School of System Design and Intelligent Manufacturing

Program of Automation for International Students (2023)

I. Introduction

Automation is an inter-disciplinary major that integrates automatic control, electronic engineering, computer technology, and artificial intelligence. It takes mathematics, information theory, control theory, system theory and other knowledge as the core, and aims to realize digitization, automation and intelligence of systems and management. The aim is to cultivate compound talents with international vision and competitiveness with equal emphasis on scientific innovation and engineering practice. As an important direction of information science, Automation focuses on intelligent systems and is widely used in the areas of national strategic development to promote the rapid development of society and economy. With the boost of modern science, the application field of automation technology will expand day by day, and the demand for automation professionals will continue to increase in the future. Graduates of automation will also take advantage of extensive applications of this cutting-edge technology to give full play to their professional advantages.

Academic subject areas: Automation

Program code: 080801

II. Objectives and Learning Outcomes

1. Objectives

Cultivate outstanding talents in automation and related fields with "international vision and native land emotion", who can abide by engineering ethics and professional ethics, and have a solid theoretical foundation and outstanding practical innovation ability.

Alumni of Automation (5 years after graduation) should demonstrate:

Technical Skills: technically competent to conduct research and development in industry and universities in Automation and related fields and able to discover new theories, new knowledge, and new technologies to solve complex engineering problems.

Engineering Ethos: able to think critically and creatively, able to use engineering principles to embrace challenging engineering and non-engineering problems encountered at work, able to apply an analytic mindset, make informed decisions and able to provide innovative solutions.

Attitude: self-motivated with a desire for lifelong learning to adapt to the fast changing environment, able to operate with integrity and responsibility, having optimism and composure under tight schedule, and committed to make a positive impact on society locally and globally.

Leadership: well-prepared to advance towards leadership positions with a good teamwork ability, able to capitalize the individual strengths of team members, and able to nurture the team to achieve goals.

2. Learning Outcomes

Student Outcomes (SOs) that prepare graduates to enter the professional practice of engineering:

SO 1, Engineering knowledge: an ability to apply knowledge of mathematics, natural science, automation, and other related engineering to solve complex engineering problems.

SO 2, Problem analysis: an ability to identify, formulate and analyze complex engineering problems through literature research in order to obtain effective solutions.

SO 3, Design/development solutions: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

SO 4, Research: an ability to conduct research on complex engineering problems in automation-related fields based on scientific principles, including designing experiments, analyzing data, and obtaining reasonable conclusions.

SO 5, Up-to-date techniques: an ability to develop and use appropriate techniques, resources, and information technology tools for control engineering problems, including prediction and simulation of engineering problems.

SO 6, Environment and sustainability: an ability to understand and evaluate the impact of engineering practices in the field of automation on environmental and social sustainability.

SO 7, Professional: an ability to recognize ethical and professional responsibilities in engineering situations.

SO 8, Teamwork: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

SO 9, Communication: an ability to effectively communicate with industry peers and the public on engineering issues in the field of automation, including writing reports and design manuscripts, making presentations, and expressing or responding to instructions.

SO 10, Project Management: an ability to apply the principles of project management and decision-making methods in a multidisciplinary environment.

SO 11, Life-long learning: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

III. Study Length, Degree, and Graduation Requirements

1. Study length: 4 years.

2. Degree conferred: Students who complete and meet the degree requirements of the undergraduate program will be awarded a bachelor's degree in Engineering

3. The minimum credit requirement for graduation: 154 credits. The specific requirements are as follows.

<table>
<tr><th colspan="2">Module</th><th>Category</th><th>Minimum Credit Requirement</th></tr>
<tr><td rowspan="14">General Education Courses</td><td rowspan="2">Chinese Language and Culture Module</td><td>Chinese Language and Culture</td><td>16</td></tr>
<tr><td rowspan="2">Arts and Physical Education Module</td><td>Physical Education</td><td>4</td></tr>
<tr><td>Arts</td><td>2</td></tr>
<tr><td rowspan="3">Competence Development Module</td><td>Computer Programming</td><td>3</td></tr>
<tr><td>Writing</td><td>2</td></tr>
<tr><td>Foreign Languages</td><td>14</td></tr>
<tr><td rowspan="3">Humanities and Social Sciences Module</td><td>Humanities</td><td rowspan="2">6</td></tr>
<tr><td>Social Sciences</td></tr>
<tr><td>Chinese Studies</td><td>2</td></tr>
<tr><td rowspan="4">Mathematics and Natural Sciences Module</td><td>Mathematics</td><td>12</td></tr>
<tr><td>Physics</td><td>10</td></tr>
<tr><td>Chemistry</td><td>3</td></tr>
<tr><td>Geoscience + Life science</td><td>3</td></tr>
<tr><td>GE to Majors Bridging Module</td><td>Introduction to Majors</td><td>2</td></tr>
<tr><td rowspan="4">Major Courses</td><td rowspan="3">Major Required Courses</td><td>Major Foundational Courses</td><td>22</td></tr>
<tr><td>Major Core Courses</td><td>15</td></tr>
<tr><td>Practice-based Learning

(Undergraduate Thesis, Internships, Research projects, etc.)</td><td>14</td></tr>
<tr><td>Major Elective Courses</td><td>Major Elective Courses</td><td>24</td></tr>
<tr><td colspan="3">Total</td><td>154</td></tr>
<tr><td colspan="4">Note: please see the General Education Requirement for more details on Chinese Language and Culture Module, Arts and Physical Education Module, Competence Development Module（Foreign Languages & Writing）, Humanities and Social Sciences Module, and GE to Majors Bridging Module.</td></tr>
</table>

IV. Course Requirements for the Mathematics and Natural Sciences Module and Computer Programming

Course Category	Course Code	Course Name	Credits	Terms	Prerequisite	Dept.
Mathematics	MA117	Calculus I	4	1 Fall	None	MA
	MA127	Calculus II	4	1 Spring	MA117	
	MA113	Linear Algebra	4	1 Spring & Fall	None	
Physics	PHY105	College Physics I	4	1 Fall	None	PHY
	PHY106	College Physics II	4	1 Spring	PHY105	
	PHY104B	Experiments of Fundamental Physics	2	1-2 Spring & Fall	None	
Chemistry	CH105	Chemistry: The Central Science	3	1-2 Spring & Fall	None	CH
Geoscience + Life science	BIO102B	Introduction to Life Science	3	1-2 Spring & Fall	None	BIO
Computer Programming	CS111	Introduction to C programming	3	1-2 Spring & Fall	None	CS

Note:

1. The course of Calculus I and II can be replaced by Mathematical Analysis I and II.

2. The course of College Physics I and II can be replaced by General Physics I and II

3. The course of Linear Algebra can be replaced by Advanced Linear Algebra I.

V. Prerequisites for Major Declaration

Major Declaration Time	Course Code	Course Name	Prerequisite
Declare major at the end of the first academic year	MA117	Calculus I	None
	MA127	Calculus II	MA117
	MA113	Linear Algebra	None
	PHY105	College Physics I	None
	PHY106	College Physics II	PHY105
	PHY104B	Experiments of Fundamental Physics	None
	CS111	Introduction to C programming	None
Declare major at the end of the second academic year	MA117	Calculus I	None
	MA127	Calculus II	MA117
	MA113	Linear Algebra	None
	PHY105	College Physics I	None
	PHY106	College Physics II	PHY105
	PHY104B	Experiments of Fundamental Physics	None
	CS111	Introduction to C programming	None
	CH105	Chemistry: The Central Science	None
	BIO102B	Introduction to Life Science	None
	CS103	Introduction to Artificial Intelligence	None

Note:

1. If the number of students entering a major at the end of the first academic year in the department is greater than or equal to the total number of the teaching-research faculty (PI)*2*60%, all majors in the department may implement the prerequisites for major declaration at the end of the second academic year.
2. If the number of students entering a major at the end of the first academic year in the department is less than the total number of the teaching-research faculty (PI)*2*60%, all majors in the department do not implement the prerequisites for major declaration at the end of the second academic year.
3. Suppose the number of students applying for a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), then the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).
4. For departments that do not implement prerequisites for major declaration at end of the second academic year, if the cumulative number of students applying for a major at the end of the second academic year and the number of students who have entered a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).

VI: Major Course Arrangement

Table 1: Major Required Courses

Program of Automation

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Major Foundational Courses	EE104	Fundamentals of Electric Circuits	2	0	1 Spring	MA117 MA113	EE
	SDM244	Electronic Circuit Principles and Design	4	1	2 Fall	PHY106 EE104	SDIM
	SDM252	Introduction to C++ Programming	3	1	2 Fall	None	SDIM
	SDM246	Signals and Linear System Analysis	3	0	2 Fall	MA127 EE104	SDIM
	SDM234	Mathematical Foundations of Control Engineering	4	0	2 Fall	MA127 PHY106 MA113	SDIM
	MA212	Probability and Statistics	3	0	2 Spring	MA127	MA
	SDM358	Microcomputer and Embedded Systems	3	1	3 Fall	SDM244	SDIM
	Total		22	3			
Major Core Courses	SDM274	AI and Machine Learning	3	0	2 Fall	MA127 MA113	SDIM
	SDM271	System Modeling and Simulation	3	1	2 Spring	SDM234	SDIM
	SDM301	Innovative Practice for Intelligent Control Science I	1	1	2 Spring	None	SDIM
	SDM302	Innovative Practice for Intelligent Control Science II	1	1	3 Fall	None	SDIM
	SDM263	Feedback Control Theory	3	0	2 Spring	EE104	SDIM
	SDM303	Innovative Practice for Intelligent Control Science III	1	1	3 Spring	None	SDIM
	SDM364	Multi-variable Control and Applications	3	0	3 Fall	SDM234 EE205 SDM263	SDIM
	Total		15	4			
Practice-e-	SDM403	Internship	2	2	3 Summer	None	EE

	SDM492	Undergraduate Thesis/Projects	12	12	4 Spring	None	EE
	Total		14	14			
Total			51	21			
Note: Students who have completed Comprehensive Design I&II are not required to take the Graduation Projects/Thesis.							

Table 2: Major Elective Courses

Program of Automation

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Module A	EE211	Robotic Perception and Intelligence	3	1	2/秋	E	EE
	SDM273	Intelligent Sensors and Signal Processing	3	1	2 Spring	EE104	SDIM
	EE326	Digital Image Processing	3	1	2 Spring	EE205	EE
	SDM359	Advanced Machine Learning	3	0	2 Spring	MA113	SDIM
	SDM5006	System Identification and Adaptive Control	3	0	3 Fall	EE371	SDIM
	SDM357	Computer Networking and its Industrial Application	3	0.5	3 Fall	None	SDIM
	SDM5007	Engineering Optimization Methods	3	0	3 Fall	MA127 MA113 MA212	SDIM
	ME336	Collaborative Robot Learning	3	1	3 Spring	ME306 或 ME331	ME
	CS314	Internet of Things	3	1	3 Spring	CS305	CS
	EE332	Digital System Design	3	1	3 Spring	EE202-17	EE
	EE368	Robotic Motion and Control	3	1	3 Spring	EE205	EE
	SDM5009	Discrete Time System Control	3	0	3 Spring	SDM271 SDM263	SDIM
	SDM366	Optimal Control and Estimation	3	0	3 Spring	EE371	SDIM
	EE346	Mobile Robot Navigation and Control	3	1	3 Fall	EE205 MA212	EE
	SDM5008	Advanced Robot Control	3	1	4 Fall	SDM271 SDM263	SDIM

Module B	EE206	Communication Principles	3	1	2 Spring	EE205	EE
	CS208	Algorithm Design and Analysis	3	1	2 Spring	CS109 CS203B	CS
	EE313	Wireless Communications	3	1	3 Fall	EE206	EE
	EE323	Digital Signal Processing	3	1	3 Fall	EE205	EE
	EE342	Sensors and Applications	3	0	3 Fall	None	EE
	CS303B	Artificial Intelligence B	3	1	3 Fall	CS203B CS109 MA212	CS
	CS307	Principles of Database Systems	3	1	3 Fall	None	CS
	MA305	Numerical Analysis	3	0	3 Fall	MA203A 或 MA213	MA
	CS405	Machine Learning	3	1	4 Fall	MA212 MA113	CS
Total			72	16.5			

Note:

At least 24 credits are required , and at least five courses from Module A are required.

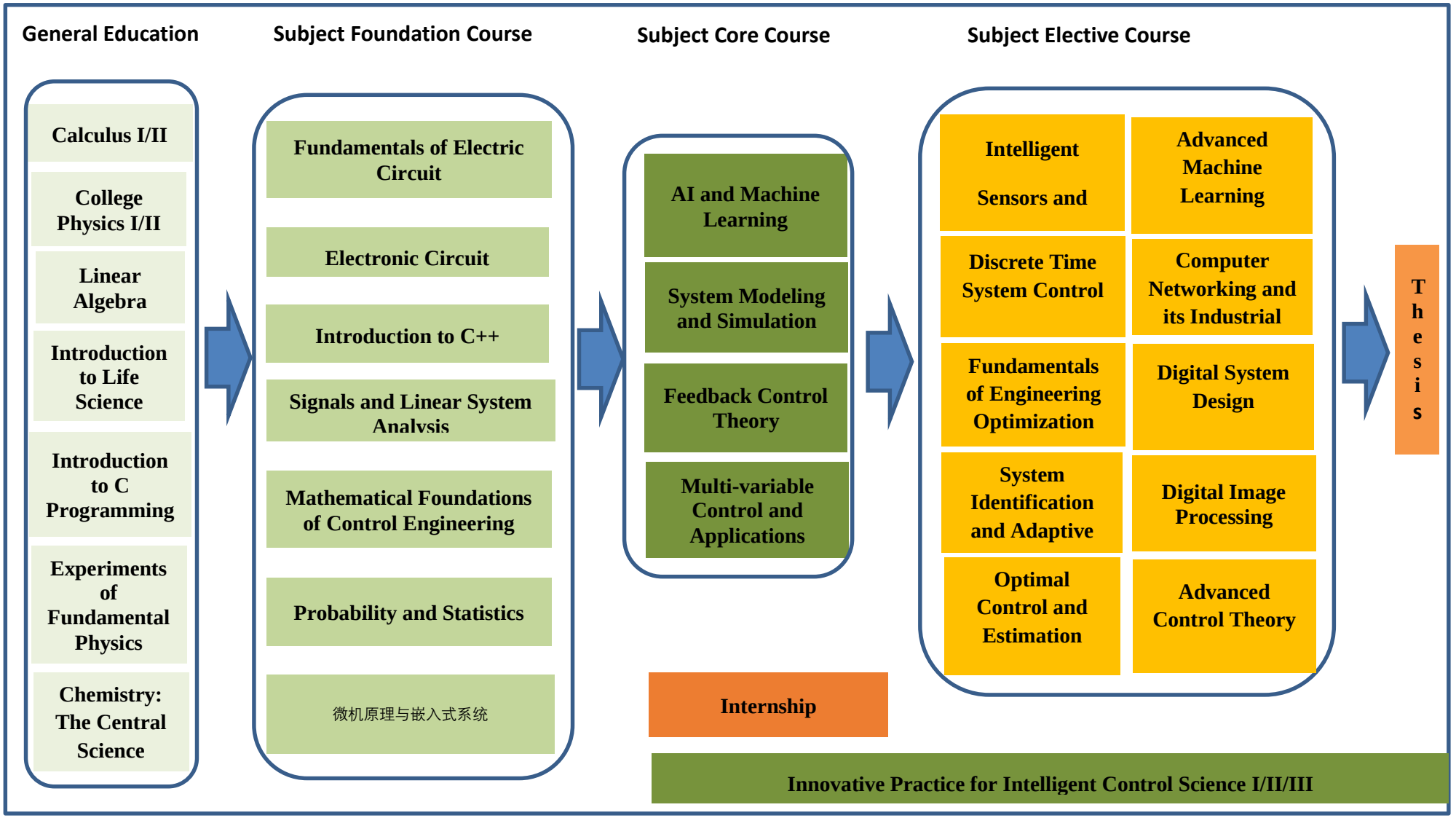
Table 3: Overview of Practice-based Learning

Program of Automation

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
SDM244	Electronic Circuit Principles and Design	4	1	2 Fall	PHY106 EE104	SDIM
SDM252	Introduction to C++ Programming	3	1	2 Fall	None	SDIM
EE211	Robotic Perception and Intelligence	3	1	2/秋	E	EE
EE206	Communication Principles	3	1	2 Spring	EE205	EE
SDM271	System Modeling and Simulation	3	1	2 Spring	SDM234	EE
SDM273	Intelligent Sensors and Signal Processing	3	1	2 Spring	EE104	SDIM
SDM301	Innovative Practice for Intelligent Control Science I	1	1	2 Spring	EE201-17 or EE202-17	SDIM
EE326	Digital Image Processing	3	1	2 Spring	EE205	EE
CS208	Algorithm Design and Analysis	3	1	2 Spring	CS109 CS203B	CS
EE313	Wireless Communications	3	1	3 Fall	EE206	EE
SDM302	Innovative Practice for Intelligent Control Science II	1	1	3 Fall	EE317	EE
EE323	Digital Signal Processing	3	1	3 Fall	EE205	EE
SDM358	Microcomputer and Embedded Systems	3	1	3 Fall	SDM244	SDIM
CS303B	Artificial Intelligence B	3	1	3 Fall	CS203B CS109 MA212	CS
CS307	Principles of Database Systems	3	1	3 Fall	None	CS
SDM357	Computer Networking and its Industrial Application	3	0.5	3 Fall	None	SDIM
ME336	Collaborative Robot Learning	3	1	3 Spring	ME306 或 ME331	ME
CS314	Internet of Things	3	1	3 Spring	CS305	CS
EE332	Digital System Design	3	1	3 Spring	EE202-17	EE
EE346	Mobile Robot Navigation and	3	1	3 Fall	EE205 MA212	EE

	Control					
EE368	Robotic Motion and Control	3	1	3 Spring	EE205	EE
SDM303	Innovative Practice for Intelligent Control Science III	1	1	3 Spring	None	SDIM
SDM403	Internship	2	2	3 Summer	None	EE
SDM5008	Advanced Robot Control	3	1	4 Fall	SDM271 SDM263	SDIM
CS405	Machine Learning	3	1	4 Fall	MA212 MA113	CS
SDM492	Undergraduate Thesis/Projects	12	12	4 Spring	None	EE
Total		78	36.5			

Curriculum Structure of Automation



Note: The Subject Elective course lists include only part of the courses, see more in Program.