中国地质大学（武汉）
测控技术与仪器专业 2023版培养方案

（适用于我校测控技术与仪器专业 2023-2026级本科生）

测控技术与仪器专业培养方案

专业名称与代码：测控技术与仪器 080301

专业培养目标：

本专业为适应国民经济发展需求，培养品德高尚、具有高度社会责任感和良好的科学、文化素养，具备测量、控制和仪器领域的基础理论、专业知识及技能，具有创新意识、自主学习能力和实践能力，能够在测量控制与仪器，特别是智能地学仪器与装备等领域从事科学研究、技术开发、设计制造和生产管理等方面工作的宽口径、复合型工程技术人才，使学生成为德智体美劳全面发展的社会主义建设者和接班人。

学生毕业五年左右预期具有如下能力：

1. 具有人文社会科学素养、职业道德、社会责任感和创新意识；（职业和专业素养）
2. 掌握以测量为中心，信息流为主线，传感、测量与控制相互支撑的知识体系；（专业知识）
3. 能够运用现代设计工具和信息技术，开展测量控制仪器的研究、设计、制造、测试、生产和应用，具有较强的工程实践能力和创新意识，成为科研院所及企事业单位的专业技术人才和业务骨干；（专业能力）
4. 具备团队协作能力、组织管理能力、沟通及交流能力，能从事本专业相关的技术与管理工作；（沟通、交流与管理能力）
5. 胜任岗位职责，具有终身学习和适应发展的能力。（学习与发展能力）

专业毕业要求：

本专业主要学习测量理论、仪器设计和测控系统集成技术基础，学习测量、控制和仪器相关的数理基础、电子电路、光学、地球物理、机械、计算机、控制等专业基础以及传感、测试、仪器等专业知识，接受课程实验、课程设计、实习等训练，具备沟通、创新、再学习及解决测控系统与仪器领域复杂工程问题的能力。

毕业生应达到以下知识、素质和能力等方面的要求：

1. 基础知识：掌握扎实的数学与自然科学、电子电路、光学、地球物理、机械、计算机、控制等专业基础以及传感、测试、仪器等专业知识，并能用于解决复杂工程问题。
2. 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析复杂工程问题，以获得有效结论。
3. 设计/开发解决方案：能够设计针对复杂工程问题的解决方案，设计满足特定需求的系统和单元（部件），并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。
4. 研究：能够基于测量和控制的基本原理，采用科学方法对复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。
5. 使用现代工具：能够针对复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂工程问题的预测与模拟，并能够理

解其局限性。

6. 专业与社会：能够基于工程相关背景知识进行合理分析，评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。
7. 环境和可持续发展：能够理解和评价针对复杂测控仪器工程问题的工程实践对环境、社会可持续发展的影响。
8. 职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。
9. 个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。
10. 沟通：能够就复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。
11. 项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。
12. 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。

毕业要求 1（基础知识）：掌握扎实的数学与自然科学、电子电路、光学、地球物理、机械、计算机、控制等专业基础以及传感、测试、仪器等专业知识，并能用于解决复杂测控仪器工程问题。	指标点 1-1：能熟练运用数学与自然科学知识进行问题表述。
	指标点 1-2：熟练掌握电子电路、光学、地球物理、机械、计算机、控制等基本技能，能采用工程基础与专业知识对传感、测试、仪器问题进行推演和分析。
	指标点 1-3：能够将相关理论知识和专业技能用于仪器系统方案的比较与综合。
毕业要求 2（问题分析）：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析复杂测控仪器工程问题，以获得有效结论。	指标点 2-1：能够应用科学原理，识别仪器设计工程问题的关键环节，并使用理论分析和参数设计加以表达。
	指标点 2-2：能够通过文献研究，分析仪器设计工程问题，寻求解决问题的多种备选方案。
	指标点 2-3：通过运用测控相关专业知识和原理，分析影响因素，获得有效的工程问题解决方案。
毕业要求 3（设计/开发解决方案）：能够设计针对复杂测控仪器工程问题的解决方案，设计满足特定需求的系统和单元（部件），并能够在设计环节中体现创新意识，考虑社会、健康、安全、法	指标点 3-1：能够使用测控仪器系统基本设计技术，了解影响设计的因素。
	指标点 3-2：能够针对测控仪器系统的特定需求完成传感器、信号提取与处理、数据处理等信号链单元的设计。

律、文化以及环境等因素。	指标点 3-3：能够进行测控仪器系统设计，在设计与实践环节中体现创新意识。
	指标点 3-4：能够在安全、健康、法律、文化和环境等因素的约束下，对设计方案的可行性进行分析。
毕业要求 4（研究）：能够基于测量和控制的基本原理，采用科学方法对复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	指标点 4-1：能够根据工程基础知识与科学原理，分析测控仪器复杂工程问题的解决方案。
	指标点 4-2：能够运用专业理论和技术，选择研究路线，设计、构建和实施测控专业实验。
	指标点 4-3：针对测控仪器工程问题，能够通过信息分析与综合得到结果，并科学解释数据。
毕业要求 5（使用现代工具）：能够针对复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂工程问题的预测与模拟，并能够理解其局限性。	指标点 5-1：了解测控专业常用测试仪器、信息技术工具、工程工具和模拟软件的使用原理和方法，并理解其适用范围和局限性。
	指标点 5-2：针对测控仪器复杂工程问题，能够选择软件仿真工具，进行满足特定需求的系统和单元（部件）的分析、计算与设计。
	指标点 5-3：能够设计实验系统，对测控仪器工程问题进行模拟和预测，并分析其局限性。
毕业要求 6（专业与社会）：能够基于工程相关背景知识进行合理分析，评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	指标点 6-1：了解测控仪器工程相关领域的方针政策和法律法规，理解社会文化对工程活动的影响。
	指标点 6-2：能够认知所设计方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。
毕业要求 7（环境和可持续发展）：能够理解和评价针对复杂测控仪器工程问题的工程实践对环境、社会可持续发展的影响。	指标点 7-1：树立科学发展观，了解国家环境保护相关政策法规，理解社会可持续发展的重要性、内涵和意义。
	指标点 7-2：能够评价测控仪器工程实践对环境保护、社会可持续发展的影响。
毕业要求 8（职业规范）：具有人文社会科学素养、社会责任感，能够在测控仪器实践中理解并遵守工程职业道德和规范，履行责任；树立和践行社会主义核心价值观。	指标点 8-1：形成正确的世界观、人生观，理解个人与社会的关系，了解中国国情。
	指标点 8-2：具有人文社会科学素养、工程职业道德和规范，具备社会责任感。

毕业要求 9（个人和团队）：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	指标点 9-1：了解多学科背景下团队的构成以及不同角色成员的职责，能与其他成员有效沟通。
	指标点 9-2：具有团队合作意识，能听取、协调、综合成员意见，并形成合理决定。
毕业要求 10（沟通）：能够就复杂测控仪器工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	指标点 10-1:了解测控仪器工程项目实施的流程，能够理解并运用工程管理方法，能够在工程项目方案设计过程中考虑和融入经济因素。
	指标点 10-2:能知悉和跟踪测控学科国内外发展趋势，具备跨文化背景下的语言文字表达与专业沟通能力。
毕业要求 11（项目管理）：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	指标点 11-1:了解测控仪器工程项目实施的流程，能够理解并运用工程管理方法。
	指标点 11-2:了解测控仪器工程项目的成本构成，能够在工程项目方案设计过程中考虑和融入经济因素。
毕业要求 12（终身学习）：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	指标点 12-1:具备自主和终身学习的意识，以及持续学习的健康体魄。
	指标点 12-2:能适应社会发展，具备自主学习的能力，能主动理解、归纳与提出问题。

毕业要求对培养目标的支撑：

培养目标 / 毕业要求	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5
1. 基础知识		√	√		
2. 问题分析		√	√		
3. 设计/开发解决方案		√	√		
4. 研究		√	√		
5. 使用现代工具		√	√		
6. 专业与社会	√				
7. 环境和可持续发展	√				√
8. 职业规范	√			√	√
9. 个人和团队				√	√
10. 沟通				√	
11. 项目管理	√			√	
12. 终身学习					√

主干学科：仪器科学与技术；控制科学与工程。

专业核心课程：电路理论、模拟电子技术、数字电子技术、自动控制原理 I、嵌入式原理及应用 I、工程信号分析及处理、计量误差理论、传感器原理及检测技术、智能仪器仪表设计基础、精密机械设计基础、工程光学及光电检测、嵌入式技术与仪器等。

主要专业实验：电子电路、现代可编程逻辑器件、DSP 原理及应用、微机接口技术、智能仪器设计基础、计算机软件技术、虚拟仪器、嵌入式技术与仪器、传感器技术实验等。

主要实践性教学环节：金工实习、计算机程序设计实践、电子技术综合实践、测控电路实习、传感器与光电检测实践、智能地学虚拟仪器设计、智能感知与控制综合实习、生产实习、毕业实习与毕业设计。

毕业学分要求：169.5。

学制与学位：四年，工学学士。

本专业学生可以辅修的其他专业：计算机科学与技术、通信工程、电子信息工程。

相近专业：自动化、电子信息工程、光电信息科学与工程、机械工程、电子科学与技术。

Program for Measurement & Control Technology and Instrument

Specialty and Code: Measurement & Control Technology and Instrumentation, 080301

Education Objective:

To meet the developmental needs of the national economy and the field of earth sciences, the program is aimed at cultivating specialized talents who have a sense of social responsibility and science & culture qualities; who possess the basic knowledge, basic theory, and basic skills in the field of measurement, control, instrumentation; who have the ability of innovating, independent learning and practice; who can engage in scientific research, technology development, design and manufacture, production management, etc., in the field of intelligent geophysical instrument and equipment, measurement control and instrument, etc. After 5 years of work or study since graduation, the students should have the following abilities:

1. Understanding of humanities & social science, professional ethics, social responsibility, and innovation.
2. Master the knowledge system which focuses on the measurement, take information flow as the main line, and mutual support of sensing, measurement, and control.
3. Use modern design tools and information technology to conduct research, design, manufacturing, testing, production, and application of measurement and control instruments, possessing strong engineering practical ability and innovative consciousness, and becoming a professional technical talent and backbone of scientific research institutes and enterprises and institutions.
4. Collaborate, organize, manage, communicate, communicate, and engage in technology development & management in related fields.
5. Performing job responsibilities, as well as lifelong learning and adaptive development.

Graduation Requirements:

This major focuses on the measurement theory, instrument design， and the foundation of integration technology for measurement & control system; the mathematic basis of measurement, control, instrument, electronic circuits, optics, geophysics, mechanics, computers, control, and other professional knowledge of sensing, testing, and instrumentation; as well as the training on course experiment, course design, internship, etc.; establish the ability to communicate, innovate, re-learn and solve complex engineering problems in the instrument field. Graduates should meet the following requirements of knowledge, quality, and ability:

1. Fundamental knowledge: master the foundations of mathematics & natural sciences, electronic circuits, optics, geophysics, machinery, computers, control, and other

professional knowledge of sensing, testing, and instrumentation, being able to solve complex engineering problems in the instrument field.

2. Problem analysis: apply the basic principles of mathematics, natural sciences, and engineering science to identify, express, and analyze complex engineering problems in the field of instrumentation through literature research, to obtain valid conclusions.
3. Design/Development solution: design solutions for complex engineering problems in the instrument field, develop systems and units (components) that meet specific needs and reflect innovation in the design process, considering social, health, safety, legal, cultural and environmental factors.
4. Research: apply scientific methods to study complex engineering problems in the instrument field including design experiments, analysis & interpretation of data, and obtain reasonable and effective conclusions through information synthesis, based on the basic principles of measurement and control.
5. Using modern tools: develop, select and adopt the reasonable technologies, resources, modern engineering tools, and information technology tools for solving complex engineering problems in the instrument field, including prediction & simulation of complex engineering problems, and understand their limitations.
6. Specialty and society: conduct a reasonable analysis to evaluate the impact of professional engineering practices and complex engineering problem solutions on society, health, safety, law, culture, and to understand the responsibilities, based on the relevant background knowledge of engineering such as measurement, control systems, etc.
7. Environment and sustainable development: have the ability to understand and evaluate the impact of professional engineering practices on complex engineering issues in the measurement & control instrument profession on environmental and social sustainability.
8. Professional norms: humanities & social science literacy and social responsibility, the ability to understand and comply with engineering professional ethics and norms, fulfill responsibilities in engineering practice.
9. Individuals and teams: undertake the roles of individuals, team members, and responsible individuals in a multidisciplinary team.
10. Communication: effective communication with industry peers and public on complex engineering issues in the instrument field, including write reports and design contributions, present statements, express or respond to instructions, and an international perspective, being able to communicate in a cross-cultural context.
11. Project management: Understand and master the engineering management principles and economic decision-making methods, applying them in a multidisciplinary environment.
12. Lifelong learning: awareness of self-directed learning and lifelong learning, with the ability to continuously learn and adapt to development.

Graduation Requirement 1 Engineering Knowledge: Graduates are required to master mathematics, natural science, electronic circuit, optics, geophysics, machinery, computer, control and other professional knowledge as well as sensing, testing, instrumentation and other professional knowledge, and can be used to solve complex measurement and control instrument engineering problems.	1-1： Master the mathematical foundation necessary for engaging in automation engineering, and be able to mathematically deduce, model, and solve complex objects.
	1-2： Proficient in electronic circuit, optics, geophysics, machinery, computer, control and other basic skills, can use engineering foundation and professional knowledge to deduce and analyze sensing, testing, instrument problems.
	1-3： Be able to apply relevant theoretical knowledge and professional skills to the comparison and synthesis of instrument system schemes.
Graduation Requirement 2 Problem Analysis: Graduates are required to apply the basic principles of mathematics, natural science and engineering science to identify and accurately describe complex engineering problems in the field of measurement & control technology and instrument, and analyze them through literature research to obtain valid conclusions.	2-1： Be able to apply the fundamental principles of mathematics, physics, and engineering science to identify and judge the key aspects and parameters of complex engineering problems in measurement & control technology.
	2-2：Be able to analyze instrument design engineering problems through literature research and seek multiple options to solve problems.
	2-3：Be able to apply professional knowledge of measurement & control technology and instrument and Instrument to analyze influencing factors and draw valid conclusions.
Graduation Requirement 3 Solution Design/Development: Graduates are required to design solutions for complex engineering problems in the field of measurement & control technology and instrument, design systems, units	3-1： Be able to use basic design techniques of measurement and control instrument systems and understand the factors that affect design.
	3-2： Be able to complete the design of sensor, signal extraction and processing, data processing and other signal chain units according to the specific needs of measurement and control instrument system.

(components), algorithms, techniques, and devices that meet specific requirements, and demonstrate innovative thinking in the design process, considering social, health, safety, legal, cultural, and environmental factors.	3-3： Be able to develop and implement measurement & control technology and instrument systems and demonstrate innovative thinking in the design and practical stages.
	3-4： Be able to analyze the feasibility of design solutions under the constraints of safety, health, legal, cultural, and environmental factors.
Graduation Requirement 4 Research: Graduates are required to conduct research on complex engineering problems in the field of measurement & control technology and instrument based on scientific principles and methods, analyze through literature investigation, including modeling, design, synthesis, experimentation, simulation, optimization, analysis and interpretation of data, and obtain reasonable and effective conclusions through information integration.	4-1： Be able to analyze and solve complex engineering problems of measurement and control instruments according to basic engineering knowledge and scientific principles.
	4-2：Be able to use professional theories and techniques, choose research routes, design, construct and implement professional experiments of measurement and control.
	4-3： Analyze and synthesize information from experimental and operational data of measurement & control technology and instrument systems using methods to obtain effective conclusions and scientifically interpret the data.
Graduation Requirement 5 Modern Tool Application: Graduates are required to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools to solve complex engineering problems in measurement & control technology and instrument, including prediction and simulation of the problems. Meanwhile, they need to have a	5-1： Understand the principles and methods of test instruments, information technology tools, engineering tools and simulation software commonly used in measurement and control profession, and understand their applicable scope and limitations.
	5-2： For complex engineering problems of measurement and control instruments, software simulation tools can be selected to analyze, calculate and design systems and units (components) that meet specific needs.
	5-3： Be able to develop and design experimental systems or tools that meet specific needs, simulate and predict measurement & control technology and instrument engineering problems, and analyze their

clear understanding of the limitations of these modern tools.	limitations.
Graduation Requirement 6 Engineering and Society: Graduates are required to conduct reasonable analysis based on engineering-related knowledge, evaluate the impact of measurement & control technology and instrument engineering practices and complex engineering problem solutions on society, health, safety, law, and culture, and understand the corresponding responsibilities to be undertaken.	6-1：Understand the policies, laws and regulations, engineering ethics, technical standards system, intellectual property, and industrial policies related to measurement & control technology and instrument engineering, and understand the impact of different social cultures on automation engineering activities.
	6-2：Be able to recognize the impact of the designed measurement & control technology and instrument scheme on society, health, safety, ethics, law, and culture, as well as the impact of these limiting factors on project implementation, and understand the responsibilities that should be undertaken.
Graduation Requirement 7 Environment and Sustainable Development: Graduates are required to be able to understand and evaluate the impact of measurement & control technology and instrument engineering practices, especially the practices of complex engineering problems, on environmental and social sustainability.	7-1：Establish a scientific development concept, understand the national environmental protection policies and regulations in the field of automation, and understand the importance, concepts, connotations, and significance of social sustainable development.
	7-2：Be able to think from the perspective of environmental protection and sustainable development about the sustainability of automation control engineering practice and evaluate the potential damage and hazards to humans and the environment during the product life cycle.
Graduation Requirement 8 Professional Norm: Graduates are required to have patriotic feelings and the willingness to become a qualified builder and reliable successor of the socialist cause. Have humanistic and social science literacy and social responsibility, be able to understand and abide by	8-1：Form a correct worldview and outlook on life, understand the relationship between individuals and society, understand the national conditions of China, and have the willingness to become a qualified builder and reliable successor of the socialist cause.
	8-2：Have humanistic and social science literacy, understand and consciously abide by engineering professional ethics and norms.

engineering professional ethics and norms in the process of complex system design, operation, and maintenance of automation engineering, and fulfill corresponding responsibilities.	
Graduation Requirement 9 Individual and Teamwork: Graduates are required to assume the roles of individual, team member and leader in a multidisciplinary team.	9-1：Understand the composition of the team under a multidisciplinary background and the responsibilities of different role members, and be able to communicate effectively with other members.
	9-2：Have a sense of teamwork, be able to listen, coordinate, and integrate member opinions, form reasonable decisions, and be able to independently, cooperatively, and leadership-wise solve problems within the team.
Graduation Requirement 10 Communication: Graduates are required to effectively communicate with industry counterparts and the public on complex automation engineering issues, including writing reports and designing manuscripts, presenting statements, clearly expressing and responding to instructions. They also need to have international vision and can communicate in a cross-cultural context.	10-1：Be able to accurately express one's own views in oral or written form regarding complex engineering problems in the field of automation, and able to effectively communicate and respond to questions from peers in the industry and the general public in different fields. Able to understand and deal with the differences in communication between peers in the industry and the general public.
	10-2：Be able to be aware of and track the development trends of automation discipline both domestically and internationally, possess a certain international perspective, understand and respect the differences and diversity of cultures around the world, and have the ability to communicate and express professionally in language and cross-cultural contexts.
Graduation Requirement 11 Project Management: Graduates are required to understand and master engineering management principles and economic decision-making methods, and apply them in a multidisciplinary environment.	11-1：Master the management and economic decision-making methods involved in engineering projects, understand the cost structure of the entire life cycle and process of engineering and products, and understand the engineering management and economic decision-making issues involved.
	11-2：Be able to apply principles of engineering management and economic decision-making methods in the research, design, development, and implementation of complex measurement & control technology and instrument engineering problems in a multidisciplinary environment.

Graduation Requirement 12 Lifelong Learning: Graduates are required to have the consciousness of autonomous and lifelong learning, the ability to learn continuously and adapt to development, and have a strong work ethic and ability	12-1：Have the awareness of self-directed and lifelong learning, as well as the physical health to sustain continuous learning.
	12-2：Be able to adapt to social development, have the ability to learn independently, and be able to actively understand, summarize, and propose questions.

The support of Requirements to Training Goals：

Training goals / Graduation requirements	Training goal 1	Training goal 2	Training goal 3	Training goal 4	Training goal 5
1. Fundamental knowledge		√	√		
2. Problem analysis		√	√		
3. Design/Development solution		√	√		
4. Research		√	√		
5. Using modern tools		√	√		
6. Specialty and society	√				
7. Environment and sustainable development	√				√
8. Professional norms	√			√	√
9. Individuals and teams				√	√
10. Communication				√	
11. Project management	√			√	
12. Lifelong learning					√

Major Disciplines: Instrument Science and Technology, Control Science and Engineering

Main Courses: Theory of Circuitry, Analog Electronics, Digital Electronics, Principles of Automatic Control I, Embedded System Principle and Application I: Principle of Micro-computer and Technology of Microcontroller, Signals and Systems, Digital Signal Processing, Metrology Error Theory, Sensors Principle and Detection Technology, Principle and Interface of Computer, the Basis of Intelligent Instrument Design, Introduction to Measuring and Controlling Software Design, Engineering Optics and Optoelectronic Detection， Modern Programming Logic Device, Principle & Application of DSP, Virtual Instrument, Embedded Technology and Instrument, Network Technology, Computer Control Technology, Fundamentals of Artificial Intelligence, etc.

Lab Experiments: Electronic Circuit, Modern Programming Logic Device, Principle & Application of DSP, Principle and Interface of Computer, the Basis of Intelligent Instrument Design, Computer Software Technology, Virtual Instrument, Embedded Technology and Instrument, Sensor and Detection Technology, etc.

Practical Work: Metalworking Practice, Computer Programming Fundamentals, Course Exercise in Electronic Technology, Microcontroller Technology Training, Signal Conditioning Circuit of measurement and control, Intelligence and Control Integrated Training, Production Training, Graduate Practice, and Bachelor Thesis, etc.

Requirements for Graduation Credits: 169.5.

Duration& Degree Granted: Four years，Bachelor of Engineering.

Recommended minor: Computer Science and Technology, Communication Engineering, Electronic Information Engineering.

Related Specialties: Automation, Electronic Information Engineering, Optoelectronic Information Science and Engineering, Mechanical Engineering, Electronic Science and Technology.

毕业要求实现矩阵:

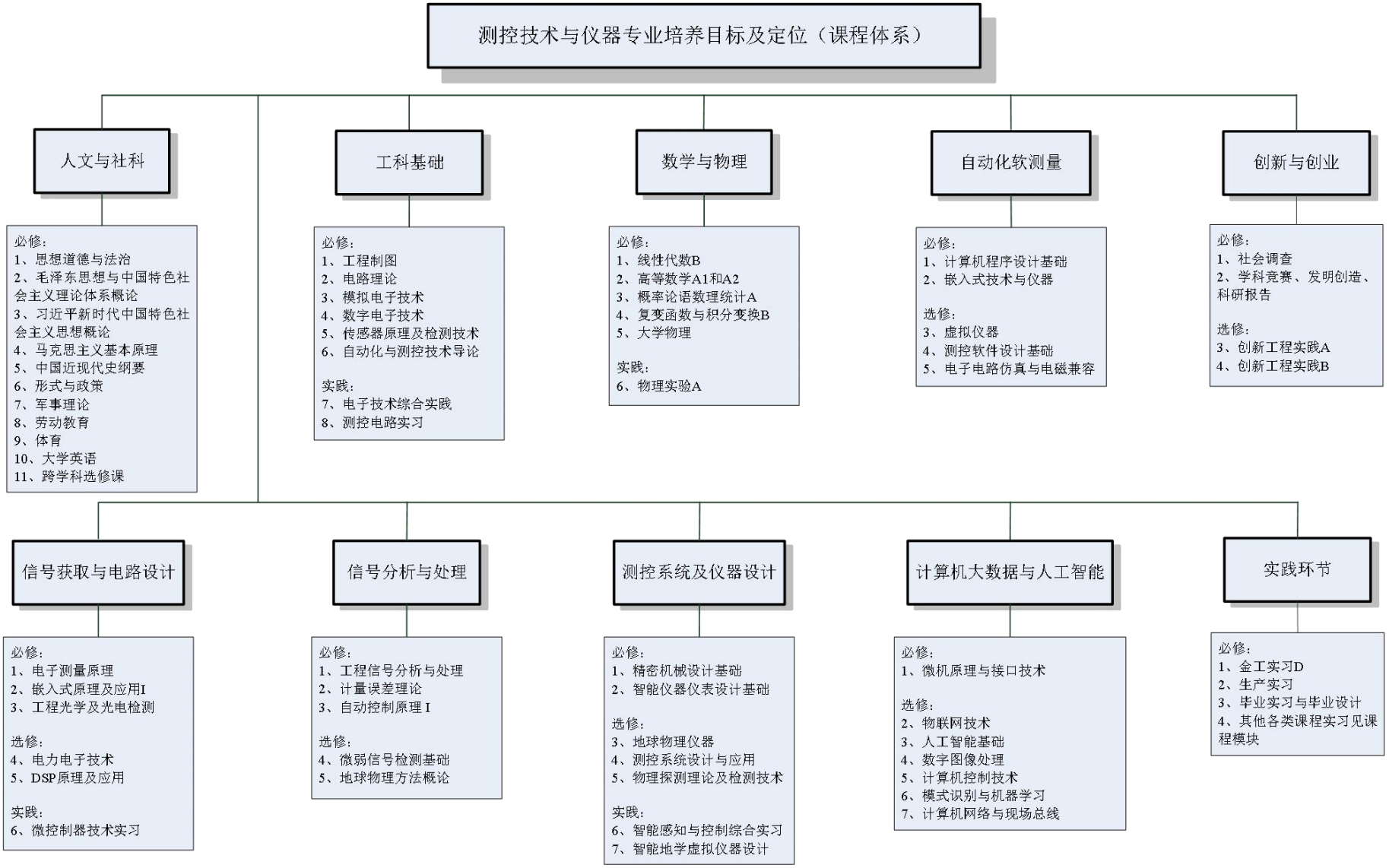
Graduation Realization Matrix：

毕业要求 Graduation Requirements / 教学活动 Teaching Activities	1			2			3				4			5			6		7		8		9		10		11		12	
	1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3	3-4	4-1	4-2	4-3	5-1	5-2	5-3	6-1	6-2	7-1	7-2	8-1	8-2	9-1	9-2	10-1	10-2	11-1	11-2	12-1	12-2
马克思主义基本原理 Basic Principles of Marxism										H											H	M							L	L
毛泽东思想和中国特色社会主义理论体系概论 Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics										H								M	L		H	M							L	L
习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era										H								M	L		H	M							L	L
中国近现代史纲要 The Essentials of Modern Chinese History										M								L	L		M	L								
思想道德与法治 Ideological morality and rule of law										H							H	H			H	H		L						
形势与政策 Situation and Policy										M								M	H	L	H	M								
体育 Physical Education																							M	M					H	
大学英语 College English					M																				H	H				L
军事理论 Military theory																					M	M	M	M						
劳动教育 Labor Education																	L	M		M										
自动化与测控技术导论 Introduction to Automation and Measuring & Control Technology							M	L	L	L									M	M									L	L
工程制图 Engineering Drawing		L						L			M			H																
高等数学 A	H	H	M	H							M																			

Advanced Mathematics A																														
计算机程序设计基础 Computer Programming Fundamentals							M	M	M					H	H	H														
大学物理 A College Physics A	H	H	L	L																										
物理实验 A Physical experiment A			M								L			L	L															
线性代数 B Linear algebra B	H	H	M	H							M																			
概率论与数理统计 A Probability Theory and Mathematical Statistics A	H	H	M	H							M		L																	
复变函数与积分变换 B Complex Variable Function and Integral Transform B	H	H	M	H							M																			
现代工程师教育 Education of Modern Engineers											H	H	H	H	H	H	L	L	L	L	L	L	L	L	M	M	H	H	H	H
电路理论 Circuit Theory	M	M				M	L	H	L					M																
模拟电子技术 Analog Electronics Technology	M	M				M	L	H	L					M		L														
数字电子技术 Digital Electronic Technology	M	M				M	L	H	L					M		L														
传感器原理及检测技术 Sensors Principle and Detection Technology				H	H		H							M			M													
自动控制原理 I Principles of Automatic Control I		M	M	M	H	H								L			L													
嵌入式原理及应用 I:微机原理与单片机技术 Embedded System Principle and Application I: Principle of Micro-computer and Technology of Microcontroller		H					H					H		M	M		L													
嵌入式技术与仪器 Embedded Technology and Instrument		H					H					H		M	M		L													
工程信号分析及处理 Engineering signal analysis and processing		M	M	M	M		L							L																
计量误差理论 Metrology Error Theory				M	M			L						L	L															
电子测量原理					M	M	M		M	L				M		M														

Principles of Electronic Measurement																														
精密机械设计基础 Basis of Precision Mechanical Design		M			L		M			L				M																
工程光学及光电检测 Engineering Optics and Optoelectronic Detection		M			M		L	M	L		L																			
智能仪器仪表设计基础 Basis of Intelligent Instrument Design				H	M			H			M			M	H													M		
军事训练 Military Training																					H	L	L	H					M	
计算机程序设计实践 Practice for Computer Programming Design								M			L	L		H	H	H														
金工实习 D Metalworking Practice D														M	M	L							M	M						
电子技术综合实践 Practice for Electronic Technology			M			M	M	M	M			M		M	M												M			
微控制器技术实习 Microcontroller Technology Training							L	L	L	M		M		M	M	M											M			
测控电路实习 Signal Conditioning Circuit of measurement and control	M	M				M	L	H	L					M		L														
传感器与光电检测实践 Practice for Sensors and Engineering Optics		M		H	M		H	M	L		L			M			M													
智能感知与控制综合实习 Intelligence and Control Integrated Training				L	L	L	M	M	M	M		L			M	M														
智能地学虚拟仪器设计实践 Practice for Intelligent Geoscience Virtual Instruments Design					L		M	M		M				M	M															
生产实习 Production Training		M	L				M	H	L	L	M	M	H	L	L	M	H	H		L		H	H	H	H	H	M	L		
毕业实习与毕业设计 Graduate Practice and Bachelor Thesis	M	M	H	H	H	H	H	H	H	M	H	H	H	H	H	H	L	L	L	L	L	L	L	L	M	M	H	H	H	H
社会调查 Social Investigation					H	H	M			M	M		H				M	M	M	M	L	L	M	M	H	H	L	L		
其他(学科竞赛、发明创造、科研报告) Others (Contest, Invention, Innovation and Research Presentation)	L		L	H	H	H	H	H	H	M	H	H	H	H	H	H							H	H	M	M	M	M	M	H

注：L、M、H 表示课程对毕业要求支撑强度分别为低、中、高。


测控技术与仪器专业培养目标及定位（课程体系）
人文与社科
必修：
1、思想道德与法治
2、毛泽东思想与中国特色社会主义理论体系概论
3、习近平新时代中国特色社会主义思想概论
4、马克思主义基本原理
5、中国近现代史纲要
6、形式与政策
7、军事理论
8、劳动教育
9、体育
10、大学英语
11、跨学科选修课
工科基础
必修：
1、工程制图
2、电路理论
3、模拟电子技术
4、数字电子技术
5、传感器原理及检测技术
6、自动化与测控技术导论
实践：
7、电子技术综合实践
8、测控电路实习
数学与物理
必修：
1、线性代数B
2、高等数学A1和A2
3、概率论语数理统计A
4、复变函数与积分变换B
5、大学物理
实践：
6、物理实验A
自动化软测量
必修：
1、计算机程序设计基础
2、嵌入式技术与仪器
选修：
3、虚拟仪器
4、测控软件设计基础
5、电子电路仿真与电磁兼容
创新与创业
必修：
1、社会调查
2、学科竞赛、发明创造、科研报告
选修：
3、创新工程实践A
4、创新工程实践B
信号获取与电路设计
必修：
1、电子测量原理
2、嵌入式原理及应用I
3、工程光学及光电检测
选修：
4、电力电子技术
5、DSP原理及应用
实践：
6、微控制器技术实习
信号分析与处理
必修：
1、工程信号分析与处理
2、计量误差理论
3、自动控制原理 I
选修：
4、微弱信号检测基础
5、地球物理方法概论
测控系统及仪器设计
必修：
1、精密机械设计基础
2、智能仪器仪表设计基础
选修：
3、地球物理仪器
4、测控系统设计与应用
5、物理探测理论及检测技术
实践：
6、智能感知与控制综合实习
7、智能地学虚拟仪器设计
计算机大数据与人工智能
必修：
1、微机原理与接口技术
选修：
2、物联网技术
3、人工智能基础
4、数字图像处理
5、计算机控制技术
6、模式识别与机器学习
7、计算机网络与现场总线
实践环节
必修：
1、金工实习D
2、生产实习
3、毕业实习与毕业设计
4、其他各类课程实习见课程模块

测控技术与仪器专业课程教学计划表

Course Descriptions of Measuring & Control Technology and Instrumentation

课程类别 Classification		课程编号 Code	课程名称 Course Name	学分 Crs	课内总学时 Hrs	学时分类 Class Hours					先修课程 Prerequisite courses	学期学分分配 Semester Credits							
						课内学时		课外学时											
						讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp		一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
通识教育课 Liberal Education Courses	必修 Compulsory	12007800	马克思主义基本原理 Principles of Marxism	3	48	48							3						
		12008100	毛泽东思想和中国特色社会主义理论体系概论 Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics	2	32	32									2				
		12008000	习近平新时代中国特色社会主义思想概论 Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	3	48	48									3				
		11711800	中国近现代史纲要 The Essentials of Modern Chinese History	2	32	32							2						
		12007900	思想道德与法治 Ideological morality and rule of law	3	48	48						3							
		12005300	形势与政策 Situation and Policy	2	32	32						每学期平均分配							
		113076*0	体育 Physical Education	4	144	144						1	1	1	1				
		109234*0	大学英语 College English	9	144	144				48		3	3	3					
		14300300	军事理论 Military Theory	2	36	36						2							
		12008200	劳动教育（理论课） Labor Education	1	16	16						1							
	选修 Elective	包括**地球科学概论、生态学概论**两门必修课程，美育、心理健康教育课程（各不少于2学分）总计12学分，跨学科选修课不低于4学分		12	192	192													
		小计 Sum		**43**	**772**	**772**				**48**		**10**	**9**	**4**	**6**				
大类平台课 Platform Courses		22300100	自动化与测控技术导论 Introduction to Automation and Measuring & Control Technology	1	16	16						1							
		20732100	工程制图 Engineer Drawing	2	32	32		2				2							
		212127*1	高等数学 A Advanced Mathematic A	11.5	184	184						5	6.5						

课程类别 Classification	课程编号 Code	课程名称 Course Name	学分 Crs	课内总学时 Hrs	学时分类 Class Hours					先修课程 Prerequisite courses	学期学分分配 Semester Credits							
					课内学时		课外学时											
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp		一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
	21945700	计算机程序设计基础 Computer Programming Fundamentals	2.5	40	40		16				2.5							
	212130*1	大学物理 A College Physics A	8	128	128					高等数学 A		4	4					
	212169*1	物理实验 A Physical Experiment A	2	64	4	60				大学物理 A		1	1					
	21212802	线性代数 B Linear Algebra B	2.5	40	40					高等数学 A			2.5					
	21213501	概率论与数理统计 A Probability Theory and Mathematical Statistics A	3.5	56	56					高等数学 A			3.5					
	21201902	复变函数与积分变换 B Complex Function and the Integral Transformation B	2.5	40	40					高等数学 A			2.5					
	小计 Sum		**35.5**	**600**	**540**	**60**	**18**				**10.5**	**11.5**	**13.5**					
学科基础课 Disciplinary Fundamental Courses	22300300	电路理论 Circuit Theory	4.5	72	64	8				高等数学 A 线性代数 B		4.5						
	22308100	模拟电子技术 Analog Electronics Technology	3	48	40	8	8	4		电路理论			3					
	22308200	数字电子技术 Digital Electronics Technology	2.5	40	32	8	4	4		电路理论			2.5					
	22308510	自动控制原理 I（系统建模与经典控制论） Principles of Automatic Control I (Modeling and Classical Control Theory)	3.5	56	48	8		4		高等数学 A 复变函数与积分变换 B 线性代数				3.5				
	22315210	现代工程师教育 I（工程与社会、环境与可持续发展、职业规范、工程管理基础） Modern Education for Engineers I	2	32	32											2		
	22315220	现代工程师教育 II（企业兼职教师讲授工程管理应用、当代企业先进技术） Modern Education for Engineers II	0.5	8	8												0.5	
	小计 Sum		**16**	**256**	**224**	**32**	**12**	**12**				**4.5**	**5.5**	**3.5**		**2**	**0.5**	
专业主干课 Main Specialty urses	22314110	传感器原理及检测技术 Sensors	I: 传感器原理及检测技术基础 Basis of Sensors Principle and Detection Technology	2.5	40	36	4				数字电子技术 模拟电子技术			2.5				

课程类别 Classification	课程编号 Code	课程名称 Course Name	学分 Crs	课内总学时 Hrs	学时分类 Class Hours					先修课程 Prerequisite courses	学期学分分配 Semester Credits							
					课内学时		课外学时											
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp		一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
	22314120	Principle and Detection Technology II: 现代传感器技术 Modern Sensors Technology	1	16	16		16			数字电子技术 模拟电子技术					1			
	22308610	嵌入式原理及应用 I:微机原理与单片机技术 Embedded System Principle and Application I: Principle of Micro-computer and Technology of Microcontroller	2.5	40	32	8	4			数字电子技术				2.5				
	22314500	工程信号分析及处理 Engineering signal analysis and processing	2	32	32		8			复变函数与积分变换 B					2			
	22311500	计量误差理论 Metrology Error Theory	1.5	24	24		8			概率论与数理统计					1.5			
	22314400	电子测量原理 Principles of Electronic Measurement	2.5	40	32	8	8			计量误差理论					2.5			
	22314600	嵌入式技术与仪器 Embedded Technology and Instrumentation	1.5	24	16	8	4	4		数字电子技术 模拟电子技术 嵌入式原理及应用 I						1.5		
	22314700	精密机械设计基础 Basis of Precision Mechanical Design	2	32	32		16			工程制图						2		
	22314800	工程光学及光电检测 Engineering Optics and Optoelectronic Detection	2	32	32		8			大学物理 A						2		
	22312100	智能仪器仪表设计基础 Basis of Intelligent Instrument Design	2	32	32		8			模拟电子技术 传感器原理及检测技术						2		
	小计 Sum		**19.5**	**312**	**284**	**28**	**80**	**4**						**5**	**7**	**7.5**		
专业选修课 Specialty Elective Courses		可按方向设课，具体见专业选修课列表 Courses can be arranged according to the direction, as shown in the list of professional elective courses.	**16**	**272**	**272**													
合计 Sub-total			**130**	**2212**	**2092**	**120**	**110**	**16**	**48**		**20.5**	**25**	**23**	**14.5**	**7**	**9.5**	**0.5**	

课程类别 Classification	课程编号 Code	课程名称 Course Name	学分 Crs	课内总学时 Hrs	学时分类 Class Hours					先修课程 Prerequisite courses	学期学分分配 Semester Credits							
					课内学时		课外学时											
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp		一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
实践环节 Practical Work	44300400	军事训练 Military Training	2	2 周							2							
	42313300	计算机程序设计实践 Practice of Computer Programming	2	2 周						计算机程序设计基础		2						
	42008300	劳动教育（实践课） Labor Training	1	1 周												1		
	40724604	金工实习 D Metalworking Practice D	1	1 周						工程制图			1					
	42313400	电子技术综合实践 Practice for Electronic Technology	2	2 周						电路理论 数字电子技术 模拟电子技术			2					
	42313500	微控制器技术实习（含企业认知环节） Microcontroller Technology Training	3	3 周						嵌入式原理及应用 I				3				
	42314400	测控电路实习 Signal Conditioning Circuit of measurement and control	3	3 周						嵌入式技术与仪器					3			
	42314600	传感器与光电检测实践 Practice for Sensors and Engineering Optics	1.5	1.5 周						传感器原理及检测技术						1.5		
	42314500	智能地学虚拟仪器设计 Intelligent Geoscience Virtual Instruments Design	2	2 周						电子测量原理					2			
	42314300	智能感知与控制综合实习 Intelligence and Control Integrated Training	5	5 周						智能仪器仪表设计基础						5		
	42302500	生产实习 Production Training	2	2 周													2	
	42314700	毕业实习与毕业设计 Graduate Practice and Bachelor Thesis	10	16 周														10
	小计 Sum		**34.5**	**40.5 周**							**2**	**2**	**3**	**3**	**5**	**7.5**	**2**	**10**
创新创业自主学习 Freedom study	ZZ35000S	社会调查 Social Investigation	2												2			
		其他(创业基础、学科竞赛、发明创造、科研报告) Others (Start-up, Contest, Invention, Innovation and Research Presentation)	3															
	小计 Sum		**5**															
总计 Total			**169.5**	**2212+40.5 周**	**2092**	**120**	**110**	**16**	**48**		**22.5**	**28**	**25**	**17.5**	**12**	**17**	**2.5**	**10**

课程类别 Classification	课程编号 Code	课程名称 Course Name	学分 Crs	课内总学时 Hrs	学时分类 Class Hours					先修课程 Prerequisite courses	学期学分分配 Semester Credits							
					课内学时		课外学时											
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp		一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
可开出专业选修课列表 Specialty Elective Courses	22312400	电子电路仿真与电磁兼容 Electronic Circuit Simulation and EMC	1.5	24	16	8	8			模拟电子技术 数字电子技术					1.5			
	22308900	虚拟仪器 Virtual Instrument	1.5	24	16	8	8			嵌入式原理及应用 I 传感器原理及检测技术					1.5			
	22301602	现代可编程逻辑器件 B Modern Programmable Logic Device	2	32	16	16				数字电子技术					2			
	22311700	微机原理与接口技术 Principle and Interface of Computer	2	32	32		16			嵌入式原理及应用 I					2			
	22310200	DSP 原理及应用 Principle & Application of DSP	1.5	24	16	8	8			工程信号分析及处理						1.5		
	22314900	微弱信号检测基础 Introduction to Weak Signal Detection	2	32	24	8				概率论与数理统计						2		
	22304700	物理探测理论及检测技术 Physical Detection Theory and Technology	2	32	24	8				大学物理 A 传感器原理及检测技术							2	
	20626100	地球物理方法概论 Introduction of Geophysical Method	2	32	32					大学物理 A							2	
	20617200	地球物理仪器 Geophysical Instrument	2	32	20	12				地球物理方法概论							2	
	22312600	测控软件设计基础 Introduction to Measuring and Controlling Software Design	2	32	32		16			计算机程序设计基础					2			
	22310500	电力电子技术 Power Electronic Technology	2	32	28	4	4			电路理论 模拟电子技术					2			
	22308800	人工智能基础 Fundamentals of Artificial Intelligence	2	32	28	4	4			计算机程序课程设计					2			
	22303800	测控系统设计与应用 Design & Application of Measurement and Control System	2	32	32					模拟电子技术 数字电子技术						2		
	22315000	智能制造大数据技术 Big Data Technology in Intelligent Manufacturing	2	32	24	8				计算机程序设计基础						2		
	22311000	模式识别与机器学习 Pattern Recognition and Machine Learning	2	32	28	4				人工智能基础							2	
	22315100	物联网技术 Networking Technology	2	32	16	16				嵌入式原理及应用 I							1.5	

课程类别 Classi-fication	课程编号 Code	课程名称 Course Name		学分 Crs	课内总学时 Hrs	学时分类 Class Hours					先修课程 Prerequisite courses	学期学分分配 Semester Credits							
						课内学时		课外学时											
						讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp		一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
	22315200	创新创业选修课	创新工程实践(智能车方向，机器人方向，自主选题方向) Innovative Engineering Practice	1	16	4	12	16							1				
	22313300		“走进自动化”创新实践 "Entering Automation" innovative Practice	1	16		8	8	8					1					

注：全英课程须在课程名称后打*标出，通识教育选修课学分未列入具体学期，学院须根据学校创新创业自主学习学分认定一览表制订实施细则。

Note: All English courses should be marked * after the title of the course, general education elective course credits are not included in the specific semester, and colleges should formulate implementation rules according to the list of credits for independent learning of school innovation and entrepreneurship.

测控技术与仪器专业课程分类统计

课程类别 / 统计	通识教育课程 Liberal Education Courses		大类平台课+学科基础课 Platform & Disciplinary Fundamental Courses	专业主干课 Main Specialty Courses	专业选修课 Specialty Elective Courses	实践环节 Practical Work	创新创业自主学习 Freedom Study	学时总计 Total Hour	学分总计 Total Credits
	必修 Compulsory	选修 Elective							
课内总学时/学分 Hours/Credits	580/31	192/12	856/51.5	312/19.5	272/16	40.5 周 +120/42	5	2204 +40.5 周	169.5
学分所占比例 Ratio of Credits	25.4%		30.4%	11.5%	9.4%	24.8%	3%		100%

注：学时总计未计入创新创业选修课及跨学科选修课。