS	Theory	Practice
MAT-M701	Advanced Master Module III	8	6	2
MAT-M702	Interdisciplinary Mathematical Research Project	8	5	3
MAT-M703	Higher Education Teaching, Science Communication, Leadership and Emotional Intelligence	4	3.25	0.75
MAT-M704	Research Seminar II and Master Thesis Proposal	5	4.5	0.5
	Total	25	18.75	6.25

MAT-M701 - Advanced Master Module III

Scope	Theory	Practice / research	Workload
8 ECTS	6 ECTS	2 ECTS	200 hours

Course component	ECTS	Share
Advanced specialist theory	2	25.00%
Research-oriented methods	2	25.00%
Mathematical problem seminar	2	25.00%
Independent research or modelling work	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Advanced Master Module III.
- Apply and compare methods relating to advanced specialist theory and research-oriented methods.
- Analyse mathematical problems involving mathematical problem seminar and justify the selected approach.
- Implement, evaluate or validate work relating to independent research or modelling work.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: advanced paper. Oral: problem seminar. Practical / research-related: research or modelling work.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M702 - Interdisciplinary Mathematical Research Project

Scope	Theory	Practice / research	Workload
8 ECTS	5 ECTS	3 ECTS	200 hours

Course component	ECTS	Share
Interdisciplinary problem definition	2	25.00%
Mathematical model development	2	25.00%
Computation, simulation or data analysis	2	25.00%
Validation and interdisciplinary transfer	2	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Interdisciplinary Mathematical Research Project.
- Apply and compare methods relating to interdisciplinary problem definition and mathematical model development.
- Analyse mathematical problems involving computation, simulation or data analysis and justify the selected approach.
- Implement, evaluate or validate work relating to validation and interdisciplinary transfer.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: research report. Oral: interdisciplinary defence. Practical / research-related: model, simulation, data analysis or software.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M703 - Higher Education Teaching, Science Communication, Leadership and Emotional Intelligence

Scope	Theory	Practice / research	Workload
4 ECTS	3.25 ECTS	0.75 ECTS	100 hours

Course component	ECTS	Share
Higher-education didactics and teaching planning	1	25.00%
Mathematical science communication	1	25.00%
Leadership, collaboration and conflict competence	1	25.00%
Supervision, feedback and ethical responsibility	1	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Higher Education Teaching, Science Communication, Leadership and Emotional Intelligence.
- Apply and compare methods relating to higher-education didactics and teaching planning and mathematical science communication.
- Analyse mathematical problems involving leadership, collaboration and conflict competence and justify the selected approach.
- Implement, evaluate or validate work relating to supervision, feedback and ethical responsibility.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: teaching and communication concept. Oral: teaching sequence and reflection. Practical / research-related: completed teaching or supervision simulation.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M704 - Research Seminar II and Master Thesis Proposal

Scope	Theory	Practice / research	Workload
5 ECTS	4.5 ECTS	0.5 ECTS	125 hours

Course component	ECTS	Share
Topic identification and research question	1	20.00%
State of research and literature base	1	20.00%
Method and proof strategy	1	20.00%
Work, time and risk planning	1	20.00%
Research proposal and defence	1	20.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Research Seminar II and Master Thesis Proposal.
- Apply and compare methods relating to topic identification and research question and state of research and literature base.
- Analyse mathematical problems involving method and proof strategy and justify the selected approach.
- Implement, evaluate or validate work relating to work, time and risk planning and research proposal and defence.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: research proposal. Oral: defence. Practical / research-related: methodological pilot or feasibility evidence.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

3.5 Master Semester 4 - Master Thesis, Defence and Publication

Independent research, formal defence, publication preparation and academic transfer.

Code	Module	ECTS	Theory	Practice
MAT-M801	Master Thesis	20	14.5	5.5
MAT-M802	Master Colloquium, Defence and Publication Seminar	5	4.25	0.75
	Total	25	18.75	6.25

MAT-M801 - Master Thesis

Scope	Theory	Practice / research	Workload
20 ECTS	14.5 ECTS	5.5 ECTS	500 hours

Course component	ECTS	Share
Research question and mathematical framework	3	15.00%
Systematic literature and source review	3	15.00%
Methodology, proof or modelling strategy	3	15.00%
Independent mathematical research contribution	6	30.00%
Validation, reproducibility and error analysis	3	15.00%
Presentation of results, discussion and completion	2	10.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Master Thesis.
- Apply and compare methods relating to research question and mathematical framework and systematic literature and source review.
- Analyse mathematical problems involving methodology, proof or modelling strategy and justify the selected approach.
- Implement, evaluate or validate work relating to independent mathematical research contribution and validation, reproducibility and error analysis.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: master thesis. Oral: interim and final colloquia. Practical / research-related: proof, model, code, simulation, data or methods package.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

MAT-M802 - Master Colloquium, Defence and Publication Seminar

Scope	Theory	Practice / research	Workload
5 ECTS	4.25 ECTS	0.75 ECTS	125 hours

Course component	ECTS	Share
Academic presentation	1.25	25.00%
Oral defence	1.25	25.00%
Practical or methodological demonstration	1.25	25.00%
Publication version and transfer	1.25	25.00%

Learning Outcomes

- Demonstrate a rigorous and appropriately advanced understanding of Master Colloquium, Defence and Publication Seminar.
- Apply and compare methods relating to academic presentation and oral defence.
- Analyse mathematical problems involving practical or methodological demonstration and justify the selected approach.
- Implement, evaluate or validate work relating to publication version and transfer.
- Present and defend methods, assumptions, results, uncertainty and limitations in written, oral and practical or research-related formats.

Assessment Methods

Written: publication or transfer version. Oral: defence. Practical / research-related: demonstration, reproducible software, model or data package.

Quality Management and Progression

Evaluation at module, subtopic and competency level; deviations trigger targeted student-development or quality-improvement measures.

3.6 Master Thesis, Defence and Research Approval

The master thesis constitutes an independent academic contribution. The research question, assumptions, methodology, results, validation, limitations and open questions must be documented transparently. The defence includes a publication or transfer version and a reproducible practical or methodological component where applicable.

3.7 Master Total

Semester	ECTS	Theory	Practice / research	Workload
Master Semester 1	25	18.75	6.25	625 hours
Master Semester 2	25	18.75	6.25	625 hours
Master Semester 3	25	18.75	6.25	625 hours
Master Semester 4	25	18.75	6.25	625 hours
Total	100	75	25	2,500 hours

- The overall pass threshold is 66.67%.
- At least two of the three equal assessment components must independently meet the competency threshold.
- Subject-specific barrier assessments may exclude compensation.
- Research approval requires academic integrity, transparent documentation and appropriate ethical and legal review.

4. Overall Qualification Pathway in Mathematics

Level	Cumulative ECTS	Cumulative workload	Academic capability
Bachelor Stage 1	60	1,500 hours	Secure foundations and defined applications
Bachelor Stage 2	120	3,000 hours	Structural integration and reasoned method selection
Bachelor Stage 3	180	4,500 hours	Independent modelling, simulation and specialisation
Bachelor Stage 4 / B.Sc.	240	6,000 hours	Independent research, defence and transfer
Master / M.Sc.	340	8,500 hours	Advanced research, leadership and publication

4.1 Competency Progression

- Progression is evaluated through module-, subtopic- and assessment-component data.
- Each stage targets a clearly documented improvement in independent academic competence.
- Support intensity is governed separately from the 25-hour ECTS workload model.
- High standards are maintained through transparent thresholds, barrier assessments and controlled completion approval.

4.2 Sustainability and Reuse

Modules are first developed independently and in full. Only after all curricula have been completed are overlaps systematically identified. Shared content is then organised as reusable Learning Objects and teaching videos, while subject-specific depth, progression and assessment remain explicitly controlled.

5. Course, Learning Object and Teaching-Video Integration

The curriculum provides the academic source structure for later production of digital learning content. Course components are mapped to reusable Learning Objects only after the independent curriculum versions have been completed and compared.

Architecture layer	Function
Curriculum	Defines programme outcomes, progression, ECTS, workload and assessment.
Module	Defines coherent subject content and competency development.
Course component	Defines the smallest academically controlled content unit.
Learning Object	Reusable, version-controlled digital learning unit.
Teaching video	Media expression linked to one or more Learning Objects.
Assessment object	Validated written, oral or practical/research-related evidence.
Quality record	Documents performance data, revisions, translations and approvals.

- Common content is produced once and assigned to multiple curricula only after academic comparison.
- Subject-specific variants are retained where depth, terminology, application or assessment differs.
- Translation versions are linked to the same controlled Learning Object and version history.
- Accessibility, multilingual delivery and human escalation pathways are included from the outset.

6. Governance, Versioning and System Boundaries

6.1 Change-Control Principle

The curriculum is a controlled academic master record. Changes to module titles, ECTS, workload, theory/practice allocation, learning outcomes, assessment rules, country variants or accreditation variants require documented justification, versioning and approval by the competent academic body.

6.2 Quality and Transparency

- All module versions retain a complete change history.
- Learning Objects, teaching videos, translations and assessments inherit the approved module version.
- Only affected components are revised; the overall system is not unnecessarily rebuilt.
- Performance data, support measures and quality interventions remain auditable.
- Academic, legal, professional-regulatory and accreditation status is stated transparently.
- The protected name Yushin-Ryu is retained unchanged in all languages and publications.

Responsibility	Primary role
Academic bodies	Programme approval, amendments and completion standards
Quality management	Monitoring, analysis, intervention and effectiveness review
Digital production	Version-controlled Learning Objects, teaching videos and translations
Legal / accreditation review	Country-specific approvals, recognition and regulatory boundaries

7. Concluding Statement

The Curriculum in Mathematics establishes a complete academic pathway from mathematical foundations through advanced research and publication. It combines a 240-ECTS extended bachelor programme with a 100-ECTS research-oriented master programme, based on 25 hours of student workload per ECTS and a separately governed support and quality architecture.

The foundational curriculum, ECTS, performance, percentage-weighting, assessment, progression, reuse and quality-management logic was developed by Prof. Dr. Frank Benjamin Weibel. Yushin-Ryu Private University LLC is the publisher. Formal implementation remains subject to the required academic, legal and accreditation approvals.

Yushin-Ryu Private University
Curriculum in Mathematics

Bachelor of Science - 240 ECTS | Master of Science - 100 ECTS

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