Measurement Control Technology and Instruments

(Grade 2024)

Course code: 080301

I. Cultivation Objectives

1. General cultivation objective

This program is designed to meet the needs of national economic and scientific development and to cultivate high quality application-oriented engineering talents with comprehensive development of morality, intellect, physique, aesthetics and labour who have solid basic theory, broad professional knowledge, strong practical ability, modern scientific innovation spirit and international vision, who can engage in research, development, engineering design, technical management and service of modern instruments and testing equipment in the industrial field related to intelligent manufacturing.

2. Objective of value guidance

The objective of this program is to cultivate high quality application-oriented engineering talents who can adapt to the development of society, the value orientation of this program is craftsmanship, and the carrier of this program is school-enterprise cooperation and curriculum teaching. This program cultivates students' professional spirit of rigorous and meticulous, dedicated and responsible, and striving for excellence, and enhances students' ability of independent learning, teamwork, innovation and social adaptability.

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

1) Master solid engineering knowledge and professional knowledge of measurement and control, able to use measurement and control professional knowledge and modern tools to engage in the design, development and production and commissioning of complex measurement and control-related products, taking into account social and environmental factors and relevant policies and regulations.

2) Be able communicate effectively within and outside the industry, organize and manage, collaborate and make decisions.

3) A sense of social responsibility and adherence to the professional codes of ethics, engineering ethics and industry codes of conduct.

4) Master the current situation and development trend of the industry, with a sense of innovation, have independent learning ability and lifelong learning ability.

II. Graduation requirements

1. Engineering knowledge: Have knowledge of mathematics, natural sciences, engineering fundamentals and professional knowledge required to work in the field of measurement control and instrument and be able to use such knowledge in an integrated manner to solve engineering problems in the field of measurement and control and related engineering.

1-1: Master knowledge of mathematics, natural sciences and basic engineering knowledge, and be able to identify and express engineering problems.

1-2: Be able to apply mathematics, natural science knowledge and basic engineering knowledge to carry out theoretical analysis and model solving for engineering problems related to measurement and control and instrumentation..

1-3: Master the professional technical knowledge of measurement control technology and instruments, and be able to use professional knowledge comprehensively to deduce, analyze and compare the complex engineering problems in the field of measurement control and instruments.

2. Problem analysis ability: Be able to apply the basic principles of mathematics, natural science and engineering science to identify, express and analyze complex engineering problems in measurement and control and instrumentation related fields through literature research to obtain effective conclusions

2-1: Be able to apply basic knowledge of mathematics, natural sciences and engineering sciences to identify and determine the key aspects of engineering problems.

2-2: Be able to apply basic professional knowledge to correctly formulate engineering problems and analyse object characteristics.

2-3: Be able to apply professional knowledge in a comprehensive manner to analyse the influencing factors of engineering problems with the help of literature research and to seek multiple ways to solve the problems and obtain valid conclusions.

3. Design/develop solutions: Capable of designing solutions to complex engineering problems in measurement, control and instrument-related fields, and be able to demonstrate a sense of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.

3-1: Be able to apply relevant professional knowledge to design and develop solutions to simple engineering problems and understand the factors that influence design objectives and technical solutions.

3-2: Master the basic design (development) methods and techniques for the full cycle and full process of measurement and control engineering design and product development, and apply them to design solutions to complex engineering problems, reflecting a sense of innovation.

3-3: Be able to consider social, health, safety, legal, cultural and environmental factors in the design process and evaluate the feasibility of solutions.

4. Scientific research ability: Be able to conduct research on complex engineering problems related to measurement and control and instrumentation based on scientific principles and methods, including designing experiments, analyzing and interpreting data, and obtaining reasonable and effective conclusions through information synthesis.

4-1: Be able to investigate and analyze complex engineering problems in the field of measurement and control and instrumentation based on scientific principles, through literature research and related methods

4-2: Be able to select a line of research, design a simulation or experimental program, and construct an experimental system and conduct experiments safely, based on specialist theories and object characteristics.

4-3: Be able to analyze and interpret data information according to the requirements of engineering tasks in measurement and control and instrument related fields, and get reasonable and effective conclusions through information synthesis.

5. Ability to use modern tools: Be able to understand, select and use or develop appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems in the field of measurement and control and instrumentation, including simulation and prediction of complex engineering problems and understanding of their limitations.

5-1: Be able to search and retrieve professional literature and information on measurement and control through information technology tools and means such as the internet.

5-2: Be able to compare and select instruments, information technology tools, modern engineering tools and simulation software commonly used in the field of measurement and control and instrumentation, and understand the characteristics and limitations of each.

5-3: Be able to use appropriate technology, select appropriate modern engineering tools and software, complete the design/simulation/simulation analysis of measurement and control systems for complex engineering problems in the field of measurement and control, and be able to understand their limitations..

6. Engineering and Society: Be able to carry out sound analysis based on relevant background knowledge in the field of measurement and control engineering and evaluate the social, health, safety, legal and cultural impacts of professional engineering practice and solutions to complex engineering problems in measurement and control and related fields, and understand the responsibilities involved.

6-1: Understand the technical standards system, intellectual property rights, industrial policies and laws and regulations in the field of measurement and control and instrumentation, and understand the influence of different social cultures on engineering activities.

6-2: Have consciousness and understanding of trends in the international and domestic situation and a sense of social responsibility.

6-3: Be able to objectively analyse and evaluate the social, health, safety, legal and cultural impacts of engineering practices and solutions in measurement and control, and understand the responsibilities involved.

7. Environment and Sustainable Development: Be able to understand and evaluate the impacts of professional engineering practice for complex engineering problems in the field of measurement and control and related fields on environmental, socially sustainable development.

7-1: Understand the connotation of the concept of environment and sustainable development, and understand the impact of project implementation and operation on environmental protection and social sustainable development.

7-2: Be able to analyze and evaluate environmental and social sustainable development issues involved in complex engineering in the field of measurement and control and instrumentation, and consider environmental and sustainable development factors in professional engineering practice.

8. Professional norms: Have human, social and scientific literacy, social responsibility and the ability to understand and comply with the ethics and codes of the engineering profession and to fulfil responsibilities in engineering practice.

8-1: Have proper perspective on life, values and the World. Have human, social and scientific literacy and a sense of social responsibility.

8-2: Be able to understand and comply with engineering ethics and codes of practice and fulfil responsibilities in the practice for engineering.

9. Individuals and teams: Be able to assume the role of individual, team member and leader in a team in a multidisciplinary context.

9-1: Be able to assume the role of team member and completing the work assigned by the team independently.

9-2: Be able to assume the role of team leader, grasp the work schedule, organize and coordinate team members to carry out work.

10. Communication skills: Be able to communicate and interact effectively with industry peers and the public on engineering issues in the field of measurement and control and related fields, and to have a certain international perspective and be able to communicate and interact in a cross-cultural context.

10-1: Be able to effectively communicate and communicate with industry peers and the public on complex engineering issues in the field of measurement and control and instrumentation, including writing reports, presentations, and clear expressions.

10-2: Have a certain international vision, have cross-cultural communication language and written expression skills, and can communicate and exchange professional issues in a cross-cultural context

11. Project Management Competencies: Understand and master the principles of engineering management and economic decision-making methods, and can be applied in a multidisciplinary environment.

11-1: Understand and appreciate the principles of engineering management and economic analysis and decision-making methods involved in engineering projects.

11-2: Be able to apply engineering management principles and economic decision-making methods to the design, operation and management of measurement and control engineering in a multidisciplinary environment.

12. Be able to learn throughout life: Have sense of independent and lifelong learning, have the ability to learn continuously and adapt to development.

12-1: Be able to correctly understand the necessity of self-exploration and lifelong learning, and have the consciousness of independent learning and lifelong learning.

12-2: Master the methods of independent learning, understand the ways to expand knowledge and ability, pay attention to the dynamics of professional development, and have the ability to adapt to development and knowledge update.

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

In order to graduate, students must complete the minimum number of credits required by the Instructive Cultivation Plan for each course category and all the content required by the Extracurricular Class, with a total of 166 credits, and will be awarded a Bachelor of Engineering degree if they meet the requirements for the award of a Bachelor's degree.

VI. Discipline

Instrument Science and Technology, Control Science and Engineering.

VII. Core Courses

Fundamentals of Programming, Principles of Automatic Control, Principles of Sensors, Signals and Systems, Error Theory and Data Processing, Motion Control Systems, Optoelectronic Sensing and Detection, Intelligent Instrumentation Technology, Digital Image Processing (In Chinese and English), Virtual Instrumentation Technology, Measurement and Control Technology and Systems, Engineering Optics, Industrial Automation and Robotics, PLC Principles and Applications

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

Category	Total Credit	%	Total Course	Theory Learning	Practical Training
Public Fundamental Course	60.5	37	1104	1022	82
General Education	10	6	160	152	8
Engineering Fundamental Course	20	12	320	240	80
Professional Fundamental Course	16	10	256	208	48
Professional Course	25	15.2	400	318	82
Professional Practice	33.5	20.3	952	0	952
Total	165	100	3192	1940	1252
Theory: **Practical** (%)	61: 39				

IX. Teaching schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	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 Modern Chinese History	non-test	3	48	42	6	Autumn 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	School of Mathematics, Physics and Statistics	b1020080+	Advanced MathematicsA1	test	4	64	64		Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020081+	Advanced MathematicsA2	test	4	64	64		Spring 1
	required	School of Mathematics, Physics and Statistics	b1020012	Linear Algebra	test	2	32	32		Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020114	Probability Theory and Mathematical Statistics	test	2	32	32		Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020100	Functions of complex variables and integral transformations	test	3	48	48		Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020062	Academic Physics A (Module 1)	test	3	48	48		Spring 1
	required	School of Mathematics, Physics and Statistics	b1020065	Academic Physics B	test	2	32	32		Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020111	Academic Physics C	non-test	2	32		32	Spring 1
	required	College of Physical Education	-----	Physical Education I to VI	non-test	3	160	160		Autumn 1 to 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	Others	b1110004	Mental Health Education for University Students	non-test	2	32	16	16	Autumn 1
	required	School of Foreign Language and Cultural Communication	b1020018	Academic Chinese	non-test	2	32	32		Autumn 1
	required	School of Foreign Language and Cultural Communication	b1020003	General English III	test	3	48	48		Autumn 1
	required	School of Foreign Language and Cultural Communication	b1020004	General English IV	test	3	48	48		Spring 1
	required	School of Foreign Language and Cultural Communication	b1020005	General Academic English A	test	2	32	32		Autumn 2
	required	School of Foreign Language and Cultural Communication	---	English Knowledge Expansion	non-test	2	32	32		Spring 2
Subtotal (Public Fundamental Course)						**56.5**	**1040**	**960**	**80**	
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

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended Semester
	selective	Each College	b0 ---	Social Sciences and Humanistic Qualities	non-test	4	64	64		Autumn, Spring
				Natural Sciences and Technology Innovation	non-test	4	64	64		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	b2013182	Modern Engineering Drawing	test	3	48	32	16	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011169	Fundamentals of Programming	test	3	48	32	16	Spring 1
	required	Engineering Training	b2011031	Circuits	test	4	64	48	16	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011539	Engineering Mechanics	test	2	32	32	0	Autumn 2
	required	Engineering Training	b2012060	Analog Electronic Technology	test	3	48	36	12	Autumn 2
	required	Engineering Training	b2012099	Digital Electronic Technology	test	3	48	36	12	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011045	Engineering Optics	test	2	32	24	8	Autumn 3
Subtotal (Engineering Fundamental Course)						**20**	**320**	**240**	**80**	
Professional Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011296	Introduction to the Measurement and Control Technology and Instrumentation program	non-test	1	16	14	2	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011257	Fundamentals of microcontroller technology	test	2	32	24	8	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011471	Signal and System	test	3	48	36	12	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011418	Fundamentals of precision mechanics	test	2	32	26	6	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011292	Principle of automatic control	test	3	48	36	12	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011520	Scientific and Technical Paper Writing and Literature Search	non-test	1	16	16	0	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011550	Sensor principle	test	3	48	36	12	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011551	Measurement and control bus and instrument communication technology	non-test	1	16	12	4	Spring 3
Subtotal (Professional Fundamental Course)						**16**	**256**	**208**	**48**	
Professional Course	required	School of Intelligent Manufacturing and Control Engineering	b2011235	Virtual instrument technology	non-test	3	48	36	12	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b2011162	Intelligent instrument technology	non-test	3	48	32	16	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011006	PLC Principles and Applications	non-test	2	32	24	8	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011547							
	required	School of Intelligent Manufacturing and Control Engineering	b2011298							
	required	School of Intelligent Manufacturing and Control Engineering	b2011124	Digital image processing	non-test	3	48	36	12	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011131	Error theory and data processing	test	2	32	24	8	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011419	Photovoltaic sensing and detection	non-test	2	32	24	8	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011297	Motion control systems	test	2	32	24	8	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011131							
	required	School of Intelligent Manufacturing and Control Engineering	b2011056	Technology for industrial automation and robotics	non-test	2	32	24	8	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b2011143	Project Management	non-test	2	32	26	6	Spring 3
Subtotal(Required Professional Course)						**21**	**336**	**250**	**86**	
		School of Intelligent Manufacturing and Control Engineering	b2011135	Advanced Manufacturing Technology	non-test	2	32	26	6	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011014	Application of measurement and control technology	non-test	2	32	28	4	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011542	Machine vision and industrial inspection	non-test	2	32	28	4	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011543	Virtual reality technology	non-test	2	32	28	4	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011275	Modern control theory	non-test	2	32	28	4	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011522	Artificial intelligence technology and application	non-test	2	32	26	6	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011552	Python programming	non-test	2	32	26	6	Autumn 4
		School of Intelligent Manufacturing and Control Engineering	b2011553	Quality control	non-test	2	32	28	4	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011273	Principles and interface technology of microcomputer	test	2	32	28	4	Spring 3
		School of Intelligent Manufacturing and Control Engineering	b2011554	Electric vehicle drive and control	non-test	2	32	28	4	Spring 3
Subtotal (Selective Professional Course)						**8**	**128**	**112**	**16**	

Subtotal (Professional Course)		**25**	**400**	**318**	**82**	

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	Engineering Training	b4090002	Basic Engineering Training B	non-test	2	48		48	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011386	Cognitive practice for measurement and control systems	non-test	2	48		48	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011128	Practice for Electronic Technology	non-test	1	24		24	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011145	Computer-aided design	non-test	1	24		24	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011387	Data acquisition system design	non-test	2	48		48	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011388	Electronic Circuit Design and Simulation	non-test	1	24		24	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011389	Embedded System Design and Applications	non-test	2	48		48	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011390	Microcontroller design and applications	non-test	1	24		24	Autumn 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011391	Virtual instrument design and development	non-test	2	48		48	Autumn 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	b4011392	Practice for Electrical Controls and Programmable Controllers	non-test	1	24		24	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011171	Printed board design and implementation	non-test	1	24		24	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011393	Design and development of measurement and control systems	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011394	Integration of vision inspection and motion control systems	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4000004	the Program of Measurement Control Technology and Instruments Innovation and Entrepreneurship	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011358	Industrial robot system integration	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011298	Comprehensive Practice for Measurement and Control	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011251	Measurement Control Technology and Instruments Graduation Internship and Graduation Design (Thesis)	non-test	6	288		288	Spring 4
Subtotal(Professional Practice)						**32.5**	**952**		**952**	
Extracurricular Class	required	Others	b5110001	Extracurricular Class	non-test	**1**	-	-	-	Autumn, Spring, Summer
Total						**166**	**3192**	**1940**	**1252**	

.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.