Mechatronics Engineering

(Pathway from Secondary Vocational to Undergraduate Education, Undergraduate Education level)

(Grade 2024)

Course code: 080204

I. Cultivation Objectives

1. General cultivation objective

Mechatronics Engineering cultivates high quality application-oriented engineering and technical talents with comprehensive development of moral, intellectual, physical, and aesthetic skills who have a solid foundation in natural sciences and good humanities, master basic professional knowledge and skills such as mechanical design, electrical control, computer and information technology, have good professional ethics and strong mechatronics comprehensive practical ability, can be engaged in the application and development of modern mechatronics products or systems, assembly and maintenance of intelligent mechatronics equipment, system integration, operation management and technical services, etc. in the mechatronics industry or the industry applying mechatronics technology.

2. Objective of value guidance

Take the spirit of model workers and craftsmanship as the value orientation to cultivate ingenuity and educate craftsmen. In the implementation of professional courses, especially practice courses, the engineering values and engineering ethics education are embedded in the spirit of craftsmanship, and at the same time, the program will cultivate students to develop a rigorous, meticulous, focused and responsible work attitude, meticulously crafted and refined work philosophy, and master superb skills and exquisite skills, devote themselves to the transformation and upgrading of the manufacturing industry, so as to improve the quality, speed, quality and efficiency of China's "manufacturing" to China's "intelligent manufacturing".

3. Five years after graduation, students in this program should achieve the following objectives:

(1)Be able to meet the technological developments in mechatronics engineering and propose solutions to complex engineering problems in mechatronics engineering and related fields in practical work using professional theories and engineering knowledge.

(2)Have spirit of technological innovation, the ability to perform engineering innovation, the ability to comprehensively use professional knowledge and modern tools, and the ability to engage in the design, development and production of products related to complex engineering problems in mechatronics engineering and related fields to meet the needs of companies, institutions and users.

(3)Have the sense of social responsibility, an understanding of and adherence to professional standards, and the ability to integrate legal, safety, environmental and sustainability considerations into engineering practice

(4)Have good scientific and humanistic qualities, dedication to work, selflessness, teamwork spirit, effective communication skills and the ability to manage engineering projects

(5)Have the ability to follow the latest developments and trends at both domestic and international levels in the field of mechanical engineering in practical work, have an international perspective, and the ability for independent and lifelong learning.

II. Requirement for Graduation

According to the 12 graduation requirements of the General Standard of China Engineering Education Accreditation Association (CEEAA), the mechatronics engineering program has expanded the core competencies and quality expressions of the 12 graduation requirements in accordance with the orientation of talent cultivation in our university, and the indicators of each graduation requirement are listed as follows:

1. Engineering Knowledge: The ability to apply mathematical, natural science and engineering

fundamentals and expertise to the solution of complex mechatronics engineering problems.

1-1: Be able to apply the necessary mathematical, natural science and engineering fundamentals and expertise in mechatronics engineering to the formulation of complex mechanical engineering problems.

1-2: Be able to develop and solve a mathematical model for a complex mechatronics system or mechatronics control process.

1-3: Be able to apply relevant knowledge and mathematical models to the derivation, analysis and discrimination of solutions to complex mechatronics engineering problems.

1-4: Be able to apply mathematical models and relevant engineering knowledge to analyse, compare and attempt to improve solutions to complex mechatronics engineering problems.

2. Analysis of the Problem: Be able to apply the fundamental principles of mathematics, natural and engineering sciences to identify, represent, and through literature research to analyse complex mechatronics engineering problems in order to reach valid conclusions.

2-1: Be able to apply the fundamental principles of mathematics, natural and engineering sciences to identify and determine the key techniques and parameters of complex mechatronics engineering problems.

2-2: Be able to correctly represent, deduce and analyse complex mechatronics engineering problems based on relevant scientific principles and mathematical models.

2-3: Be able to recognize that there are multiple options for solving complex mechatronics engineering problems and seek alternative and stand-by solutions through literature research.

2-4: Be able to apply basic principles of mechatronics engineering and related fields to analyse how solutions may be affected during implementation and obtain valid conclusions.

3. Design/Development of Solutions: Be able to design solutions to complex mechatronics engineering problems, to design mechatronics systems, mechanical equipments or control systems that meet specific needs, and demonstrate the spirit of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.

3-1: Master the basic design/development methods and techniques for the full life cycle and full process of mechatronics engineering design and mechatronics product development. Be able to describe design objectives and understand the factors that influence design objectives and technical solutions.

3-2: Be able to develop solutions and complete designs of system, component and part for complex mechatronics engineering problems, especially for specific needs in mechatronics equipment and control process.

3-3: Be able to design complex mechatronics system or mechatronics control process and to demonstrate the spirit of innovation in the design.

3-4: Be able to comprehensively consider social, health, safety, legal, ethical, cultural and environmental factors in design.

4. Research: Be able to use scientific principles and methods to investigate complex mechatronics engineering problems, including designing experiments, analyzing and interpreting data, and synthesizing information to reach reasonable and valid conclusions.

4-1: Be able to investigate and analyse complex mechatronics engineering problems based on scientific principles, combined with literature research or related methods.

4-2: Be able to select routes of research and design experimental protocols based on the characteristics of complex mechatronics engineering problems.

4-3: Be able to construct experimental systems based on experimental protocols, conduct experiments in a safe

and standardized manner, and collect experimental data correctly.

4-4: Be able to correctly analyse and interpret experimental results and synthesize information to reach reasonable and valid conclusions.

5. Use of Modern Tools: Be able to develop, select and use appropriate techniques, resources, modern engineering tools and information technology tools for complex mechatronics engineering problems, including prediction and simulation of complex mechatronics engineering problems, and be able to understand their limitations.

5-1: Understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in mechatronics engineering, and understand the limitations of their use.

5-2: Be able to select and use appropriate instruments, information resources, engineering tools and specialist simulation software to analyse, calculate and design complex mechatronics engineering problems.

5-3: Be able to develop or select modern tools to meet specific needs, simulate and predict specialist problems for specific objects of complex mechatronics engineering problems and be able to analyse their limitations.

6. Engineering and Society: Be able to perform reasonable analysis based on engineering-related contextual knowledge and evaluate how engineering practices and solutions to complex mechatronics engineering problems may impact society, health, safety, law, and culture, and understand the responsibilities involved.

6-1: Understand the system of technical standards, intellectual property rights, industrial policies and laws and regulations in fields related to mechatronics engineering and understand the impact of different social cultures on engineering activities.

6-2: Be able to analyze and evaluate the impacts of mechatronics engineering practices on society, health, safety, law, culture and the impacts of these constraints on project implementation, and understand the responsibilities involved.

7. Environment and Sustainable Development: Be able to understand and evaluate the impacts of engineering practices for complex mechatronics engineering problems on environment and sustainable development of society.

7-1: Understand the meaning and significance of environmental protection and sustainable development of society and be able to practise environmental protection and sustainable development of society when solving complex mechatronics engineering problems.

7-2: Be able to evaluate the potential damage and hazards to humans and the environment in relation to actual mechatronics engineering projects, and understand the social, safety and legal responsibilities involved.

8. Professional Codes: Have humanistic, social and scientific qualities, social responsibility, and the ability to understand and comply with engineering ethics and codes in the practice of mechatronics engineering and fulfill the responsibilities.

8-1: Have humanistic, social and scientific qualities, correct values, understanding of the relationship between the individual and society, and knowledge of the Chinese context.

8-2: Understand the engineering ethics and codes of honesty, fairness and integrity, and be able to consciously observe them in the practice of mechatronics engineering.

8-3: Understand the social responsibility of mechatronics engineers for the safety, health and well-being of the public, and for environmental protection, and be able to consciously exercise this responsibility in the practice of mechatronics engineering.

9. Individual and team: Be able to assume the role of individual, team member and leader of multidisciplinary team.

9-1: Be able to communicate effectively and work independently or collaboratively.

9-2: Be able to organise, coordinate and direct teams in a multidisciplinary team.

10. Communication: Be able to communicate and interact effectively with industry peers and the public on complex mechatronics engineering issues, including writing reports and design submissions, presenting statements, clearly expressing or responding to instructions, and having an international perspective and the ability to communicate and interact in a cross-cultural context.

10-1: Be able to express views accurately, respond to challenges and understand the differences in communication with industry peers and the public on complex mechatronics engineering issues, either orally, in manuscripts, diagrams or drawings.

10-2: Understand international trends and research hotspots in the field of mechatronics engineering, as well as understand and respect the differences and diversity of different cultures around the world.

10-3: Be able to communicate verbally and in writing across cultures and to communicate and interact in a basic way in the cross-cultural context on complex mechatronics engineering issues.

11. Project Management: Understand and master the principles of engineering management and economic decision-making methods and be able to apply them in a multidisciplinary environment.

11-1: Master the principles of engineering management and economic decision-making methods involved in mechatronics engineering activities.

11-2: Understand the cost components of mechatronics engineering and mechatronics products throughout their life cycle and processes, and understand the engineering management and economic decision-making issues involved.

Target point 11-3: Be able to apply engineering management and economic decision-making methods in the design and development of mechatronics engineering project solutions in a multidisciplinary environment (including simulated environment).

12. Spirit and ability of lifelong learning: Have the spirit of independent and lifelong learning and the ability to learn and adapt to development constantly.

12-1: Be able to properly understand the necessity of self-exploration and lifelong learning and have the spirit of independent and lifelong learning.

12-2: Be able to adopt an appropriate approach to independent learning according to personal or professional development needs and be able to adapt to technological developments and knowledge updates in society and in the field of mechatronics engineering.

III. Schooling System

Four years.

IV. Length of Study

Flexible study period, generally four years, the minimum length of flexibility is not less than three years, the longest not more than six years.

V. Requirements for Graduation and Degree Conferring

Students of this program must complete the minimum credits required for each category of courses and complete all the content specified in extracurricular class according to the requirements of the instructive cultivation plan , and the total credits must reach 166 credits for graduation; those who meet the requirements for bachelor's degree can be conferred bachelor degree in engineering.

VI. Discipline

Mechanical Engineering (0802), Electronic Science and Technology (0809), Control Science and Engineering

(0811).

VII. Core Courses

Modern Engineering Drawing I/II, Engineering Mechanics I/II, Fundamentals of mechanical design, Fundamentals of Programming, Electrical and Electronic Engineering I/II, Fundamentals of Control Engineering, Embedded Systems and Its Applications, Sensor and Intelligent Detection Technology, CNC machine tools and programming, Mechatronics transmission control, Modern Engineering Drawing and Mapping, Practice for Embedded Systems and Its Applications, Mechanical Design Course Design, PLC Control System Design Practice, Sensor and Test Technology practice, CNC machining practice, CNC system practice, Mechatronics system design comprehensive practice.

VIII. Course Structure and Course Hours (excluding Extracurricular Class)

Category	**Total Credit**	**%**	**Total Course**	**Theory Learning**	**Practical Training**
Public Fundamental Course	60.5	37	1456	1370	86
General Education	10	6	160	152	8
Engineering Fundamental Course	20	12	320	272	48
Professional Fundamental Course	17	10	272	242	30
Professional Course	22	13	352	298	54
Professional Practice	35.5	22	1000	0	1000
Total	160	100	3560	2334	1226
Theory: **Practical** (%)	66: 34				

IX. Teaching schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended Semester
	required	School of Marxism	b1080006	Outline of Modern Chinese History	non-test	3	48	42	6	Autumn 1
Public Fundamental Course	required	School of Marxism	b1080001	Basic Principles of Marxism	test	3	48	42	6	Spring 1
	required	School of Marxism	b1080009	Ethics and the Rule of Law	non-test	3	48	42	6	Spring 1
	required	School of Marxism	b1080010	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	test	3	48	42	6	Spring 2
	required	School of Marxism	b1080011	Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	test	3	48	42	6	Autumn 2
	required	School of Marxism	-----	Situation and Policy (Modules 1 to 4)	non-test	2	32	28	4	Autumn 1 to Spring 2
	required	School of Marxism	b1080008	Labour Education A	non-test	0.5	16	16		Autumn 2
	required	Others	b1110004	Mental Health Education for University Students	non-test	2	32	16	16	Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020080-	Advanced Mathematics A1	test	4	64	64	0	Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020081-	Advanced Mathematics A2	test	4	64	64	0	Spring 1
	required	School of Mathematics, Physics and Statistics	b1020012-	Linear Algebra	test	2	32	32	0	Spring 1
	required	School of Mathematics, Physics and Statistics	b1020013-	Probability Theory and Mathematical Statistics	test	2	32	32	0	Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020076	Calculation method	test	2	32	32	0	Spring 2
	required	School of Mathematics, Physics and Statistics	b1020023	Complex function and integral transformation	non-test	2	32	32	0	Spring 2
	required	School of Mathematics, Physics and Statistics	b1020062-	Academic Physics A (Module 1)	test	3	48	48	0	Spring 1
	required	School of Mathematics, Physics and Statistics	b1020065-	Academic Physics B	test	2	32	32	0	Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020111-	Academic Physics C	non-test	2	32	0	32	Spring 1
	required	College of Resources and Environment	b1013001-	Academic Chemistry	test	2	32	28	4	Autumn 1
	required	School of Foreign Language and Cultural Communication	b1020018	Academic Chinese	non-test	2	32	32		Spring 1
	required	College of Physical Education	-----	Physical Education I to VI	non-test	3	160	160	0	Autumn 1 to
	required	Others	b1110003	Military skills	non-test	0.5	0			Autumn 1
	required	Others	b1110002	Military theory	non-test	0.5	32	32		Autumn 2
	required	School of Foreign Language and Cultural Communication	b1020096-	General German I	test	3	144	144		Autumn 1
	required	School of Foreign Language and Cultural Communication	b1020097-	General German II	test	3	144	144		Spring 1
	required	School of Foreign Language and Cultural Communication	b1020048-	General German III	test	2	112	112		Autumn 2

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended Semester
	required	School of Foreign Language and Cultural Communication	b1020046-	General German IV	test	2	112	112		Spring 2
Subtotal (Public Fundamental Course)						**60.5**	**1456**	**1370**	**86**	
General Education	selective	School of Computer and Information Engineering	b1012001	Artificial Intelligence Application and Practice	non-test	1	16	8	8	Autumn 1
	selective	School of Resources and Environment	b1012002	Green, Low-carbon and Ecological Civilization	non-test	1	16	16		Spring 1
	selective	Art Education Center	b0-----	Aesthetic Education	non-test	2	32	32		Autumn, Spring
	selective	Each Colleges	b0-----	Social Sciences and Humanistic Qualities	non-test	4	64	64		Autumn, Spring
				Natural Sciences and Technology Innovation	non-test	2	32	32		Autumn, Spring
Subtotal (General Education)						**10**	**160**	**152**	8	

IX. Teaching schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended Semester
Engineering Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011246	Modern Engineering Drawing	test	4	64	44	20	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011397	Fundamentals of Engineering Materials	test	2	32	28	4	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011049	Engineering Mechanics I	test	3	48	48	0	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011050	Engineering Mechanics II	test	3	48	44	4	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011521	Fundamentals of Thermal Engineering and Fluid Mechanics	test	3	48	44	4	Spring 2
	required	Engineering Training	b2090015	Electrical and Electronic Engineering	test	5	80	64	16	Autumn 2
Subtotal (Engineering Fundamental Course)						**20**	**320**	**272**	**48**	
Professional Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011237	Introduction to Mechatronics Engineering	non-test	1	16	16	0	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011315	Fundamentals of Programming	test	2	32	26	6	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011345	Fundamentals of mechanical design	test	4	64	60	4	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011080	Fundamentals of Mechanical manufacturing	test	3	48	42	6	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011152	Hydraulic and pneumatic Transmission	test	2	32	28	4	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011090	Fundamentals of Control Engineering	test	3	48	44	4	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011143	Project Management	non-test	2	32	26	6	Spring 3
Subtotal (Professional Fundamental Course)						**17**	**272**	**242**	**30**	
Professional Course	required	School of Intelligent Manufacturing and Control Engineering	b2011443	Embedded Systems and Its Applications	test	2	32	26	6	Spring 2

	required	School of Intelligent Manufacturing and Control Engineering	b2011562	Electrical and PLC control of machine tools	test	2	32	26	6	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011561	Sensor and Intelligent Detection Technology	test	3	48	42	6	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011119	CNC machine tools and programming	test	2	32	26	6	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011562	Mechatronics transmission control	test	2	32	26	6	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011446	Technology for industrial robots	non-test	2	32	28	4	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011520	Scientific and Technical Paper Writing and Literature Search	non-test	1	16	16	0	Autumn 3
	Subtotal(Required Professional Course)					**14**	**224**	**190**	**34**	
	selective 8 credits	School of Intelligent Manufacturing and Control Engineering	b2011530	Python Programming	test	2	32	28	4	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011331	Machine Vision Technology and Its Applications	non-test	2	32	26	6	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011447	Matlab and Mechatronics System Simulation	non-test	2	32	28	4	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011251	Introduction to Intelligent Manufacturing	non-test	2	32	28	4	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011156	Finite Element Analysis and Practice	non-test	2	32	24	8	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011433	Production Management of Intelligent Manufacturing (MES/ERP)	test	2	32	24	8	Spring 3
	Subtotal (Selective Professional Course)					**8**	**128**	**108**	**20**	
Subtotal (Professional Course)						**22**	**352**	**298**	**54**	

IX. Teaching schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended Semester
Professional Practice	required	School of Intelligent Manufacturing and Control Engineering	b4011088	Modern Engineering Drawing	non-test	2	48		48	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011106	Corporate Understanding Internship	non-test	1	24		24	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011357	Comprehensive Practice for Electrical and Electronic Engineering	non-test	4	96		96	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b4090005	Electrotechnical skills internship	non-test	1	24		24	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011310	Practice for Embedded Systems and Its Applications	non-test	1	24		24	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011043	Practice for Interchangeability and measurement technology	non-test	2	48		48	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011311	Mechanical Design Course Design (E)	non-test	1	24		24	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011345	Practice for Numerical control systems	non-test	3	72		72	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011403	Computer Aided Design and Manufacturing	non-test	2	48		48	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4000011	Mechatronics Engineering Innovation and Entrepreneurship	non-test	2	48		48	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011356	Fault analysis and repair practice for CNC equipment	non-test	3	72		72	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011339	Labour Education B	non-test	0.5	16		16	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011312	Practice for PLC control system design	non-test	2	48		48	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011405	Sensors and Intelligent Detection Technology Practice	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011314	Practice for Industrial robotics	non-test	1	24		24	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011317	Comprehensive Practice for Mechatronics Systems Design	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011246	Mechanical Engineering Graduation Internship and Graduation Design (Thesis)	non-test	6	288		288	Spring 4
Subtotal (professional practice)						**35.5**	**1000**		**1000**	
Extracurricular Class	required	Others	b5110001	Extracurricular Class	non-test	**1**	-	-	-	Autumn, Spring, Summer
Total						**166**	**3560**	**2334**	**1226**	

Explanation of the relevance of professional certificates to the course:

Students who have passed Computer Aided Design and Manufacturing, CNC machine tool assembly and maintenance, comprehensive theoretical fundamental of maintenance electrician (Advanced), comprehensive practical training for maintenance electrician (Advanced), can participate in the professional qualification certificate assessment related to this program: UG Advanced, Maintenance Electrician Certificate (Advanced), CNC Machine Tool Assembly and Maintenance Worker Certificate (Intermediate), CNC Machine Tool Assembly and Maintenance Worker Certificate (Advanced) etc..

Students who have obtained the UG advanced certificate can apply for exemption of the Computer Aided Design and Manufacturing course and get corresponding credits; Students who have obtained CNC Machine Tool Assembly and Maintenance Worker Certificate (Advanced) can apply for exemption of CNC machine tool fault analysis and maintenance practice and get corresponding credits.

X. Credit of Extracurricular Class

Through taking extracurricular classes, students are encouraged to take part in academic lectures, social practice activities, campus cultural and sports activities, innovative and entrepreneurial activities, voluntary activities, etc. to improve their social adaptability and enhance the competitiveness in the job market. Details are specified in Students' Manual.