Mechatronics Engineering

(Grade 2022)

Course code: 080204

I. Cultivation Objectives

1. General cultivation objective

Mechatronics Engineering cultivates senior application-oriented engineering and technical talents 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 electromechanical products or systems, assembly and maintenance of intelligent electromechanical equipment, system integration, operation management and technical services, etc. in the electromechanical industry or the industry applying electromechanical 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. Objectives that students must achieve five years after graduation:

(1)Be able to meet the technological developments in mechanical engineering and propose solutions to complex engineering problems in mechanical 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 expertise and modern tools, and the ability to engage in the design, development and production of products related to complex engineering problems in mechanical 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, 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 recognise 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/Develop 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.

Indicators 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, analysing 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 organize, 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 instructional training plan, and the total credits must reach 153 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 & Technology, Control Science and Engineering(0811)

VII. Core Courses

Modern engineering drawing I/II, Engineering Mechanics I/II, Fundamentals of Mechanical Design, Fundamentals of the Programming Design C++, Electrical and Electronic Engineering I/II, Fundamentals of Control Engineering, Embedded Systems and Its Applications, Sensors and test technology, CNC machine tools and programming, Electromechanical Drive Control, Modern Engineering Drawing and Surveying, Practice for Electrical Intelligent Manufacturing Skills , Practice for Embedded System and Its Applications, Mechanical Design and Course Design, Practice for PLC control system design , Practice for sensor and test technology, Practice for CNC machining, Practice for CNC system, Practice for electromechanical system design comprehensive, Innovation and Entrepreneurship in Mechatronics Engineering, Mechatronics Graduation Internship and Graduation Design (Thesis)

This course mainly studies the related problems of electric drive and control of electromechanical equipment. Through the study of this course, students will understand the general knowledge of electromechanical transmission control, master the system composition, control principle and method of electromechanical transmission control, and the structure composition, working principle and performance characteristics of typical transmission control components, understand the application characteristics of the equipment and its selection method. This course will cultivate the students' ability to analyze and solve the problems related to electromechanical transmission control in production machinery, and lay the foundation for the design and application of electromechanical transmission control systems in the future.

VIII. Course Structure and Course Hours

Category	Total Credit	%	Total Course Hours	Theory Learning	Practical Training
Public Fundamental Course	57.5	35	1056	972	84
General Education	10	6	160	160	0
Engineering Fundamental Course	21	13	336	288	48
Professional Fundamental Course	17	10	272	242	30
Professional Course	22	14	352	306	46
Professional Practice	36.5	22	1024	0	1024
Total	**164**	**100**	**3200**	**1968**	**1232**
Theory : Practice(%)	64:36				

IX. Teaching schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Recommended Semester
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	b1080006	Outline of Chinese Modern History	non-test	3	48	42	6	Autumn 1
	required	School of Marxism	b1080004	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics I	test	3	48	42	6	Autumn 2
	required	School of Marxism	b1080007	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics II	test	2	32	28	4	Spring 2
	required	School of Marxism	-----	Situation and Policy (module 1 ~ 4)	non-test	2	32	28	4	Autumn 1 ~ Spring 2
	required	School of Marxism	b1080008	Labor Education A	non-test	0.5	16	16		Autumn 2
	required	College of Arts and Sciences	b1020080+	Advanced Mathematics A1	test	4	64	64		Autumn 1
	required	College of Arts and Sciences	b1020081+	Advanced Mathematics A2	test	4	64	64		Spring 1
	required	College of Arts and Sciences	b1020012	Linear algebra	test	2	32	32		Autumn 2
	required	College of Arts and Sciences	b1020013	Probability Theory and Mathematical Statistics	test	2	32	32		Autumn 2
	required	College of Arts and Sciences	b1020076	Calculation method	test	2	32	32		Spring 2
	required	Others	b1110004	Mental Health Education for University Students	non-test	2	32	16	16	Autumn 1
	required	College of Arts and Sciences	b1020062	Academic Physics A(module 1)	test	3	48	48		Spring 1
	required	College of Arts and Sciences	b1020065	Academic Physics B	test	2	32	32		Autumn 2
	required	College of Arts and Sciences	b1020111	Academic Physics C	non-test	1	32		32	Spring 1
	required	College of Arts and Sciences	b1013001	Academic Chemistry	test	1	32	28	4	Autumn 1
	required	College of Arts and Sciences	b1020018	Academic Chinese	non-test	2	32	32		Spring 1
	required	College of Physical Education	-----	Physical Education I ~ VI	non-test	3	160	160		Autumn 1 ~ Autumn 4
	required	Others	b1110003	Military skills	non-test	0.5	2W			Autumn 1
	required	College of Arts and Sciences	b1110002	Military theory	non-test	0.5	32	32		Autumn 2
	required	College of Arts and Sciences	b1020003	General English III	test	3	48	48		Autumn 1
	required	College of Arts and Sciences	b1020004	General English IV	test	3	48	48		Spring 1
	required	College of Arts and Sciences	b1020005	General Academic English A	test	2	32	32		Autumn 2
	required	College of Arts and Sciences	---	English development	non-test	2	32	32		Spring 2
Total (Public Fundamental Course)						**57.5**	**1056**	**972**	**84**	
General Education	required	Art Education Center	b0-----	Aesthetic Education	non-test	2	32	32		Autumn, Spring
	selective	Each College	b0-----	Social Science and Humanities Literacy (4 credits)	non-test	4	128	64		Autumn, Spring
				Natural Science and Technological Innovation	non-test	2	32	32		Autumn, Spring
Subtotal (General Education)						**10**	**160**	**160**		

IX. Teaching schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Recommended Semester
Engineering Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011137	Modern Engineering Drawing I	test	3	48	40	8	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011138	Modern Engineering Drawing II	non-test	3	48	32	16	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011397	Fundamentals of Engineering Materials	test	2	32	26	6	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	b2090013	Electrical and Electronic Engineering I	test	2.5	40	36	4	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b2090014	Electrical and Electronic Engineering II	test	2.5	40	36	4	Spring 2
	required	Engineering Training	b2011521	Fundamentals of Thermal Engineering and Fluid Mechanics	test	4	64	54	10	Spring 2
Subtotal (Engineering Fundamental Course)						**21**	**336**	**288**	**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	b2011443	Fundamentals of Programming C++	test	2	32	26	6	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011497	Fundamentals of mechanical design	test	4	64	60	4	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011444	Mechanical principles	test	3	48	42	6	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011176	Hydraulic and Pneumatic Transmission	test	2	32	28	4	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011119	Principles of engineering control	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
		School of Intelligent Manufacturing and Control Engineering	b2011497	Electrical and PLC control of machine tools	test	3	48	42	6	Autumn 3
		School of Intelligent Manufacturing and Control Engineering	b2011444	Sensor and Test Technology	test	3	48	42	6	Spring 3
		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	b2011249	Mechatronics drive control	test	3	48	42	6	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011446	Technology for industrial robots	non-test	2	32	28	4	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011520	Scientific and Technical Paper Writing and Literature Search	non-test	1	16	16	0	Autumn 3
	Selective 6 credits	**Subtotal (Required Professional Course)**				**16**	**256**	**222**	**34**	
				Python Programming	test	2	32	28	4	Autumn 4
				Machine Vision Technology and Its Applications	non-test	2	32	26	6	Autumn 4
				Matlab and Mechatronics System Simulation	non-test	2	32	28	4	Autumn 4
				Introduction to Intelligent Manufacturing	non-test	2	32	28	4	Autumn 4
				Finite Element Analysis and Practice	non-test	2	32	24	8	Spring 3
				Production Management of Intelligent Manufacturing (MES/ERP)	test	2	32	24	8	Spring 3
		Subtotal (Selective Professional Course)				**6**	**96**	**84**	**12**	
Subtotal (Professional Courses)						**22**	**352**	**306**	**46**	

IX. Teaching schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Recommended Semester
Professional Practice	required	Engineering Training	b4090001	Basic engineering training A	non-test	3	72		72	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011088	Modern Engineering Drawing and Surveying	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 2
	required	Engineering Training	b4011354	Electrical engineering technical internship	non-test	1	24		24	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011310	Practice for Embedded system application	non-test	1	24		24	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011355	Computer Aided Design and Manufacturing	non-test	3	72		72	Spring 3
		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	b4011302	Course Design for Mechanical Design (English)	non-test	2	48		24	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011312	PRACTICE for PLC CONTROL SYSTEM DESIGN	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011313	Sensors and test technology practice	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011082	CNC machining practice	non-test	1	24		24	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011314	Industrial robot application practice	non-test	1	24		24	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011345	Explanation of the relevance of professional certificates to the course:	non-test	3	72		72	Autumn 4
			b4011083	Fault analysis and repair practice for CNC equipment	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011317	Comprehensive practice for electromechanical system design	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4000011	Innovation and Entrepreneurship of Mechatronics Engineering	non-test	2	48		48	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011339	Labor Education B	non-test	0.5	16		16	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011246	Graduation Practice and Graduation Design (Thesis) for Mechatronics Engineering	non-test	6	288		288	Spring 4
Subtotal (Professional Practice)						**36.5**	**1024**		**1024**	
Extracurricular Class	required	Others	b5110001	Extracurricular Class	non-test	1	-	-	-	Autumn, Spring, Summer
Total						**165**	**3200**	**1968**	**1232**	

Explanation of the relevance of professional certificates to the course:

Students who have passed Computer Aided Design and Manufacturing, CNC machine tools and programming, CNC machining practice, CNC system practice, can participate in the professional qualification certificate assessment related to this program: UG Advanced, CNC machine tool assembly, adjustment and maintenance 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.

X. Prerequisite for Course Study

No.	Course name	Prerequisite Course	No.	Course name	Prerequisite Course
1	Calculation method	Advanced Mathematics A1	7	Hydraulic and Pneumatic Transmission	Advanced Mathematics A1
		Advanced Mathematics A2			Advanced Mathematics A2
		Linear algebra			Engineering Mechanics
		Programming basic			
2	Engineering Mechanics	Advanced Mathematics A1	8	Embedded system application	Programming basic
		Advanced Mathematics A2			Electrical and Electronic Engineering
		Academic Physics			
3	Fundamentals of Mechanical Design	Advanced Mathematics	9	Machine tool electrical and PLC control	
		Engineering Mechanics			Electrical and Electronic Engineering
		Modern Engineering Drawing			Academic Physics
4	Mechanical manufacturing and engineering material foundation	Basic engineering training	10	Sensors and test technology	Electrical and Electronic Engineering
		Modern Engineering Drawing			Electrical and Electronic Engineering
					Control Engineering Foundation
5	Fundamentals of Control Engineering	Advanced Mathematics A1	11	CNC machine tools and programming	Electrical and Electronic Engineering
		Advanced Mathematics A2			Machine tool electrical and PLC control
		Academic Physics			Fundamentals of Mechanical Design
		Electrical and Electronic Engineering			Fundamentals of Mechanical manufacturing and engineering material
6	Electrical and Electronic Engineering	Advanced Mathematics A1	12	Electromechanical drive control	Electrical and Electronic Engineering
		Advanced Mathematics A2			Fundamentals of Control Engineering
		Academic Physics			Fundamentals of Mechanical Design

XI. 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.