Program for Talent Cultivation in Robotics Engineering

I. Program Overview

Major Code: 080803T

Admission Category: National College Entrance Examination

Discipline and Major Category: Engineering — Automation Category

Standard Duration of Study: 4 Years

II. Educational Objectives

This program is oriented toward robot application technology in the high-end equipment industry, serving the "Beijing-Tianjin-Hebei Coordinated Development Planning Outline" and the "Manufacturing-Oriented City" strategy of Tianjin. It aims to cultivate high-quality applied talents with comprehensive development in morality, intelligence, physical health, aesthetics, and labor who adapt to the needs of the economic and social development of the Beijing-Tianjin-Hebei region. Graduates shall possess good professional ethics and dedication, a high sense of national consciousness and social responsibility, a rigorous scientific attitude and innovative thinking, and a good spirit of teamwork. They shall be equipped with solid professional fundamental knowledge and techniques, as well as certain organizational and management capabilities, enabling them to engage in robot research and development, manufacturing, system design, production line design, application maintenance, and other related work. The program cultivates high-quality applied socialist builders and successors who are developed comprehensively in morality, intelligence, physical health, aesthetics, and labor; who are politically sound, highly skilled, honest, trustworthy, rational, and composed, serving regional economic transformation, industrial upgrading, and technological innovation.

Approximately 5 years after graduation, through personal effort and professional experience, graduates should be able to become engineers or outstanding professional talents and possess the following capabilities:

Objective 1: Familiar with the current development status and trends in the field of robotics engineering. Master the multidisciplinary comprehensive knowledge required for the robotics engineering profession, be capable of mastering new knowledge and technologies in line with scientific and technological developments, and be able to apply mathematical, physical, and engineering foundations along with robot system knowledge to solve complex engineering problems in fields related to robotics engineering.

Objective 2: Possess basic skills and engineering application capabilities in scientific computing, hardware design, software development, experimental testing, and information synthesis related to the field of industrial robots. Be capable of mastering modern engineering design and development technologies in conjunction with engineering needs, and be able to comprehensively apply professional knowledge in the field of control engineering to perform system design and integration, robot control and design

development, safety in production, energy conservation, emission reduction, and production management.

Objective 3: Possess the fundamental professional qualities and social responsibility of a robotics engineer, and strictly adhere to professional ethics and standards. Be familiar with relevant standards, laws, and regulations in the professional engineering field. In practice, persist in prioritizing public interest and comprehensively consider factors such as law, environment, and sustainable development.

Objective 4: Possess healthy physical and mental wellbeing, good socialist values, and literacy in humanities and social sciences. Possess teamwork spirit, effective communication, and expression skills. Understand and master engineering management and economic decision-making methods, enabling them to play an effective role as a technical backbone in the research and development, production, and management of enterprises.

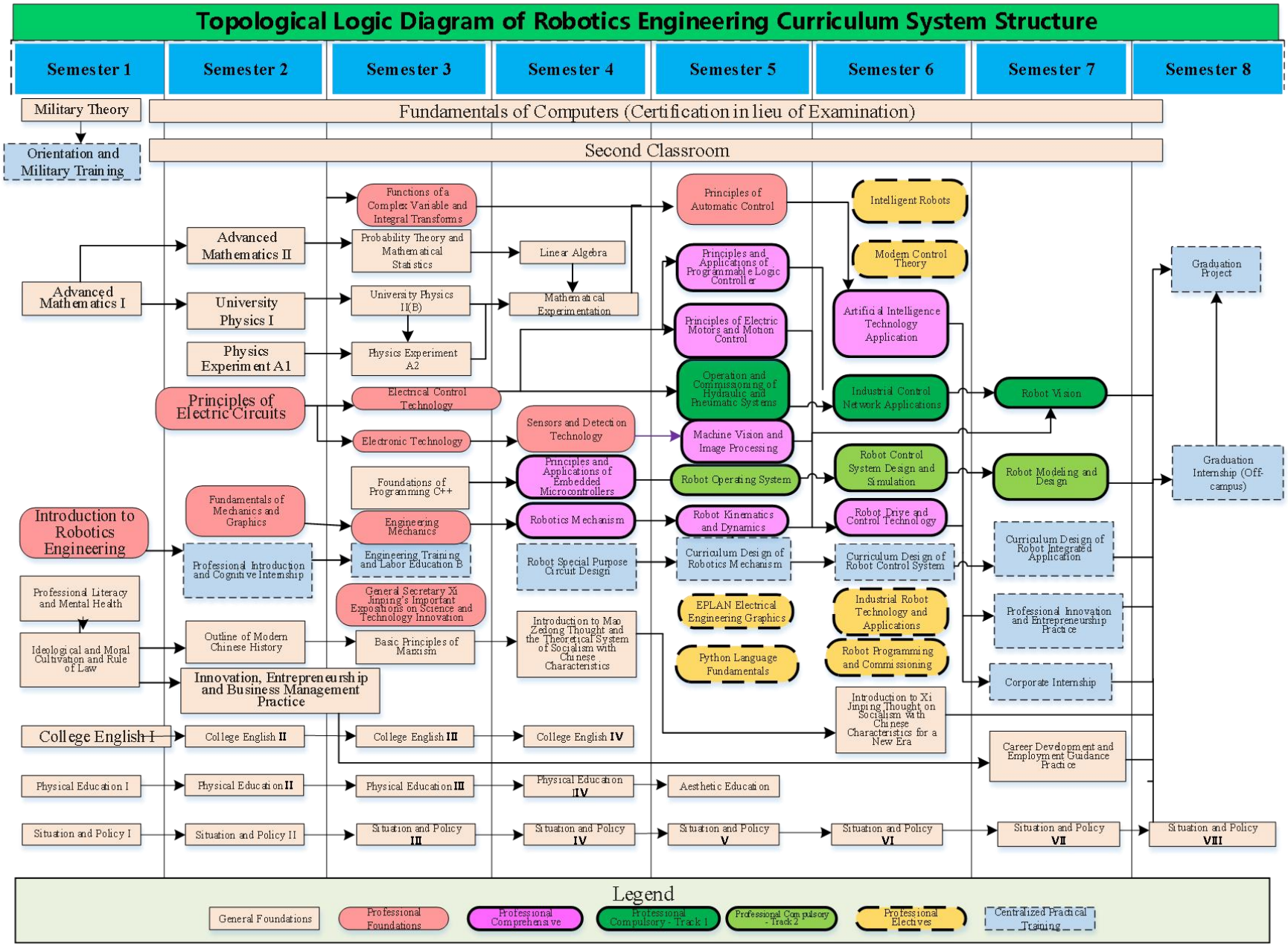
Objective 5: Possess the capacity for lifelong learning and self-improvement with a certain international perspective, and be able to quickly adapt to professional development and changes in job positions. Capable of continually enhancing professional literacy and personal quality through engineering practice and continuing education.

III. Graduation Requirements and Mapping Matrix

Graduation Requirements	Implementation Components / Channels
1. Engineering Knowledge: Capable of applying knowledge of mathematics, natural sciences, engineering foundations, and professional expertise to solve complex engineering problems.	Advanced Mathematics, Linear Algebra, Physics, Functions of a Complex Variable and Integral Transforms, Engineering Graphics, Principles of Electric Circuits, Electrical Control Technology, Fundamentals of Mechanics, Engineering Mechanics.
2. Problem Analysis: Capable of applying basic principles of mathematics, natural sciences, and engineering sciences to identify, express, and analyze complex engineering problems through literature research to reach valid conclusions.	Principles of Electric Circuits, Sensors and Signal Processing, Principles of Automatic Control, Principles and Applications of Embedded Microcontrollers, Modern Control Theory, Principles and Applications of Programmable Logic Controller.
3. Design/Development of Solutions: Capable of designing solutions for complex engineering problems and designing systems, units (components), or technological processes that meet specific needs; capable of demonstrating innovation during the design process while considering social, health, safety, legal, cultural, and environmental factors.	Principles and Applications of Microcontrollers, Principles and Applications of Programmable Logic Controller, Robotics Mechanism, Robot Programming and Engineering Simulation, Operation and Commissioning of Hydraulic and Pneumatic Systems, Industrial Control Network Applications, Robot Kinematics and Dynamics.
4. Research: Capable of conducting research on complex engineering problems based on scientific principles and using scientific methods, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.	Principles of Electric Motors and Motion Control, Robot Drive and Control Technology, Robot Kinematics and Dynamics, Image Processing and Machine Vision, Modern Control Theory, Foundations of Artificial Intelligence, Robot Drive and Control Technology, Robot Programming and Engineering Simulation.
5. Use of Modern Tools: Capable of developing, selecting, and using appropriate techniques, resources, modern engineering tools, and information technology tools for complex	Principles and Applications of Microcontrollers, Principles and Applications of Programmable Logic Controller, Robot Programming and Engineering Simulation, Robot Control System Design and

Graduation Requirements	Implementation Components / Channels
engineering problems, including the prediction and simulation of complex engineering problems, while understanding their limitations.	Simulation, Robot Modeling and Design.
6. Engineering and Society: Capable of conducting rational analysis based on engineering-related background knowledge to evaluate the impact of professional engineering practices and solutions for complex engineering problems on society, health, safety, law, and culture, and understanding the responsibilities to be assumed.	Military Theory, Ideological and Moral Cultivation and Rule of Law, Situation and Policy, Outline of Modern Chinese History, Basic Principles of Marxism, Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics, Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, General Secretary Xi Jinping's Important Expositions on Science and Technology Innovation, Robot System Design and Application, Artificial Intelligence Technology Application, Robot Workstation System Integration.
7. Environment and Sustainable Development: Capable of understanding and evaluating the impact of engineering practices for complex engineering problems on environmental and social sustainable development.	Industrial Control Network Applications, Robot Programming and Engineering Simulation, Robot Kinematics and Dynamics, Robot Drive and Control Technology, Intelligent Production Line Design and Integration.
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 engineering practice and fulfilling responsibilities.	Career Development and Employment Guidance for College Students, Professional Labor Education, Curriculum Design of Robot Drive and Control, Robot Programming and Engineering Simulation, Curriculum Design of Robot System Integration.
9. Individual and Team: Capable of assuming the roles of individual, team member, or leader in a team within a multidisciplinary background.	Curriculum Design of Robot Drive and Control, Robot Programming and Engineering Simulation, Robot Design and Integration, Intelligent Production Line Design and Integration.
10. Communication: Capable of communicating and exchanging ideas effectively with industry peers and the public regarding complex engineering problems, including writing reports and design manuscripts, making presentations, and clearly expressing or responding to instructions. Possess a certain international perspective and the ability to communicate and exchange ideas in cross-cultural settings.	Professional Cognitive Internship, Electronic Product Design and Production, Intelligent Production Line Design and Integration, Corporate Internship.
11. Project Management: Understand and master engineering management principles and economic decision-making methods, and be able to apply them in multidisciplinary environments.	Curriculum Design of Robot Drive and Control, Curriculum Design of Robot System Integration, Intelligent Production Line Design and Integration, Corporate Internship, Graduation Internship, Graduation Project, Second Classroom.
12. Lifelong Learning: Possess the awareness of autonomous learning and lifelong learning, with the ability to continuously learn and adapt to development.	College English I-IV, Professional Literacy and Mental Health, Corporate Internship, Graduation Internship, Graduation Project, Second Classroom.
13. Vocational Qualification Certificates: Capable of applying professional knowledge in the field of control engineering to solve complex problems in robot system applications and obtaining one intermediate vocational qualification certificate.	Electrical Control Technology, Principles and Applications of Programmable Logic Controller, Robot Programming and Engineering Simulation, Industrial Robot System Integration.

IV. Curriculum Topology


Topological Logic Diagram of Robotics Engineering Curriculum System Structure
Semester 1
Semester 2
Semester 3
Semester 4
Semester 5
Semester 6
Semester 7
Semester 8
Military Theory
Fundamentals of Computers (Certification in lieu of Examination)
Orientation and Military Training
Second Classroom
Advanced Mathematics I
Advanced Mathematics II
University Physics I
Physics Experiment A1
Principles of Electric Circuits
Introduction to Robotics Engineering
Professional Literacy and Mental Health
Ideological and Moral Cultivation and Rule of Law
College English I
Physical Education I
Situation and Policy I
Fundamentals of Mechanics and Graphics
Professional Introduction and Cognitive Internship
Outline of Modern Chinese History
Innovation, Entrepreneurship and Business Management Practice
College English II
Physical Education II
Situation and Policy II
Functions of a Complex Variable and Integral Transforms
Probability Theory and Mathematical Statistics
University Physics II(B)
Physics Experiment A2
Electrical Control Technology
Electronic Technology
Foundations of Programming C++
Engineering Mechanics
Engineering Training and Labor Education B
General Secretary Xi Jinping's Important Expositions on Science and Technology Innovation
Basic Principles of Marxism
College English III
Physical Education III
Situation and Policy III
Linear Algebra
Mathematical Experimentation
Sensors and Detection Technology
Principles and Applications of Embedded Microcontrollers
Robotics Mechanism
Robot Special Purpose Circuit Design
Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics
College English IV
Physical Education IIV
Situation and Policy IV
Principles of Automatic Control
Principles and Applications of Programmable Logic Controller
Principles of Electric Motors and Motion Control
Operation and Commissioning of Hydraulic and Pneumatic Systems
Machine Vision and Image Processing
Robot Operating System
Robot Kinematics and Dynamics
Curriculum Design of Robotics Mechanism
EPLAN Electrical Engineering Graphics
Python Language Fundamentals
Aesthetic Education
Situation and Policy V
Intelligent Robots
Modern Control Theory
Artificial Intelligence Technology Application
Industrial Control Network Applications
Robot Control System Design and Simulation
Robot Drive and Control Technology
Curriculum Design of Robot Control System
Industrial Robot Technology and Applications
Robot Programming and Commissioning
Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era
Situation and Policy VI
Robot Vision
Robot Modeling and Design
Curriculum Design of Robot Integrated Application
Professional Innovation and Entrepreneurship Practice
Corporate Internship
Career Development and Employment Guidance Practice
Situation and Policy VII
Graduation Project
Graduation Internship (Off-campus)
Situation and Policy VIII
Legend
General Foundations
Professional Foundations
Professional Comprehensive
Professional Compulsory - Track 1
Professional Compulsory - Track 2
Professional Electives
Centralized Practical Training

V. Core Professional Courses

The following core professionalcourses are offered in this major:

(1) Robotics Mechanism: This course covers the classification of robot mechanisms, rigid body motion and transformation, and the mathematical foundations of robot mechanism analysis. Through this course, students shall master the basic concepts of robot mechanisms, become familiar with mathematical methods for mechanism analysis, and be able to apply modern mathematical tools to analyze robot mechanisms. They will master the application of spatial mechanisms in robots, including the structural design of robot bodies, arms, hands, walking mechanisms, and joints.

(2) Robot Kinematics and Dynamics: This course teaches the basic concepts of robot kinematics, statics, and dynamics, and introduces modeling methods for robot systems and typical robot system models. Through learning, students shall master basic knowledge of robot kinematics, statics, and dynamics; be able to perform three-dimensional modeling of robots; determine kinematics parameters; solve robot dynamics models; and master the relationships between forces, moments, positions, velocities, and accelerations of various robot mechanisms.

(3) Principles of Electric Motors and Motion Control: This course covers the basic principles and knowledge of electric motors, as well as the operational performance, analysis, calculation, motor selection, and experimental methods of electric drive systems. Through this course, students will master the basic structures, working principles, and mechanical characteristics of alternating current and direct current motors; master the working principles, characteristics, and applications of control motors; and master the basic structure, working principle, and operation of frequency converters. This prepares necessary foundational knowledge for subsequent professional courses, cultivates interest in professional learning, and enhances students' ability to analyze and solve problems.

(4) Robot Drive and Control Technology: This course teaches the basic principles of robot drive systems, with an emphasis on servo drives and various control technologies such as position, speed, and torque control. Through this course, students will understand coupled, non-linear, and multi-variable robot control systems and master knowledge related to various robot drive systems.

(5) Sensors and Detection Technology: This course covers the working principles, characteristics, and applications of commonly used sensors, especially intelligent sensors, as well as the basic theories and application cases of signal acquisition, conversion, and processing. It involves constructing general hardware and software development platforms. Through learning, students can systematically master the methods and ideas for data acquisition, signal conversion, and processing using relevant sensors, and flexibly apply multiple sensors and signal processing technologies to robot systems.

(6) Principles and Applications of Programmable Logic Controller: This course teaches the principles and applications of programmable controllers, focusing on the composition, structure, working principle, instruction system, communication, use of Human-Machine Interface configuration software and programming, and the use of the programming environment. Through learning, students will develop the ability to analyze and solve problems and independently design electrical control systems.

(7) Principles of Automatic Control: This is a foundational theory course covering basic concepts of automatic control theory and methods for the analysis and design of automatic control systems. Specifically, it includes: the basic composition and structure of automatic control systems, performance indicators, types of systems (continuous, discrete, linear, non-linear, etc.) and their characteristics, and methods for analysis (time-domain method, frequency-domain method, etc.) and design.

(8) Machine Vision and Image Processing: This course teaches the basic methods and algorithms of machine vision and their applications in practical engineering. Through learning, students will master the theory of digital image signal processing and gain an in-depth understanding of common machine vision algorithms such as image segmentation, detection, and enhancement, as well as advanced methods like optical flow, stereo vision, and pattern recognition, enabling them to design machine vision systems and select appropriate algorithms.

(9) Principles and Applications of Embedded Microcontrollers: This course teaches embedded technology and its peripheral circuits based on the STM32 core controller. Specifically, it includes: microcontroller hardware structure, instruction systems, and programming methods. Through this course, students can master the working principles of microcontrollers, program

writing, and the application of integrated development platforms, cultivating their problem-solving abilities and practical skills. Simultaneously, it introduces students to the cutting-edge developments in the embedded industry to lay a foundation for future career choices.

VI. Main Practical Training Links

Students' practical abilities are cultivated through experiments, integrated theory-practice sessions, the "Second Classroom," and various social practice activities.

Experimental courses are offered within general education courses, professional foundation courses, and professional courses to deepen students' understanding of knowledge and technology during the experimental process.

Integrated theory-practice courses are offered within professional courses. Under the premise of integrating teaching staff, teaching environments, and teaching content, project-based and modular methods are adopted to integrate the learning of knowledge and technology into the practical process, cultivating students' ability to comprehensively apply knowledge and technology during practice. A total of 7 integrated theory-practice courses are offered, including: Electrical Control Technology, Principles and Applications of Embedded Microcontrollers, Principles and Applications of Programmable Logic Controller, Operation and Commissioning of Hydraulic and Pneumatic Systems, Industrial Control Network Applications, Robot Control System Design and Simulation, and Robot Modeling and Design.

Within the centralized practical course platform, 1 professional engineering foundation training course is offered to cultivate students' solid practical abilities in electronics, electrical engineering, and mechanical foundations; 3 "Curriculum Design" practical courses are offered, where students can complete the design and development of two systems of a certain scale and complexity; 1 professional comprehensive training course and 1 professional innovation training course are offered to improve students' professional comprehensive practical and innovation capabilities; 1 professional cognitive internship course and 1 corporate internship course are offered, utilizing off-campus internship bases to allow students to understand and participate in production practice activities; and graduation internship and graduation project (thesis) courses are offered during the graduation stage to ensure the practical and engineering nature of the topics.

The main professional practical courses offered by the centralized practical course platform are as follows:

(1) Engineering Training and Labor Education: Third semester, dedicated practice week. Through this course, students master basic mechanical benchwork skills and standards, cultivating good fundamental professional norms and literacy in mechanical benchwork.

(2) Robot Special Purpose Circuit Design: Fourth semester, dedicated practice week. Through this course, students master the design methods of electronic circuit boards and the programming and debugging of control boards for electronic products, cultivating good electronic product design capabilities.

(3) Curriculum Design of Robotics Mechanism: Fifth semester, implemented on-campus, dedicated practice week. Through this course, students master industrial robot structures, disassembly and assembly processes, and debugging skills; exercise spatial configuration and associative thinking abilities; gain a perceptual understanding of robot component systems and the flexible use of parts according to different situations; and practice using assembly tools. This cultivates students' good robot structural design capabilities.

(4) Curriculum Design of Robot Control System: Sixth semester, implemented on-campus, dedicated practice week. Through this course, students master robot main control modules, programming environments, various functional functions, underlying code, and the writing, burning, and debugging of programs, cultivating the ability to design robot control systems using controllers and drive components.

(5) Curriculum Design of Robot Integrated Application: Seventh semester, school-enterprise co-constructed course, dedicated practice week. Through this course, students master the control system design and debugging of intelligent production lines, cultivating the ability to complete the design and debugging of intelligent control systems using intelligent control algorithms, industrial controller programming technology, and network communication technology.

(6) Introduction to Professional and Cognitive Internship: Second semester, implemented off-campus (enterprises), does not occupy dedicated practice weeks, executed in a distributed manner over 16 class hours. This course is taught by enterprise mentors with the assistance of professional supervisors. Students understand the basic work content of robot-related positions,

and the course trains students in good professional norms and communication skills. This is a school-enterprise co-constructed course, with partner enterprises including Tianjin Bonomarker Robot, Great Wall Motor, etc.

(7) Corporate Internship (Off-campus): Seventh semester, implemented off-campus (enterprises) for 4 weeks. This course is taught by enterprise mentors with the assistance of professional supervisors. The course cultivates students' good sense of social responsibility and professional norms, as well as project management capabilities. This is a school-enterprise co-constructed course, with partner enterprises including Tianduan, Lizhong Wheel Group, etc.

(8) Graduation Internship (6 weeks): Eighth semester, students implement this at an enterprise for 6 weeks. Students complete a graduation internship of no less than 6 weeks. Students choose their own internship enterprises. This course is primarily guided by enterprise mentors, with class advisors handling management tasks.

(9) Graduation Project (12 weeks): Eighth semester, implemented for 12 weeks. Guidance relationships are determined by mutual selection between teachers and students. Under the guidance of supervisors, students independently complete their graduation projects and conduct the graduation defense. Professional supervisors and enterprise mentors (with a professional supervisor simultaneously appointed as the second supervisor) serve as the students' guidance teachers.

VII. Graduation and Degree Requirements

Students complete all 160.5 credits required by this cultivation program with passing grades, obtain a professional-related vocational qualification certificate (see the table below), and meet all other graduation requirements will be awarded a Bachelor's Graduation Certificate in Robotics Engineering. 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 may 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	Industrial Robot Application	Qualified	Tianjin Municipal Human Resources and Social Security Bureau
2	Designer of Programmable Control Systems	Intermediate Level or above	Tianjin Municipal Human Resources and Social Security Bureau
3	Industrial Robot Professional Technical Skill Certificate	Intermediate Level or above	Ministry of Industry and Information Technology
4	Industrial Robot System Operator	Intermediate Level or above	Tianjin Municipal Human Resources and Social Security Bureau
5	Industrial Robot System Maintenance Personnel	Intermediate Level or above	Tianjin Municipal Human Resources and Social Security Bureau
6	National Computer Rank Examination Certificate	Level 2 or above	Ministry of Education
Note: Students must obtain at least one of the required certificates listed in the table above. If a listed certificate is cancelled during the period of study, the teaching unit shall provide a replacement certificate of an equivalent level, report it to the Academic Affairs Office for the record, and notify students in advance.			

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	#
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: Liu Chunping Associate Dean for Academic Affairs: Fan Qiming Dean:

Director of Academic Affairs: Zhang Chunming Vice President for Academic Affairs: Guan Zhiwei