Wuxi University

Objectives and Learning Outcomes

Department of Automation

School of Automation

Content

Cultivation Plan of Automation

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I Objectives of the Programme

The programme of Automation adheres to the fundamental task of moral education, adapts to the needs of regional economic and social development, and cultivates people with sound personality and social responsibility, all-round development of moral, intellectual, physical, beauty and labor, mastering professional knowledge, and having the ability to solve engineering problems in the field of automation. Applied talents who can engage in technological development, product research, and management in areas such as industrial automation, industrial robots, and intelligent manufacturing.

After four years of study, graduates should have a solid knowledge of mathematics, natural science and professional knowledge, especially principles of automatic control, sensors and detection technology, motor drive and motion control, process control systems, fundamentals of robotics, etc. The graduates are able to propose solutions to engineering problems in the field of automation, and have the ability to learn independently and keep track of cutting-edge technologies. The graduates own humanities and social science literacy and social responsibility. They also have basic foreign language listening, speaking, reading and writing skills, and own a certain international perspective, and can communicate and exchange in a cross-cultural context. They are able to work independently or cooperatively in a team and be able to organize and coordinate team members to achieve goals.

II Programme Learning Outcomes

1. **Engineering Knowledge:** Ability to apply knowledge of mathematics, natural sciences, engineering fundamentals, and specialized expertise to complex engineering problems in the development or integration of systems primarily involving intelligent manufacturing, advanced production, robotics, and intelligent systems.

- 1.1. Ability to use mathematical, physical, mechanical, and other language tools to describe automation and control engineering problems.
- 1.2. Ability to establish mathematical models and solve problems for specific objects in automation engineering, such as physical and mechanical components, circuits, signals, and systems.

- 1.3. Ability to apply knowledge and methods of circuits, electronic technology, signal analysis and processing, and control principles to deduce and analyze automation engineering problems.
- 1.4. Understand the concept of systems and their embodiment in the field of control; able to compare and integrate solutions for complex engineering problems in the development or integration of automation control systems.

2. Problem Analysis: Ability to identify, formulate, and analyze complex engineering problems in areas such as control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems, using principles of mathematics, natural sciences, and engineering science, and to obtain valid conclusions through literature research.

- 2.1. Ability to use basic principles of mathematics, physics, and engineering science to identify and judge key links and parameters in automation control.
- 2.2. Ability to apply fundamental professional theories to identify and formulate key aspects of complex engineering problems in the field of automation technology.
- 2.3. Ability to comprehensively apply professional knowledge to study and analyze complex engineering problems in the fields of control systems, equipment, and information processing oriented toward smart manufacturing and advanced production, robotics and intelligent systems, etc., seek solutions with the aid of literature, consider multiple factors, and draw valid conclusions.

3. Design/Development of Solutions: Ability to design solutions for complex engineering problems in control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems; Ability to design automation systems, electronic circuits (modules), or process flows that meet specific requirements for information acquisition, transmission, processing, and application, and to demonstrate innovation in the design process while considering social, health, safety, legal, cultural, and environmental factors.

- 3.1. Ability to determine design objectives, clarify design content and indicators based on user needs or task requirements.
- 3.2. Ability to analyze specific requirements for complex engineering problems in the fields of control systems, equipment, and information processing oriented toward smart manufacturing and advanced production, robotics and intelligent systems, etc.; perform component parameter calculation, process requirement analysis, and functional analysis through modeling and simulation; complete hardware circuit and software module design for units or subsystems, demonstrating innovative awareness.

- 3.3. Ability to consider constraints such as society, health, safety, law, culture, and environment; analyze and identify parameter influences in units or subsystems; propose specific solutions that meet design objectives; and conduct feasibility analysis.

4. Research: Ability to conduct research on complex engineering problems in control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems based on scientific principles and methods, including designing experiments, analyzing and interpreting data, and synthesizing information to obtain reasonable and valid conclusions.

- 4.1. Ability to analyze key issues in the development or integration of automation control systems based on scientific principles, methods, and professional theories; design simulation or experimental plans.
- 4.2. Ability to construct experimental systems according to experimental plans, conduct experiments safely, collect and record data correctly, and verify data repeatability.
- 4.3. Ability to analyze and interpret data or phenomena in the practice of automation control system development or integration, and draw reasonable and valid conclusions through information synthesis to support the solution of complex automation engineering problems.

5. Use of Modern Tools: Ability to select and apply appropriate technologies, modern instruments, system simulation and design software, and information technology tools (including the prediction and simulation of the effectiveness of solutions to complex engineering problems) in component selection, module design, and system integration for complex engineering problems such as the development or integration of automation control systems for intelligent manufacturing, advanced production, robotics, and intelligent systems, and to understand their limitations.

- 5.1. Ability to select and use commonly used modern instruments and meters, system simulation and design software, and information technology tools in the profession, and understand their limitations.
- 5.2. Ability to use appropriate modern engineering tools for simulation to model and predict complex engineering problems, and understand their limitations.

6. Engineering and Society: Ability to conduct reasonable analysis based on background knowledge in control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems; Ability to evaluate the impact of professional engineering practices and solutions to complex engineering problems on society, health, safety, law, and culture, and to understand the responsibilities involved.

- 6.1. Familiar with technical standards, intellectual property rights, industrial policies, and laws and regulations related to the engineering field of the profession; understand the influence of different social cultures on engineering activities.
- 6.2. Ability to analyze and evaluate the impact of professional engineering practices on society, health, safety, law, and culture, as well as the influence of these constraints on the implementation of engineering projects related to control systems, equipment, and information processing in smart manufacturing, based on the actual application scenarios of engineering projects involved in smart manufacturing development, and understand the corresponding responsibilities.

7. Environment and Sustainable Development: Ability to understand and evaluate the impact of solving complex engineering problems in automation fields such as control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems on the environment and the sustainable development of society.

- 7.1. Aware of and understand the concepts and connotations of environmental protection and sustainable development; familiar with relevant national environmental protection laws and regulations.
- 7.2. Ability to reasonably evaluate the impact of engineering practices related to automation engineering development for smart manufacturing on environmental and social sustainable development.

8. **Professional Ethics:** Possess a sense of social responsibility and literacy in humanities and social sciences; ability to understand and adhere to engineering professional ethics and norms, and to fulfill responsibilities in the practice of control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems.

- 8.1. Understand and identify with core socialist values; possess humanistic and social scientific literacy and a sense of social responsibility; understand national conditions; consciously safeguard national interests.
- 8.2. Understand the professional nature and social responsibilities of engineers; able to consciously abide by professional ethics and norms and fulfill responsibilities in engineering practice.

9. Individual and Teamwork: Ability to assume roles as an individual, team member, or leader in multidisciplinary teams.

- 9.1. Ability to communicate effectively and collaborate with members of other disciplines.
- 9.2. Ability to work independently or cooperatively in a team on tasks related to automation engineering for smart manufacturing; possess organizational, coordination, and management abilities.

10.Communication: Ability to effectively communicate and interact with peers and the public regarding complex engineering problems in areas such as control systems, equipment, and information processing for intelligent manufacturing, advanced production, robotics, and intelligent systems, including writing reports and design documents, delivering presentations, and clearly expressing or responding to instructions. Ability to communicate in cross-cultural contexts with a certain international perspective.

- 10.1. Ability to accurately express personal views on professional issues in the field of smart manufacturing automation technology through oral, written, graphical, and other means; respond to queries; understand the differences in communication with industry peers and the public.
- 10.2. Possess English listening, speaking, reading, and writing skills; understand international development trends and research hotspots in the automation industry; understand and respect the differences and diversity of world cultures; able to communicate and exchange on professional issues in cross-cultural contexts.

11. Project Management: Understand and master engineering management principles and economic decision-making methods for control systems, equipment, and information processing in intelligent manufacturing, advanced production, robotics, and intelligent systems, and be able to apply them in multidisciplinary environments.

- 11.1. Understand the importance of engineering management and economic decision-making in the engineering practice of automation fields such as control systems, equipment, and information processing; master engineering management principles and economic decision-making methods.
- 11.2. Ability to apply engineering management principles and economic decision-making methods to the research, design, development, and implementation processes of complex engineering problems in automation control systems, equipment, information processing, and other fields in multidisciplinary environments (including simulated environments).

12. Lifelong Learning: Possess the awareness of autonomous and lifelong learning, along with the ability to continuously learn and adapt to development.

- 12.1. Understand the development trends of modern science and technology; recognize and identify with the necessity of continuous exploration and learning; possess awareness of independent and lifelong learning.
- 12.2. Possess the ability for independent learning, including understanding of technical problems, ability to summarize, and ability to ask questions.

III Models

Module 1: Mathematics, Physics, and Chemistry

● Learning objective: Master mathematics, natural science and computer related knowledge to lay a solid foundation for subsequent courses. Ability to apply basic knowledge to analyze and solve practical problems.

● Learning outcomes: Ability to use mathematics and natural science to understand and appropriately express technical problems; Be able to build basic models to analyze and solve practical problems in engineering; Have the ability to observe, analyze and solve practical engineering problems using mathematical methods; Have the ability to analyze, calculate and synthesize phenomena in engineering science on the basis of mathematics, natural science and information technology.

● Related courses: Advanced Mathematics I(1), Advanced Mathematics I(2), Linear Algebra, Probability Theory and Statistics, Complex Function and Integral Transformation, College Physics II(1), College Physics II(2), College Physics Experiment II.

Module 2: Engineering Fundamentals

● Learning objective: Master the basic professional knowledge and lay a solid foundation for the study of professional courses.

● Learning outcomes: Master engineering drawing, electrical and electronic, control engineering and other basic knowledge; Ability to analyze and solve practical engineering problems.

● Related courses: An Introduction to Professions, Engineering Drawing, Circuit Theory, Experiments of Circuit Theory, Foundational of Analog Electronics, Foundational of Digital Electronics, Signals and Systems, Microcomputer Principle and Interface Technology, Automatic Control Theory.

Module 3: Engineering Application

● Learning objectives: Master solid professional knowledge, and have a strong ability to use professional knowledge.

● Learning outcomes: Master the general methods and skills needed to solve practical engineering problems; According to the characteristics of automation, the phenomenon in the engineering can be continuously analyzed, summarized, inspected and concluded.

● Related courses: Fundamentals of Robot Technology, The Base of Artificial Intelligence, Motor Drive and Movement Control System, Process Control System, Computer Control Technology, Sensor Principle and Detection Circuit Application, Digital Signal Processing, Modern Control Theory, Power Electronic Technology.

Module 4: Elective Courses

● Learning objectives: According to students' course interests and career development needs, meet the personalized needs of learning, further expand students' professional knowledge and improve students' knowledge application level.

● Learning outcomes: master the cutting-edge knowledge and skills in the field of automation, and be able to comprehensively evaluate technical solutions.

● Related courses: Data Communications and Networking, Application of Engineering Database Technology, Innovative System Design and Engineering Practice, Flexible Manufacturing with MES Systems, Image Processing and Machine Vision, PLC and Its Application, Python Language Programming, Robot Operating System (ROS), Engineering Ethics, Engineering Economy, Theme Series of Automatic New Technology.

Module 5: Foreign Languages

● Learning objective: Have cross-cultural communication skills and skills in international cooperation.

● Learning outcomes: Knowledge required to pass College English Test Band 4 (CET-4); Able to find and read professional English literature, and able to communicate professional problems in English; Have cross-cultural communication skills required for career development.

● Related courses: General English (1), General English (2), General English (3), General English (4).

Module 6: General Courses

● Learning objective: Understand the Chinese social model and social norms; Have good quality, team spirit and humanistic feelings; Achieve all-round development of morality, intelligence, physical fitness, beauty and labor.

● Learning outcomes: master the knowledge of modern Chinese history, basic principles of Marxism, humanistic spirit, sports and military training; Understand social phenomena; Pay attention to and adapt to social development; Communicate and collaborate effectively with others; Have team spirit; Promoting physical and mental health and self-improvement; Have a sound personality and psychological quality; Have a correct outlook on life, values, ethics and law; Have humanistic quality and social responsibility.

● Related courses: Situation & Policy, Labor Studies for College Students, Military Theory, Ideology Morality and Rule of Law, Modern Chinese History, Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, Marxism Basic Theory, Introduction to Mao Zedong Thought and Theory of Socialism with Chinese Characteristics, Career Development, Employment Guidance, Innovation and entrepreneurship Foundation, Physical Education (1), Physical Education (2), Physical Education (3), Physical Education (4), C Language Programming, Psychological Health Education.

Module 7: Practical Courses

● Learning objective: To enable students to consolidate theoretical knowledge, enhance their understanding of applied knowledge, and be able to analyze and evaluate complex engineering problems and propose solutions.

● Learning outcomes: Master the ability to analyze and solve practical problems in automation engineering; Master the basic methods and technologies of engineering design and process development, and understand the various factors that affect technical solutions. Ability to apply engineering knowledge to analyze and evaluate problems and understand their limitations; Ability to innovate design and find valuable solutions.

● Related Courses: Cognitive Practice, Metalworking Practice, Course Exercise of Embedded Systems, Comprehensive Experiments of Single-Chip Microcomputers Principles and Applications, Subject Experiments of Movement Control, Experiments of Automatic Control Theory, Comprehensive Practice of Innovation and Entrepreneurship, Electronic and Electrical Practice, The Training of Engineering Software, Course Exercise of PLC Application, Monographic Experiments of Industrial Robot, Comprehensive Exercise of Control Systems, Academic Writing, Graduation Practice.

Module 8: Bachelor's Thesis

● Learning objectives: Be able to propose solutions on the basis of analyzing practical problems and complete practical topics.

● Learning outcomes: Able to complete the graduation design, bachelor's degree thesis with the help of the instructor and pass the graduation defense.

● Related courses: Graduation Design(Dissertation).