SIMON-INSTITUTE CURRICULUM FRAMEWORK

PROGRAM STRUCTURE OVERVIEW

Undergraduate (B.S. in AI Systems & Quantum Foundations)

- 120 semester hours
- 4 years
- Focus: **foundations + systems + applied AI + intro quantum**

Graduate (M.S. in AI & Quantum Systems)

- 30–36 semester hours
- Focus: **advanced systems + research + specialization**

Doctoral (PhD in Integrated AI & Quantum Systems)

- 60+ semester hours + dissertation
- Focus: **original research + system-level innovation**

UNDERGRADUATE PROGRAM (B.S.)

YEAR 1 — FOUNDATIONS (30 hours)

Course	Title	Hours	Description
SIMON 101	Introduction to AI Systems	3	Overview of AI systems, infrastructure, and applications.
SIMON 102	Programming for AI	3	Python and systems-level programming for AI workflows.
MATH 151	Calculus I	4	Differential calculus for modeling.
MATH 152	Calculus II	4	Integral calculus and optimization foundations.
STAT 201	Probability & Statistics	3	Foundations of probabilistic reasoning.
SIMON 110	Data Literacy & Ethics	3	Ethical frameworks for AI and data use.
ENG 101	Technical Communication	3	Writing and communication for technical domains.
SIMON 120	Systems Thinking	3	Understanding complex systems and interdependencies.
ELECTIVE	General Education	4	University requirement.

YEAR 2 — CORE COMPUTATION (30 hours)

Course	Title	Hours	Description
SIMON 201	Data Structures for AI	3	Core data structures and performance considerations.
SIMON 202	Algorithms & Optimization	3	Algorithm design and computational efficiency.
SIMON 210	Linear Algebra for AI	3	Matrix operations and vector spaces.
SIMON 220	Distributed Systems	3	Foundations of distributed computing.
SIMON 230	Computer Architecture	3	CPU, GPU, and memory systems.
SIMON 240	Databases & Data Systems	3	Data storage and retrieval at scale.
SIMON 250	Parallel Programming	3	Multi-threaded and GPU programming.
SIMON 260	Networking Fundamentals	3	High-speed networking basics.
ELECTIVE	General Education	6	University requirement.

YEAR 3 — AI + INFRASTRUCTURE (30 hours)

Course	Title	Hours	Description
SIMON 301	Machine Learning	3	Core ML models and evaluation.
SIMON 302	Deep Learning	3	Neural networks and training techniques.
SIMON 310	GPU Systems & Acceleration	3	GPU architecture and performance tuning.
SIMON 320	AI Infrastructure (Baby Bear Lab)	4	Hands-on training on supercluster systems.
SIMON 330	Storage Systems for AI	3	High-performance storage and I/O.
SIMON 340	Model Training at Scale	3	Distributed training techniques.
SIMON 350	AI Systems Optimization	3	Performance tuning and efficiency.
SIMON 360	Intro to Quantum Computing	3	Basic quantum concepts and models.
ELECTIVE	Domain Elective	5	Application-specific course.

YEAR 4 — INTEGRATION & APPLICATION (30 hours)

Course	Title	Hours	Description
SIMON 401	Advanced AI Systems	3	Integration of large-scale AI systems.
SIMON 410	Quantum Computing Applications	3	Practical quantum use cases.
SIMON 420	Hybrid AI + Quantum Systems	3	Combined workflows.
SIMON 430	Ethics & Governance of AI	3	Policy, risk, and governance frameworks.
SIMON 440	Industry Capstone (Baby Bear + Mama Bear)	6	Real-world project using full infrastructure.
SIMON 450	Research Methods	3	Experimental design and analysis.
ELECTIVE	Advanced Electives	9	Specialized study.

GRADUATE PROGRAM (M.S.)

CORE (18 hours)

Course	Title	Hours	Description
SIMON 501	Advanced Machine Learning	3	Advanced models and architectures.
SIMON 510	Distributed AI Systems	3	Multi-node training and orchestration.
SIMON 520	High-Performance Computing	3	HPC systems and optimization.
SIMON 530	Quantum Computing Systems	3	Hardware and system-level understanding.
SIMON 540	AI + Quantum Integration	3	Hybrid computing workflows.
SIMON 550	Research Seminar	3	Research presentation and critique.

SPECIALIZATION (choose 12–18 hours)

AI Systems Track

- SIMON 561 Large Model Systems
- SIMON 562 AI Infrastructure Design
- SIMON 563 Edge AI Systems

Quantum Systems Track

- SIMON 571 Quantum Algorithms
- SIMON 572 Quantum Hardware
- SIMON 573 Quantum Error Correction

Applied Domain Track

- SIMON 581 AI in Medicine
- SIMON 582 AI in Climate Science
- SIMON 583 AI in Finance

THESIS / PROJECT (6 hours)

Course	Title	Hours	Description
SIMON 590	Graduate Thesis	6	Research or applied project using SIMON systems.

PHD PROGRAM

COURSEWORK (24–30 hours)

Course	Title	Hours	Description
SIMON 701	Advanced AI Theory	3	Theoretical foundations of AI.
SIMON 710	Scalable Systems Design	3	Large-scale system architecture.
SIMON 720	Quantum Information Science	3	Advanced quantum theory.
SIMON 730	AI + Quantum Research Methods	3	Experimental hybrid systems.
SIMON 740	Advanced HPC	3	Extreme-scale computing.
SIMON 750	Governance of Advanced Systems	3	Policy and institutional impact.

RESEARCH (30+ hours)

Course	Title	Hours	Description
SIMON 800	Dissertation Research	Variable	Original research contribution.

REQUIRED MILESTONES

- Qualifying Exam
- Proposal Defense
- Dissertation Defense

CURRICULUM DIFFERENTIATORS

1. Infrastructure-Integrated Learning

Students work directly on:

- Baby Bear supercluster
- Mama Bear quantum systems

2. System-Level Thinking

Not: “learn AI tools”

But: “design and operate AI systems at scale”

3. Hybrid AI + Quantum Exposure

Students graduate with:

- Practical quantum understanding
- Not just theory

4. Governance + Ethics Built-In

Every level includes:

- Decision-making
- Responsibility
- Institutional impact

FINAL POSITIONING

This curriculum produces:

AI system operators, not just programmers
Infrastructure designers, not just users
Leaders capable of guiding superintelligence responsibly