Talent Cultivation Program for Automation

I. Program Overview

Major Code: 080801

Admission Category: National College Entrance Examination

Discipline & Major Category: Engineering — Automation Category

Standard Duration: 4 Years

II. Educational Objectives

Implement the fundamental task of fostering virtue through education, focusing on the demand for high-quality applied talents to serve regional economic transformation, industrial upgrading, and technological innovation. This program cultivates socialist builders and successors with all-round development in morality, intelligence, physical fitness, aesthetics, and labor, who are politically sound, highly skilled, honest, trustworthy, rational, and composed. Such graduates will possess solid political and ideological qualities, literacy in humanities and social sciences, and professional ethics, demonstrate strong engineering practical capabilities and an innovative spirit, and master the multidisciplinary comprehensive theoretical knowledge and practical skills required for the automation major. They shall be competent for scientific research, system design, technological development and application, as well as enterprise production management and decision-making in the field of automation engineering.

Approximately five years after graduation, through personal effort and professional experience, graduates should be able to become engineers or outstanding professional talents possessing the following capabilities:

Objective 1: Familiar with the development status and dynamics of the automation field; master the multidisciplinary comprehensive knowledge required for the automation major; capable of mastering new knowledge and technologies in line with scientific development; and able to apply mathematical, physical, engineering foundations, and automation system knowledge to solve complex engineering problems in automation-related fields.

Objective 2: Possess fundamental skills and engineering application capabilities in scientific computing, hardware design, software development, experimental testing, and information integration related to the field of automation engineering. Capable of mastering modern engineering design and development technologies according to engineering needs; and able to comprehensively utilize professional knowledge in the field of control engineering to perform automation system design, control device development, safety production, energy conservation, emission reduction, and production management.

Objective 3: Possess the basic professional qualities and sense of social responsibility of an automation engineer; strictly adhere to professional ethics and norms; be familiar with relevant standards, laws, and regulations in the engaged engineering field; and be able to prioritize public interest in practice while comprehensively considering factors such as law, environment, and sustainability.

Objective 4: Possess physical and mental health, sound socialist values, and humanities and social science literacy. Possess teamwork spirit, effective communication, and expression skills; understand and master engineering management principles and economic decision-making methods; and be able to serve as a technical backbone to play an effective role in the R&D, production, and management of enterprises.

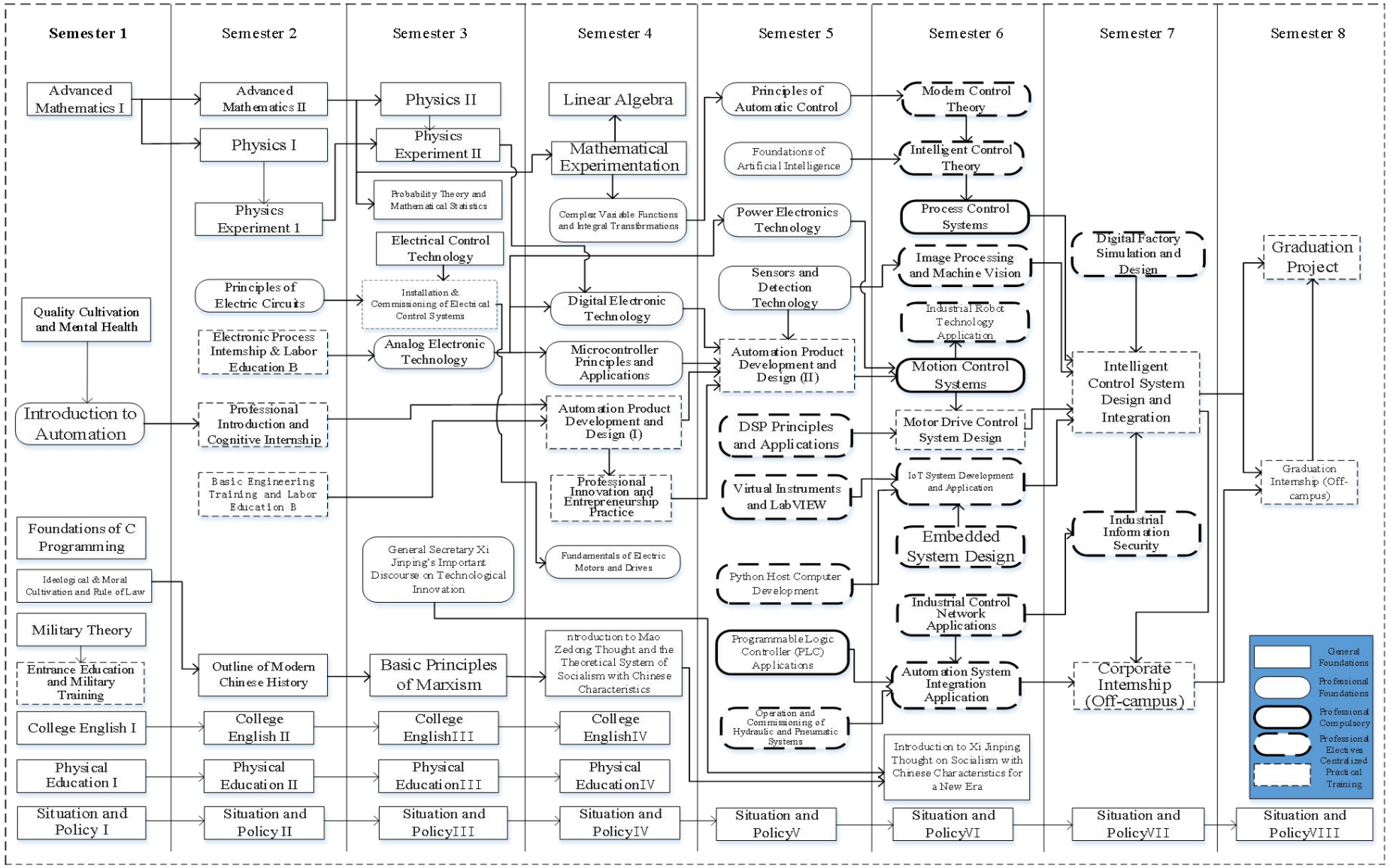
Objective 5: Possess the capacity for lifelong learning and self-improvement; have a certain international perspective; be able to adapt to professional development and job changes; and be able to continuously improve professional literacy and personal quality through engineering practice and continuing education.

III. Graduation Requirements and Mapping Matrix

Graduation Requirements	Implementation Links / Channels
1. Engineering Knowledge: Capable of applying knowledge of mathematics, natural sciences, engineering fundamentals, and professional expertise to solve complex engineering problems in the field of automation.	Advanced Mathematics, Linear Algebra, Probability Theory and Mathematical Statistics, Physics, Physics Experiment, Foundations of Programming, Electric Circuits, Electrical Control Technology.
2. Problem Analysis: Capable of applying basic principles of mathematics, natural sciences, and engineering sciences to identify, express, and analyze complex engineering problems such as modeling, control strategies, and stability of control systems in the automation field through literature research to obtain effective conclusions.	Electric Circuits, Analog Electronic Technology, Digital Electronic Technology, Power Electronics Technology, Sensors and Detection Technology, Fundamentals of Electric Motors and Drives, Automatic Control Theory, Modern Control Theory, Foundations of Artificial Intelligence, Motion Control Systems, Process Control Systems, Intelligent Control Theory.
3. Design/Development of Solutions: Capable of designing solutions for complex engineering problems in the automation field, and designing products, units (components), or technological processes that meet system control requirements, while demonstrating innovation awareness in the design process and considering factors such as society, health, safety, law, culture, and the environment.	Microcontroller Principles and Applications, Automation Product Development and Design, Programmable Logic Controller (PLC) Applications, Industrial Robot Technology Application, Operation and Commissioning of Hydraulic and Pneumatic Systems, Sensors and Detection Technology, Industrial Control Network Applications, Motor Drive Control System Design, Embedded System Principles.
4. Research: Capable of conducting research on complex engineering problems in the automation field based on scientific principles and using scientific methods, including system design, experimental design, verification, data analysis, and reasonable interpretation, to reach sound and effective conclusions through information synthesis.	Process Control Systems, Motion Control Systems, Modern Control Theory, Foundations of Artificial Intelligence, Intelligent Control Theory, Image Processing and Machine Vision, Industrial Robot System Integration, Intelligent Production Line Design and Integration.
5. Use of Modern Tools: Capable of developing, selecting, and using appropriate techniques, resources, modern engineering tools, and information technology tools for complex engineering problems in the automation field, including the selection and use of simulation software, instruments, and meters to predict and simulate complex engineering problems in the automation field, with an understanding of their limitations.	Microcontroller Principles and Applications, Programmable Logic Controller (PLC) Applications, DSP Principles and Applications, Virtual Instruments and LabVIEW, Digital Factory Simulation Technology, IoT System Development and Application, Automation Product Design, Intelligent Production Line Design and Integration.

6. Engineering and Society: Capable of conducting reasonable analysis based on background knowledge related to automation engineering, evaluating the impact of professional engineering practices and complex engineering problem solutions on society, health, safety, law, and culture, and understanding the corresponding responsibilities to be assumed.	Automation System Integration Application, IoT System Development and Application, Image Processing and Machine Vision, Digital Factory Simulation Technology, Foundations of Artificial Intelligence, Automation Professional Cognitive Internship, Corporate Internship, Graduation Internship.
7. Environment and Sustainability: Capable of understanding and evaluating the impact of engineering practices for complex engineering problems in the automation field on the environment and social sustainable development.	Labor Education for Automation Major, Industrial Information Security, Motor Drive System Analysis and Design, Operation and Commissioning of Hydraulic and Pneumatic Systems, Automation System Integration Application, Corporate Internship, Graduation Internship.
8. Professional Norms: Possess humanities and social science literacy and a sense of social responsibility; capable of understanding and abiding by engineering professional ethics and norms in automation engineering practice and fulfilling corresponding responsibilities.	Electronic Process Internship and Labor Education, Engineering Foundation Training and Labor Education, Automation System Integration Application, IoT System Development and Application, Corporate Internship, Graduation Internship.
9. Individual and Team: Capable of assuming the roles of individual, team member and leader in teams with multidisciplinary backgrounds.	Physical Education, Foundations of Innovation and Entrepreneurship, Military Theory, Entrance Education and Military Training, Industrial Robot System Integration, Intelligent Control System Design and Integration, Motor Drive Control System Design, Corporate Internship, Graduation Internship.
10. Communication: Capable of effectively communicating and exchanging ideas with industry peers and the public regarding complex engineering problems, including writing reports and design documents, making presentations, and clearly expressing or responding to instructions. Capable of reading foreign language materials in the automation major, possessing a certain international perspective, and using technical language for communication and exchange in cross-cultural contexts.	College English I-IV, Professional English for Automation, Situation and Policy, Automation Professional Cognitive Internship, Automation Product Development and Design, Intelligent Production Line Design and Integration, Corporate Internship.
11. Project Management: Understand and master the principles of engineering management and economic decision-making methods, and be capable of applying them in multidisciplinary environments.	Motor Drive Control System Design, Automation System Integration Application, Intelligent Production Line Design and Integration.
12. Lifelong Learning: Possess the consciousness of independent and lifelong learning, and the ability to continuously learn and adapt to the development of social, scientific, and technological developments.	Physical Education, College English I-IV, Second Classroom, Quality Cultivation and Mental Health, Corporate Internship, Graduation Internship, Graduation Project (Thesis).
13. Capable of applying professional knowledge in the field of control engineering to solve complex problems in the application of automation systems and obtaining one intermediate vocational qualification certificate.	Programmable Logic Controller (PLC) Applications, Industrial Robot Technology, Automation System Integration Application.

IV. Curriculum Topology



V. Core Professional Courses

(1) Microcontroller Principles and Applications: This course systematically explains embedded technology and peripheral circuits centered on MCS-51. It focuses on the hardware structure, instruction system, and programming methods of single-chip microcomputers. Through this course, students will master the working principles of microcontrollers, program writing, and the application of integrated development platforms (IDEs), fostering their ability to analyze and solve problems and practical hands-on abilities. Additionally, it introduces students to the cutting edge of the embedded industry, laying a foundation for their future career choices.

(2) Principles of Automatic Control: This course mainly introduces the basic concepts of automatic control theory and the fundamental theories of analysis and design methods for automatic control systems. It emphasizes the basic composition and structure of automatic control systems, the performance indicators of automatic control systems, the types (continuous, discrete, linear, nonlinear, etc.) and characteristics of automatic control systems, as well as the analysis (time-domain method, frequency-domain method, etc.) and design methods of automatic control systems. It cultivates students' thinking and methods for control system analysis and design, providing a solid foundation for subsequent professional courses.

(3) Image Processing and Machine Vision: This course investigates the basic theories and methods of digital image processing and their applications in intelligent detection. Machine vision, as a vital component of intelligent machines, is closely related to image processing, pattern recognition, artificial intelligence, artificial neural networks, neurophysics, and cognitive science. Learning this course provides a solid foundation for engaging in research and development in the fields of machine vision, digital image processing, and pattern recognition.

(4) Sensors and Detection Technology: This course covers the basic structure of detection systems; fundamental concepts, development trends, and applications of sensing and detection technology; static and dynamic characteristics of sensors; and the working principles, structural characteristics, measurement circuits, and applications of various common and new sensors. It includes error analysis and basic processing algorithms for measurement data, modern detection technology, and sensor fusion technology. The course is highly practical, with rapidly updated knowledge and in-depth interdisciplinary integration. Students will learn to reasonably select, use,

and maintain sensors in the comprehensive design and implementation of modern automation and intelligent systems; and be able to design sensing and detection circuits and construct automatic control systems according to the relevant requirements of the measured object, production conditions, detection environment, and control performance, while comprehensively considering factors such as safety, environmental protection, and economy that affect the system scheme, laying a good foundation for subsequent courses.

(5) Programmable Logic Controller (PLC) Applications: Using Siemens PLC as the primary carrier, this course mainly teaches PLC programming instructions, programming methods, program writing and debugging skills, and the design thinking of control systems. The course follows a project-based approach, with projects designed as typical cases based on actual automatic control projects in daily industrial production. By completing these learning projects, students acquire the ability to analyze and design integrated PLC control systems, as well as the ability to write and debug control programs. It also cultivates students' realistic scientific attitude and their ability to analyze and solve problems.

(6) Process Control Systems: Based on the actual needs of current production process automation and the new developments in process control, this course introduces the basic concepts, working principles, and usage requirements of production process control systems and automated instrumentation. On the basis of simple control system design schemes, it focuses on intelligent instruments, process system modeling, analysis and design of special processes and complex process control systems, network-based computer control systems, and engineering applications. It teaches students to start from the actual needs of production and engineering practicality, apply various advanced and mature control strategies and automated instrumentation, and achieve the unity of advanced nature and engineering practicality in process control system design.

(7) Motor Principles and Drives: This course focuses on DC motors, AC asynchronous motors, AC synchronous motors, and various control motors. It systematically explains the composition, principles, mechanical characteristics, and other contents of various motors. Through this course, students will master the operational principles, calculation, selection, and application methods of various types of motors, laying a good foundation for the subsequent study of motion control systems.

(8) Power Electronics Technology: This course focuses on the performance and working principles of typical power electronic devices, and highlights the four basic forms of power conversion circuits composed of power electronic devices, as well as related technologies such as PWM modulation and soft-switching involved in their applications. It primarily studies the electromagnetic processes, basic principles, control methods, design calculations, technical and economic indicators, and scientific experiments occurring in various power electronic devices. Prerequisite courses mainly include Advanced Mathematics, Physics, Circuit Principles, and Analog Electronic Technology. It builds a certain foundation for subsequent courses such as Motion Control System Analysis and Design, as well as technical work and scientific research related to power supply design.

(9) Motion Control Systems: This course focuses on the structure, principles, steady-state characteristics, and dynamic characteristics analysis and calculation methods of single-closed-loop and double-closed-loop DC speed control systems; the principles and characteristics of AC motor variable voltage variable frequency (VVVF) speed control systems based on steady-state models and vector control systems based on dynamic models; and the composition, principles, and characteristics of permanent magnet synchronous motor (PMSM) servo positioning control systems. Through the analysis, calculation, design, simulation, and debugging of speed control systems, students will complete the application of motor drive automatic control systems. By learning this professional course, students' ability to analyze problems and comprehensively solve motion control system application problems is cultivated.

VI. Major Practical Training Links

(1) Electronic Process Internship and Labor Education: Semester 2, dedicated practice week. Students become familiar with basic soldering processes for electronic equipment, mastering component identification, circuit board soldering, and troubleshooting of electronic circuits.

(2) Engineering Foundation Training and Labor Education: Semester 2, dedicated practice week. Students master basic mechanical benchwork (fitting) skills and standards, fostering good basic professional norms and literacy in mechanical benchwork.

(3) Electrical Control System Installation/Commissioning and Labor Education: Semester 3, dedicated practice week. Students master design standards for electrical control systems,

principles of common electrical components, and installation techniques, and cultivate good professional norms and literacy as electricians.

(4) Automation Product Development and Design: Semesters 4–5, dedicated practice weeks. Students master circuit board design methods and the programming and debugging of automation product control boards, fostering good automation product design capabilities.

(5) Motor Drive Control System Design: Semester 6, dedicated practice week. Students master driving methods and debugging techniques for different motors, cultivating good capabilities in designing and debugging motor drive methods.

(6) Professional Innovation and Entrepreneurship Practice: Semesters 4–6, dedicated practice weeks. Combining the characteristics of the Automation major with cases from international college students' innovation capacity competitions and professional contests in the discipline, course tasks are developed to cultivate students' professional innovative capabilities.

(7) Intelligent Production Line Design and Integration: Semester 7, dedicated practice week. Through this course, students master control system design and debugging for intelligent production lines, cultivating good capabilities to apply intelligent control algorithms, industrial controller programming technologies, and network communication technologies to complete the design and debugging of intelligent control systems.

(8) Graduation Project (Thesis): Semester 8, 12 weeks. Students and supervisors are matched through mutual selection. Students independently complete the graduation design and conduct a graduation defense. Guidance is provided by professional tutors and enterprise mentors (with the professional tutor simultaneously serving as the second supervisor).

VII. Graduation and Degree Requirements

Students who complete all 158 credits required by this cultivation program with passing grades, obtain professional vocational qualification certificates (see the table below), and meet all other graduation requirements will be granted the Undergraduate Graduation Certificate in Automation. Students who meet the graduation requirements and satisfy the criteria set forth in the *Implementation Rules for Bachelor's Degree Awarding of Tianjin Sino-German University of Applied Sciences* and other relevant regulations shall be granted a Bachelor of Engineering degree upon review and approval by the University Academic Degree Evaluation Committee.

Table of Vocational Qualification Certificates

No.	Certificate Name	Requirement	Issuing Authority
1	Electrician	Senior Worker	Tianjin Municipal Human Resources and Social Security Bureau
2	Programmable Control System Design and Implementation	Vocational Competency Certificate	Tianjin Municipal Human Resources and Social Security Bureau
3	Industrial Robot Application	Vocational Competency Certificate	Tianjin Municipal Human Resources and Social Security Bureau
4	Automation Instrumentation Technology Application	Vocational Competency Certificate	Tianjin Municipal Human Resources and Social Security Bureau
5	Installation, Commissioning, and Maintenance of AC/DC Drive Systems	Vocational Competency Certificate	Tianjin Municipal Human Resources and Social Security Bureau
6	Intelligent Terminal Technology Application	Vocational Competency Certificate	Tianjin Municipal Human Resources and Social Security Bureau
7	PLC Programming and Application Technology Certificate	Intermediate	Talent Exchange Center, Ministry of Industry and Information Technology
8	Industrial Robot Technology Certificate	Intermediate	Talent Exchange Center, Ministry of Industry and Information Technology
9	National Computer Rank Examination (NCRE)	Level 2	National Education Examinations Authority, Ministry of Education
Note: Students must obtain at least one of the certificates listed in the table above.			

VIII. Academic Calendar（Example）

Note: Minor adjustments may be made based on actual conditions before the start of each semester, subject to approval by the Academic Affairs Office.

Semester	Week																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	⊙	⊙	★	★	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Exam
2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	R	▲	●	Exam
3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▲	▲	▲	Exam
4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▲	▲	▲	Exam
5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▲	■	■	Exam
6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	■	■	▲	Exam
7	○	○	○	○	○	○	○	■	■	▲	Q	Q	Q	Q	Q	Q	#	#	#	Exam
8	◆	◆	◆	◆	◆	◆	※	※	※	※	※	※	※	※	※	※	※	※		

Key to Symbols ： ⊙----Entrance Education ★----Military Training

○----Curricular Teaching Exam----Examination Week

■----Professional Comprehensive Training / Professional Innovation Training ▲----Course Design

●----Engineering Basic Training and Labor Education R----Professional Cognitive Internship (Off-campus)

Q----Corporate Internship (Off-campus) ◆----Graduation Internship (Off-campus)

※----Graduation Project #----Others

IX. Program Development and Approval

Program Director: Li Yunlong Associate Dean for Academic Affairs: Fan Qiming Dean:

Director of Academic Affairs: Vice President for Academic Affairs: