Program of Study

School of Systems Engineering

Degree: Bachelor of Science in Autonomous Metastructural Engineering (B.S. AME)

Program Overview

The Bachelor of Science in Autonomous Metastructural Engineering is a pioneering, post-disciplinary program designed to educate the architects of the next technological paradigm. The AME curriculum is founded on the principle that the physical world, from the atomic to the planetary scale, can be treated as a programmable substrate. This rigorous program provides students with a unified methodology for the design, high-fidelity simulation, and autonomous physical deployment of complex, goal-oriented systems. Our core pedagogy is the seamless integration of **Conception, Simulation, and Manifestation**, training graduates to transition an idea directly into a self-executing physical reality.

Degree Requirements

- **Program Structure:** An intensive, eight-semester curriculum focused exclusively on the AME discipline and its foundational sciences.
- **Capstone:** Successful completion and public defense of the AME 499 Genesis Project is required for graduation.

Core AME Curriculum

YEAR ONE: Foundational Pillars

Focus: Establishing a common language in the core physical and computational sciences.

Semester I	Semester II
AME 101: Intro to Programmable Matter	**PHYS 111**: Physics for System Architects II
PHYS 110: Physics for System Architects I	**CS 110**: Computational Structures & AI
MATH 110: Systems Dynamics & Modeling	**CHEM 105**: Principles of Material Chemistry
AME 100: First-Year AME Seminar	**MATH 210**: Advanced Linear Algebra

YEAR TWO: The AME Core Integration

Focus: Integrating foundational knowledge into the core AME workflow.

YEAR THREE: Advanced Applications & Specialization

Focus: Applying the AME workflow to a specialized domain.

YEAR FOUR: The Genesis Capstone Project

Focus: A year-long, team-based project demonstrating full mastery of the AME process.

Semester III	Semester IV
AME 201: High-Fidelity Simulation & Digital Twinning	**AME 203**: Autonomous Robotics & Swarm Logistics
AME 202: AI Planning & Goal-Oriented Systems	**AME 204**: Energy Systems & In-Situ Resource Utilization
PHYS 210: Advanced Thermodynamics	**AME 250**: AME Ethics & Safety Protocols
CS 220: Algorithms for Complex Systems	

Semester V	Semester VI
AME 301: Advanced Materials & Nanofabrication	**AME 350**: Large-Scale Systems Management
AME 310: Control Theory & Non-Linear Dynamics	**SPEC 2**: Specialization Course II
CS 340: Distributed Computing	
SPEC 1: Specialization Course I	

Semester VII	Semester VIII
AME 498: Genesis Project I: Conception & Simulation	**AME 499**: Genesis Project II: Manifestation & Defense
SPEC 3: Specialization Course III	**SPEC 4**: Specialization Course IV

Specialization Tracks (Select 4 Courses from One Track)

A. **Extraterrestrial Engineering:** AME 311, AME 312, AME 410, AME 415

B. **Planetary Environmental Systems:** AME 321, AME 322, AME 420, AME 425

C. **Bio-Nanotechnology:** AME 331, AME 332, AME 430, AME 435

D. **Computational Substrate Design:** AME 341, AME 342, AME 440, AME 445

Course Descriptions (Abbreviated)

AME 101: Introduction to Programmable Matter An introduction to the core philosophy of AME. Explores case studies where matter is manipulated to perform computations or functions, from synthetic biology to theoretical megastructures.

AME 201: High-Fidelity Simulation & Digital Twinning Core methods for creating predictive, multi-physics digital models of complex physical systems. Topics include finite element analysis, computational fluid dynamics, and agent-based modeling.

AME 202: AI Planning & Goal-Oriented Systems Fundamentals of artificial intelligence for autonomous decision-making. Topics include search algorithms, reinforcement learning, and symbolic planning for deriving complex action sequences from high-level goals.

AME 203: Autonomous Robotics & Swarm Logistics Principles of decentralized control for multi-agent robotic systems. Covers swarm intelligence, formation control, collective construction, and fault tolerance in autonomous fleets. Lab component included.

AME 250: AME Ethics & Safety Protocols A critical examination of the ethical implications and potential hazards of large-scale, autonomous engineering. Covers containment,

value alignment, and failsafe design for high-consequence systems.

AME 498/499: Genesis Project I & II A two-semester capstone experience where student teams design, simulate, and physically prototype a complex autonomous system to solve a grand challenge. The project culminates in a formal paper and public defense.