

# 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。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) 具有开展包括地球物理仪器、地学分析仪器，地球化学等在内的测量控制仪器综合设计、实现和应用能力；(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：

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| <b>毕业要求 1 (工程知识)：</b> 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。                                   |
| <b>毕业要求 2 (问题分析)：</b> 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  |

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|  | <p>计工程问题，寻求解决问题的多种备选方案。</p>   |
|  | <p>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。</p>                |
| <p><b>毕业要求 3 (设计/开发解决方案)：</b>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、法律、文化以及环境等因素。</p> | <p>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。</p>                          |
|  | <p>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。</p>          |
|  | <p>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。</p>                        |
|  | <p>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。</p>              |
| <p><b>毕业要求 4 (研究)：</b>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。</p>                        | <p>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。</p>                   |
|  | <p>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。</p>                   |
|  | <p>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。</p>                  |
| <p><b>毕业要求 5 (使用现代工具)：</b>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。</p>                 | <p>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。</p>  |
|  | <p>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。</p> |
|  | <p>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。</p>                   |
| <p><b>毕业要求 6 (工程与社会)：</b>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。</p>                  | <p>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。</p>               |
|  | <p>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。</p>              |

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| <b>毕业要求 7（环境和可持续发展）：</b> 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。                           |
| <b>毕业要求 8（职业规范）：</b> 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。   | 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。                           |
| <b>毕业要求 9（个人和团队）：</b> 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。                         |
| <b>毕业要求 10（沟通）：</b> 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：针对测控仪器工程问题，能够以口头或书面方式准确表达自己观点，并能与业界同行、社会公众进行不同领域的有效交流。 |
|  | 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。              |
| <b>毕业要求 11（项目管理）：</b> 理解并掌握工程管理原理与经济决策方法，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。               |
| <b>毕业要求 12（终身学习）：</b> 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：**

| 本专业毕业要求  | 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 |
|----------|--------|--------|--------|--------|--------|
| 毕业要求 1-1 |        | √      | √      |        |        |
| 毕业要求 1-2 |        | √      | √      |        |        |
| 毕业要求 1-3 |        | √      | √      |        |        |
| 毕业要求 2-1 |        | √      | √      |        |        |
| 毕业要求 2-2 |        | √      | √      |        |        |

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| 毕业要求 2-3  |   | √ | √ |   |   |
| 毕业要求 3-1  |   | √ | √ |   |   |
| 毕业要求 3-2  |   | √ | √ |   |   |
| 毕业要求 3-3  | √ | √ | √ |   |   |
| 毕业要求 3-4  | √ | √ | √ |   |   |
| 毕业要求 4-1  |   | √ | √ |   |   |
| 毕业要求 4-2  |   | √ | √ |   |   |
| 毕业要求 4-3  |   | √ | √ |   |   |
| 毕业要求 5-1  |   | √ | √ |   |   |
| 毕业要求 5-2  |   | √ | √ |   |   |
| 毕业要求 5-3  |   | √ | √ |   |   |
| 毕业要求 6-1  | √ |   |   | √ |   |
| 毕业要求 6-2  | √ |   |   | √ |   |
| 毕业要求 7-1  | √ |   |   |   | √ |
| 毕业要求 7-2  | √ |   |   |   | √ |
| 毕业要求 8-1  | √ |   |   | √ | √ |
| 毕业要求 8-2  | √ |   |   | √ | √ |
| 毕业要求 9-1  |   |   |   | √ | √ |
| 毕业要求 9-2  |   |   |   | √ | √ |
| 毕业要求 10-1 |   |   |   | √ |   |
| 毕业要求 10-2 |   |   |   | √ |   |
| 毕业要求 11-1 |   |   |   | √ |   |
| 毕业要求 11-2 | √ |   |   | √ |   |
| 毕业要求 12-1 |   |   |   |   | √ |
| 毕业要求 12-2 |   |   |   |   | √ |

**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、单片机技术及应用、信号与系统、数字信号处理、计量误差理论、传感器原理及检测技术、微机原理与接口技术、智能仪器仪表设计基础、测控软件设计基础、精密机械设计基础、工程光学与光电检测、现代可编程逻辑器件、DSP 原理及应用、虚拟仪器、嵌入式技术与仪器、物联网技术、计算机控制技术、人工智能基础等。

**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、计算机程序课程设计、电子技术课程设计、单片机技术实习、智能地学虚拟仪器设计、检测技术实习、生产实习、毕业实习与毕业设计。

**毕业学分要求：**172。

**学制与学位：**四年，工学学士。

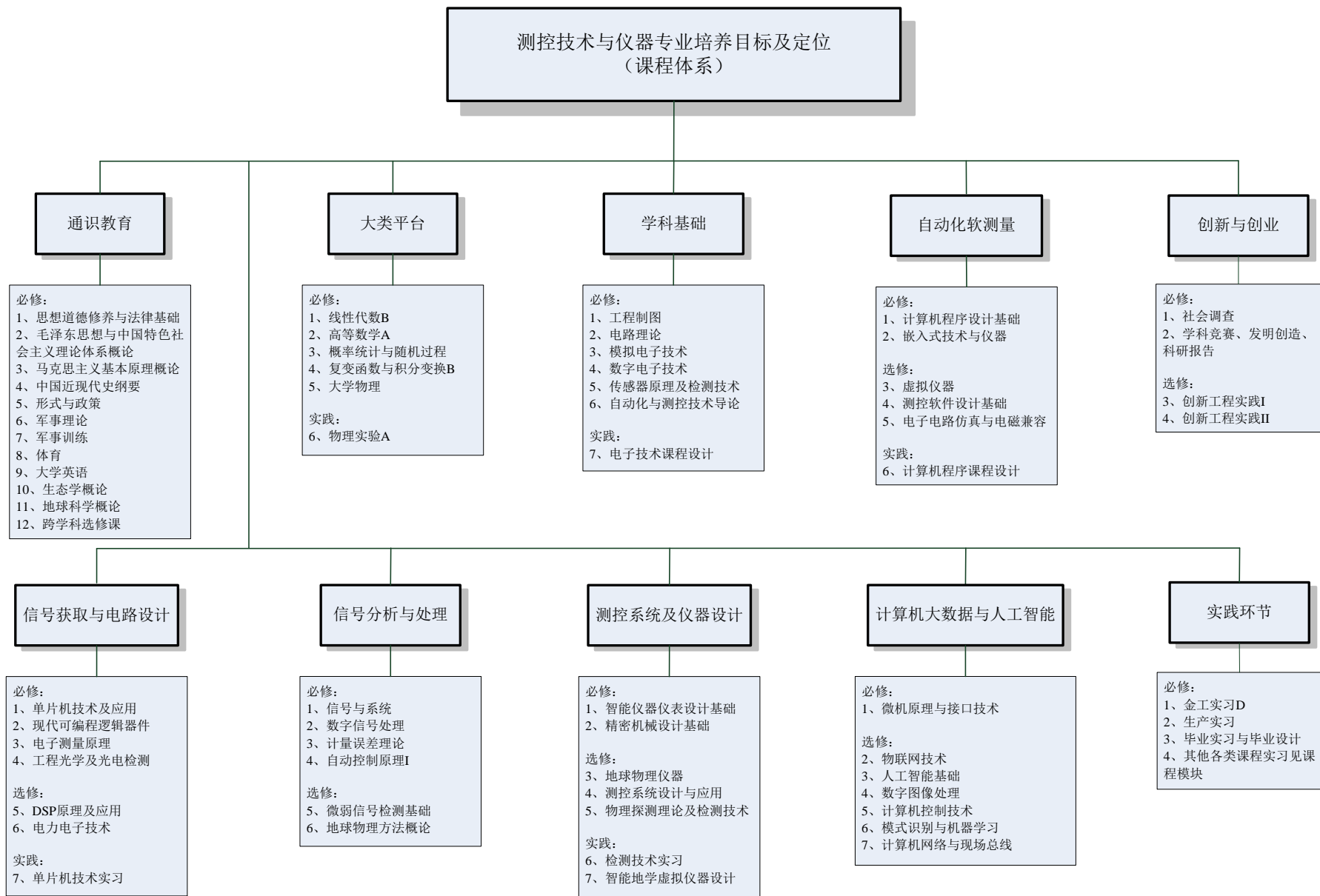
**本专业学生可以辅修的其他专业：**计算机科学与技术、通信工程、电子信息工程。

**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. design and develop of measurement-controlling equipment including geophysical instruments, etc., to meet the demands of engineering.
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:

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| <b>Graduation Requirement 1</b><br><b>(Engineering knowledge):</b> Master the foundation of mathematical and natural sciences, electronic circuits, optics, | Index Point 1-1: Proficiency in the use of mathematics and natural science knowledge for problem presentation. |
|   | Index Point 1-2: Proficiency in basic skills such as electronic circuits, optics, geophysics, mechanics,       |

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| <p>geophysics, machinery, computers, control and other professional foundations as well as sensing, testing, instrumentation and other professional knowledge, and can be used to solve complex engineering problems.</p>   | <p>computers, and control. Be able to use engineering foundations and expertise to deduct and analyze sensing, testing, and instrumentation problems.</p>                                 |
| <p><b>Graduation Requirement 2 (Problem analysis):</b> Have the ability to apply the basic principles of mathematics, natural sciences, and engineering science to discover and accurately describe complex engineering problems in the field of measurement &amp; control technology and instrument, and analyze them through literature studies to obtain valid conclusions.</p>  | <p>Index Point 1-3: Adopt relevant theoretical knowledge and professional skills for the comparison and synthesis of instrument system solutions.</p>                                     |
|   | <p>Index Point 2-1: Apply scientific principles to identify key aspects of instrument design engineering problems and use theoretical analysis and parametric design to express them.</p> |
|   | <p>Index Point 2-2: Analyze instrument design engineering problems, and seeking a variety of alternative solutions to the problem through literature research.</p>                        |
| <p><b>Graduation Requirement 3 (Design / Develop solutions):</b> Have the ability to design solutions for complex measurement and control instrument engineering problems, design systems and units (components) that meet specific needs, and reflect innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.</p> | <p>Index Point 2-3: Analyze the influencing factors and obtain effective engineering problem solutions through applying measurement &amp; control expertise and principles.</p>           |
|   | <p>Index Point 3-1: Ability to use the basic design techniques of the measurement &amp; control system to understand the factors that influence the design.</p>                           |
|   | <p>Index Point 3-2: The design of the sensor or signal processing unit can be completed for the specific needs of the measurement &amp; control system.</p>                               |
|   | <p>Index Point 3-3: Ability to design measurement &amp; control system and embody innovation awareness in design and practice.</p>  |
| <p><b>Graduation Requirement 4 (Research):</b> Have the ability to study complex engineering problems, including designing experiments, analyzing and interpreting data based on the basic principles of measurement and control, and can obtain reasonable and effective conclusions</p>   | <p>Index Point 3-4: The feasibility of the design can be analyzed under the constraints of safety, health, legal, cultural and environmental factors.</p>                                 |
|   | <p>Index Point 4-1: Ability to analyze solutions to complex engineering problems of measurement &amp; control instrument based on engineering fundamentals and scientific principles</p>  |
| <p>Index Point 4-2: Ability to apply professional theories and techniques, select research routes, design, build and implement measurement &amp;</p>  |   |

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| <p>through information synthesis.</p>  | <p>control professional experiments.</p>  |
| <p><b>Graduation Requirement 5 (Using modern tools):</b> Have the ability to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex engineering problems, including predictions and simulations of complex engineering problems, and to understand their limitations.</p>    | <p>Index Point 4-3: For engineering problems of measurement &amp; control instrument, the results can be obtained through information analysis and synthesis, and the data can be interpreted scientifically.</p>   |
| <p><b>Graduation Requirement 6 (Engineering and society):</b> Have the ability to conduct a rational analysis based on engineering-related background knowledge to evaluate the impact of professional engineering practices and complex engineering problem solutions on society, health, safety, law, culture, and understand the responsibilities</p> | <p>Index Point 5-1: Understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in measurement &amp; control major, and understand the scope and limitations of their application.</p> |
| <p><b>Graduation Requirement 7 (Environment and sustainable development):</b> Have the ability to understand and evaluate the impact of professional engineering practices on complex engineering issues in the measurement &amp; control instrument profession on environmental and social</p>  | <p>Index Point 5-2: For the engineering problems of measurement &amp; control instrument, the software simulation tools can be selected for analysis, calculation and design.</p>   |
|  | <p>Index Point 5-3: Ability to design experimental systems, simulate and predict measurement &amp; control instrument engineering problems, and analyze their limitations.</p>  |
|  | <p>Index Point 6-1: Understand the principles, policies, laws and regulations in the field of measurement &amp; control instrument engineering, and understand the impact of social culture on engineering activities.</p>  |
|  | <p>Index Point 6-2: Be able to recognize the impact of the design on society, health, safety, law, culture, and understand the responsibilities.</p>  |
|  | <p>Index Point 7-1: Establish a scientific outlook on development, understand relevant national environmental protection policies and regulations, and master the importance, connotation and significance of sustainable social development.</p>                                   |
|  | <p>Index Point 7-2: Ability to evaluate the impact of measurement &amp; control instrument engineering practices on environmental protection and</p>  |

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| sustainability.  | sustainable social development.  |
| <b>Graduation Requirement 8 (Professional norms):</b> Have the feelings of humanities and social science literacy and social responsibility, can understand and abide by engineering professional ethics and norms and fulfill our responsibilities in the practice of measurement & control instrument.   | Index Point 8-1: Form a correct world view, outlook on life, understand the relationship between individuals and society, and understand China's national conditions.  |
|  | Index Point 8-2: Have humanities and social science literacy, engineering professional ethics and norms, and have a sense of social responsibility.  |
| <b>Graduation Requirement 9 (Individuals and teams):</b> Have the ability to assume the roles of individuals, team members, and responsible individuals in a multidisciplinary team.   | Index Point 9-1: Understand the composition of the team in a multidisciplinary context and the responsibilities of members of different roles, and effectively communicate with other members.   |
|  | Index Point 9-2: With a sense of teamwork, have the ability to listen, coordinate, and integrate members' opinions and form reasonable decisions.  |
| <b>Graduation Requirement 10 (Communication):</b> Have the ability to communicate with industry peers and the public on complex measurement & control instrument engineering issues, including writing reports and design contributions, presenting statements, and articulating response instructions. Have an international perspective and can communicate in a cross-cultural context. | Index Point 10-1: For measurement & control instrument engineering problems, be able to accurately express opinions in words or in writing, and can communicate effectively with industry peers and the public in different fields.      |
|  | Index Point 10-2: Be able to understand and track the development trend of measurement & control major at home or abroad, and has the ability of language expression and professional communication under the cross-cultural background. |
| <b>Graduation Requirement 11 (Project management):</b> Understand and master the principles of engineering management and economic decision-making, and can apply it in a multidisciplinary environment.   | Index Point 11-1: Understand the process of implementing measurement & control instrument engineering projects and can apply engineering management methods.   |
|  | Index Point 11-2: Understand the cost structure of a measurement & control instrument project and can consider and integrate economic factors into the project design process.   |
| <b>Graduation Requirement 12 (Lifelong learning):</b> Have the consciousness of  | Index Point 12-1: Have a sense of autonomy and lifelong learning, and a healthy body of  |

|  |  |
|--|--|
| independent learning and lifelong learning, and have the ability to continuously learn and adapt to development. | continuous learning.   |
|  | Index Point 12-2: Be able to adapt to social development, have the ability to learn independently, and can actively understand, summarize and ask questions. |

**The support of Requirements to Training Goals:**

| Graduation Requirements | Training Goal 1 | Training Goal 2 | Training Goal 3 | Training Goal 4 | Training Goal 5 |
|-------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Requirement 1-1         |                 | √               | √               |                 |                 |
| Requirement 1-2         |                 | √               | √               |                 |                 |
| Requirement 1-3         |                 | √               | √               |                 |                 |
| Requirement 2-1         |                 | √               | √               |                 |                 |
| Requirement 2-2         |                 | √               | √               |                 |                 |
| Requirement 2-3         |                 | √               | √               |                 |                 |
| Requirement 3-1         |                 | √               | √               |                 |                 |
| Requirement 3-2         |                 | √               | √               |                 |                 |
| Requirement 3-3         | √               | √               | √               |                 |                 |
| Requirement 3-4         | √               | √               | √               |                 |                 |
| Requirement 4-1         |                 | √               | √               |                 |                 |
| Requirement 4-2         |                 | √               | √               |                 |                 |
| Requirement 4-3         |                 | √               | √               |                 |                 |
| Requirement 5-1         |                 | √               | √               |                 |                 |
| Requirement 5-2         |                 | √               | √               |                 |                 |
| Requirement 5-3         |                 | √               | √               |                 |                 |
| Requirement 6-1         | √               |                 |                 | √               |                 |
| Requirement 6-2         | √               |                 |                 | √               |                 |
| Requirement 7-1         | √               |                 |                 |                 | √               |
| Requirement 7-2         | √               |                 |                 |                 | √               |
| Requirement 8-1         | √               |                 |                 | √               | √               |
| Requirement 8-2         | √               |                 |                 | √               | √               |
| Requirement 9-1         |                 |                 |                 | √               | √               |
| Requirement 9-2         |                 |                 |                 | √               | √               |
| Requirement 10-1        |                 |                 |                 | √               |                 |
| Requirement 10-2        |                 |                 |                 | √               |                 |
| Requirement 11-1        |                 |                 |                 | √               |                 |
| Requirement 11-2        | √               |                 |                 | √               |                 |
| Requirement 12-1        |                 |                 |                 |                 | √               |
| Requirement 12-2        |                 |                 |                 |                 | √               |

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

**Main Courses:** Circuit Theory, Analog Electronics, Digital Electronics, Principles of Automatic Control I, Technology and Application 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, Course Design for Computer Programming, Course Exercise in Electronic Technology, Microcontroller Technology Training, Comprehensive Course Design of Measurement & Control System and Intelligent Instrument, Design of Intelligent Geoscience Virtual Instruments, Detection Technology Training, Production Training, Graduate Practice, and Bachelor Thesis, etc.

**Requirements for Graduation Credits:** 172.

**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.

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<br>Classification    | 课程编号<br>Code   | 课程名称<br>Course Name   | 学分<br>Crts | 课内总学时<br>Hrs | 学时分类<br>Class Hours |             |                                 |               |                 | 先修课程<br>Prerequisite courses | 学期学分分配<br>Semester Credits |          |          |          |          |          |          |          |
|---------------------------|--|---|------------|--------------|---------------------|-------------|---------------------------------|---------------|-----------------|------------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|
|                           |  |   |            |              | 课内学时                |             | 课外学时                            |               |                 |                              | 一<br>1st                   | 二<br>2nd | 三<br>3rd | 四<br>4th | 五<br>5th | 六<br>6th | 七<br>7th | 八<br>8th |
|                           |  |   |            |              | 讲课<br>Lec.          | 课内实验<br>Lab | 实验/<br>科研<br>实践<br>Lab/R<br>es. | 研<br>讨<br>Dis | 素质<br>拓展<br>Exp |                              |                            |          |          |          |          |          |          |          |
| 必修<br>Compulsory          | 11706200   | 马克思主义基本原理概论<br>Principles of Marxism  | 3          | 48           | 48                  |             |                                 |               |                 |                              |                            | 3        |          |          |          |          |          |          |
|                           | 11706500   | 毛泽东思想和中国特色社会主义理论体系概论<br>Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics | 4          | 64           | 64                  |             |                                 |               |                 |                              |                            |          | 4        |          |          |          |          |          |
|                           | 11711800   | 中国近现代史纲要<br>The Essentials of Modern Chinese History  | 2          | 32           | 32                  |             |                                 |               |                 |                              |                            |          |          |          | 2        |          |          |          |
|                           | 12005200   | 思想道德修养与法律基础<br>Morality Education and Fundamentals of Law   | 3          | 48           | 48                  |             |                                 |               |                 |                              | 3                          |          |          |          |          |          |          |          |
|                           | 12005300   | 形势与政策<br>Situation and Policy   | 2          | 32           | 32                  |             |                                 |               |                 |                              | 每学期平均分配                    |          |          |          |          |          |          |          |
|                           | 113076*0   | 体育<br>Physical Education  | 4          | 144          | 144                 |             |                                 |               |                 |                              | 1                          | 1        | 1        | 1        |          |          |          |          |
|                           | 109234*0   | 大学英语<br>College English   | 9          | 144          | 144                 |             |                                 |               | 48              |                              | 3                          | 3        | 3        |          |          |          |          |          |
|                           | 14300300   | 军事理论<br>Military Theory   | 2          | 36           | 36                  |             |                                 |               |                 |                              | 2                          |          |          |          |          |          |          |          |
|                           | 70100300   | 地球科学概论<br>Introduction to Earth Sciences  | 1.5        | 24           | 24                  |             |                                 | 8             |                 |                              |                            | 1.5      |          |          |          |          |          |          |
|                           | 70400600   | 生态学概论<br>Introduction to Ecology  | 1.5        | 24           | 24                  |             |                                 |               |                 |                              | 1.5                        |          |          |          |          |          |          |          |
| 选修<br>Elective            | 包括地球科学概论、生态学概论两门必修课程总计 12 学分，含创新创业选修课学分，跨学科选修课不低于 4 学分<br>including Introduction to Geosciences and Ecology, including Innovation and Entrepreneurship elective course credits, and no less than 4 credits in the interdisciplinary elective course. |   | 9          | 144          | 144                 |             |                                 |               |                 | 根据选修课程开课学期分配                 |                            |          |          |          |          |          |          |          |
|                           | 小计<br>Sum  |   | 41         | 740          | 740                 |             |                                 | 8             |                 | 48                           |                            | 10.5     | 5.5      | 7        | 5        |          | 2        |          |
| 大类平台课<br>Platform Courses | 22300100   | 自动化与测控技术导论<br>Introduction to Automation and Measuring & Control Technology   | 1          | 16           | 16                  |             |                                 |               |                 |                              |                            | 1        |          |          |          |          |          |          |
|                           | 20732100   | 工程制图<br>Engineer Drawing  | 2          | 32           | 32                  |             |                                 | 2             |                 |                              |                            | 2        |          |          |          |          |          |          |
|                           | 212127*1   | 高等数学 A<br>Advanced Mathematic A   | 11.5       | 184          | 184                 |             |                                 |               |                 |                              | 5                          | 6.5      |          |          |          |          |          |          |

| 课程类别<br>Classification                       | 课程编号<br>Code      | 课程名称<br>Course Name   | 学分<br>Crs   | 课内总学时<br>Hrs | 学时分类<br>Class Hours |             |                     |           |                   | 先修课程<br>Prerequisite courses | 学期学分分配<br>Semester Credits |             |          |          |          |          |          |          |
|--|-------------------|---|-------------|--------------|---------------------|-------------|---------------------|-----------|-------------------|------------------------------|----------------------------|-------------|----------|----------|----------|----------|----------|----------|
|  |                   |   |             |              | 课内学时                |             | 课外学时                |           |                   |                              | 一<br>1st                   | 二<br>2nd    | 三<br>3rd | 四<br>4th | 五<br>5th | 六<br>6th | 七<br>7th | 八<br>8th |
|  |                   |   |             |              | 讲课<br>Lec.          | 课内实验<br>Lab | 实验/科研实践<br>Lab/Res. | 研讨<br>Dis | 素质拓展<br>Exp       |                              |                            |             |          |          |          |          |          |          |
|  |                   |   |             |              |                     |             |                     |           |                   |                              |                            |             |          |          |          |          |          |          |
|  | 21945700          | 计算机程序设计基础<br>Computer Programming Fundamentals                                    | 2.5         | 40           | 40                  |             | 16                  |           |                   |                              | 2.5                        |             |          |          |          |          |          |          |
|  | 212130*1          | 大学物理 A<br>College Physics A   | 8           | 128          | 128                 |             |                     |           | 高等数学 A            |                              | 4                          | 4           |          |          |          |          |          |          |
|  | 212169*1          | 物理实验 A<br>Physical Experiment A   | 2           | 64           | 4                   | 60          |                     |           | 大学物理 A            |                              | 1                          | 1           |          |          |          |          |          |          |
|  | 21212802          | 线性代数 B<br>Linear Algebra B  | 2.5         | 40           | 40                  |             |                     |           | 高等数学 A            |                              |                            | 2.5         |          |          |          |          |          |          |
|  | 21202400          | 概率统计与随机过程<br>Probability Theory, Mathematical Statistics and Stochastic Processes | 3.5         | 56           | 56                  |             |                     |           | 高等数学 A            |                              |                            | 3.5         |          |          |          |          |          |          |
|  | 21201902          | 复变函数与积分变换 B<br>Complex Function and the Integral Transformation B                 | 2.5         | 40           | 40                  |             |                     |           | 高等数学 A            |                              |                            | 2.5         |          |          |          |          |          |          |
|  | <b>小计<br/>Sum</b> |   | <b>35.5</b> | <b>600</b>   | <b>540</b>          | <b>60</b>   | <b>18</b>           |           |                   | <b>8</b>                     | <b>14</b>                  | <b>13.5</b> |          |          |          |          |          |          |
| Disciplinary<br>Fundamental Courses<br>专业基础课 | 22300300          | 电路理论<br>Circuit Theory  | 4.5         | 72           | 64                  | 8           |                     |           | 高等数学 A、<br>线性代数 B |                              | 4.5                        |             |          |          |          |          |          |          |
|  | 22308100          | 模拟电子技术<br>Analog Electronics  | 3           | 48           | 40                  | 8           | 8                   | 4         | 电路理论              |                              |                            | 3           |          |          |          |          |          |          |
|  | 22308200          | 数字电子技术<br>Digital Electronics   | 2.5         | 40           | 32                  | 8           | 4                   | 4         | 电路理论              |                              |                            | 2.5         |          |          |          |          |          |          |
|  | 22309800          | 传感器原理及检测技术<br>Sensors Principle and Detection Technology                          | 3           | 48           | 48                  |             | 16                  |           | 单片机技术及应用          |                              |                            |             |          | 3        |          |          |          |          |
|  | <b>小计<br/>Sum</b> |   | <b>13</b>   | <b>208</b>   | <b>184</b>          | <b>24</b>   | <b>28</b>           | <b>8</b>  |                   |                              | <b>4.5</b>                 | <b>5.5</b>  | <b>3</b> |          |          |          |          |          |
| Main Specialty Courses<br>专业主干课              | 22308510          | 自动控制原理 I (系统建模与经典控制论)<br>Principles of Automatic Control I                        | 3.5         | 56           | 48                  | 8           |                     | 4         | 线性代数              |                              |                            |             | 3.5      |          |          |          |          |          |
|  | 22311200          | 单片机技术及应用<br>Technology and Application of Microcontroller                         | 2           | 32           | 32                  |             | 16                  |           | 数字电子技术            |                              |                            |             | 2        |          |          |          |          |          |
|  | 22311300          | 信号与系统<br>Signals and Systems  | 2.5         | 40           | 40                  |             | 8                   |           | 复变函数与积分变换 B       |                              |                            |             | 2.5      |          |          |          |          |          |
|  | 22311500          | 计量误差理论*<br>Metrology Error Theory*  | 1.5         | 24           | 24                  |             | 8                   |           | 概率统计与随机过程         |                              |                            |             | 1.5      |          |          |          |          |          |
|  | 22311600          | 现代可编程逻辑器件<br>Modern Programmable Logic Device                                     | 1.5         | 24           | 16                  | 8           | 8                   |           | 数字电子技术            |                              |                            |             |          | 1.5      |          |          |          |          |



| 课程类别<br>Classification              | 课程编号<br>Code      | 课程名称<br>Course Name   | 学分<br>Crs    | 课内总学时<br>Hrs | 学时分类<br>Class Hours |             |                                    |           |                 | 先修课程<br>Prerequisite courses | 学期学分分配<br>Semester Credits |           |           |             |             |           |          |          |
|-------------------------------------|-------------------|---|--------------|--------------|---------------------|-------------|------------------------------------|-----------|-----------------|------------------------------|----------------------------|-----------|-----------|-------------|-------------|-----------|----------|----------|
|                                     |                   |   |              |              | 课内学时                |             | 课外学时                               |           |                 |                              | 一<br>1st                   | 二<br>2nd  | 三<br>3rd  | 四<br>4th    | 五<br>5th    | 六<br>6th  | 七<br>7th | 八<br>8th |
|                                     |                   |   |              |              | 讲课<br>Lec.          | 课内实验<br>Lab | 实验/<br>科研<br>实践<br>Lab/Res.<br>es. | 研讨<br>Dis | 素质<br>拓展<br>Exp |                              |                            |           |           |             |             |           |          |          |
|                                     |                   |   |              |              |                     |             |                                    |           |                 |                              |                            |           |           |             |             |           |          |          |
|                                     | 20703100          | 电子测量原理<br>Principles of Electronic Measurement  | 3            | 48           | 40                  | 8           |                                    |           |                 | 计量误差理论                       |                            |           |           | 3           |             |           |          |          |
|                                     | 22312300          | 数字信号处理<br>Digital Signal Processing   | 2            | 32           | 32                  |             | 16                                 |           |                 | 信号与系统                        |                            |           |           | 2           |             |           |          |          |
|                                     | 22311700          | 微机原理与接口技术*<br>Principle and Interface of Computer*  | 2            | 32           | 32                  |             | 16                                 |           |                 | 单片机技术及应用                     |                            |           |           | 2           |             |           |          |          |
|                                     | 22311800          | 嵌入式技术与仪器<br>Embedded Technology and Instrument  | 2            | 32           | 16                  | 16          |                                    |           |                 | 单片机技术及应用                     |                            |           |           |             | 2           |           |          |          |
|                                     | 22311900          | 精密机械设计基础<br>Basis of Precision Mechanical Design  | 2.5          | 40           | 40                  |             | 8                                  |           |                 | 工程制图                         |                            |           |           |             | 2.5         |           |          |          |
|                                     | 22312000          | 工程光学及光电检测<br>Engineering Optics and Optoelectronic Detection  | 2.5          | 40           | 40                  |             | 8                                  |           |                 | 大学物理 A                       |                            |           |           |             | 2.5         |           |          |          |
|                                     | 22312100          | 智能仪器仪表设计基础<br>The Basis of Intelligent Instrument Design  | 2            | 32           | 32                  |             | 8                                  |           |                 | 模拟电子技术                       |                            |           |           |             | 2           |           |          |          |
|                                     | <b>小计<br/>Sum</b> |   | <b>27</b>    | <b>432</b>   | <b>392</b>          | <b>40</b>   | <b>96</b>                          | <b>4</b>  |                 |                              |                            |           |           | <b>9.5</b>  | <b>8.5</b>  | <b>9</b>  |          |          |
| 专业选修课<br>Specialty Elective Courses |                   | 可按方向设课，具体见专业选修课列表<br>Courses can be arranged according to the direction, as shown in the list of professional elective courses. | <b>17</b>    | <b>272</b>   | <b>272</b>          |             |                                    |           |                 |                              |                            |           |           |             |             |           |          |          |
| <b>合计<br/>Sub-total</b>             |                   |   | <b>133.5</b> | <b>2252</b>  | <b>2128</b>         | <b>124</b>  | <b>150</b>                         | <b>12</b> | <b>48</b>       |                              | <b>18.5</b>                | <b>24</b> | <b>26</b> | <b>14.5</b> | <b>11.5</b> | <b>11</b> |          |          |
| 实践环节<br>Practical Work              | 44300400          | 军事训练<br>Military Training   | 2            | 2周           |                     |             |                                    |           |                 |                              | 2                          |           |           |             |             |           |          |          |
|                                     | 41945800          | 计算机程序课程设计<br>Course Design for Computer Programming   | 1.5          | 1.5周         |                     |             |                                    |           |                 | 计算机程序设计基础                    | 1.5                        |           |           |             |             |           |          |          |
|                                     | 40724604          | 金工实习 D<br>Metalworking Practice D   | 1            | 1周           |                     |             |                                    |           |                 | 工程制图                         |                            | 1         |           |             |             |           |          |          |
|                                     | 42302800          | 电子技术课程设计<br>Course Design for Electronic Technology   | 2            | 2周           |                     |             |                                    |           |                 | 电路理论、数字电子技术、模拟电子技术           |                            | 2         |           |             |             |           |          |          |
|                                     | 42312200          | 单片机技术实习<br>Microcontroller Technology Training  | 3            | 3周           |                     |             |                                    |           |                 | 计算机程序设计基础                    |                            |           | 3         |             |             |           |          |          |

| 课程类别<br>Classification                   | 课程编号<br>Code      | 课程名称<br>Course Name  | 学分<br>Crs   | 课内总学时<br>Hrs           | 学时分类<br>Class Hours |             |                     |           |             | 先修课程<br>Prerequisite courses | 学期学分分配<br>Semester Credits |             |           |             |            |           |            |            |          |            |           |
|--|-------------------|--|-------------|------------------------|---------------------|-------------|---------------------|-----------|-------------|------------------------------|----------------------------|-------------|-----------|-------------|------------|-----------|------------|------------|----------|------------|-----------|
|  |                   |  |             |                        | 课内学时                |             | 课外学时                |           |             |                              | 一<br>1st                   | 二<br>2nd    | 三<br>3rd  | 四<br>4th    | 五<br>5th   | 六<br>6th  | 七<br>7th   | 八<br>8th   |          |            |           |
|  |                   |  |             |                        | 讲课<br>Lec.          | 课内实验<br>Lab | 实验/科研实践<br>Lab/Res. | 研讨<br>Dis | 素质拓展<br>Exp |                              |                            |             |           |             |            |           |            |            |          |            |           |
|  |                   |  |             |                        |                     |             |                     |           |             |                              |                            |             |           |             |            |           |            |            |          |            |           |
|  | 42309300          | 智能地学虚拟仪器设计<br>Design of Intelligent Geoscience Virtual Instruments                                     | 1.5         | 1.5周                   |                     |             |                     |           |             | 电子测量原理                       |                            |             |           | 1.5         |            |           |            |            |          |            |           |
|  | 42312700          | 检测技术实习<br>Detection Technology Training  | 4           | 4周                     |                     |             |                     |           |             | 智能仪器仪表设计基础                   |                            |             |           |             | 4          |           |            |            |          |            |           |
|  | 42313000          | 生产实习<br>Production Training  | 2.5         | 2.5周                   |                     |             |                     |           |             |                              |                            |             |           |             | 2.5        |           |            |            |          |            |           |
|  | 42302600          | 毕业实习与毕业设计<br>Graduate Practice and Bachelor Thesis   | 16          | 16周                    |                     |             |                     |           |             |                              |                            |             |           |             |            |           | 16         |            |          |            |           |
|  | <b>小计<br/>Sum</b> |  | <b>33.5</b> | <b>33.5周</b>           |                     |             |                     |           |             |                              |                            |             |           | <b>2</b>    | <b>1.5</b> | <b>3</b>  | <b>3</b>   | <b>1.5</b> | <b>4</b> | <b>2.5</b> | <b>16</b> |
| 创新创业自主学习<br>Freedom study                | ZZ35000S          | 社会调查<br>Social Investigation   | 2           |                        |                     |             |                     |           |             |                              |                            |             |           |             |            |           |            |            |          |            |           |
|  |                   | 其他(创业基础、学科竞赛、发明创造、科研报告)<br>Others (Start-up, Contest, Invention, Innovation and Research Presentation) | 3           |                        |                     |             |                     |           |             |                              |                            |             |           |             |            |           |            |            |          |            |           |
|  | <b>小计<br/>Sum</b> |  | <b>5</b>    |                        |                     |             |                     |           |             |                              |                            |             |           |             |            |           |            |            |          |            |           |
| <b>总计<br/>Total</b>                      |                   |  | <b>172</b>  | <b>2252<br/>+33.5周</b> | <b>2128</b>         | <b>124</b>  | <b>150</b>          | <b>12</b> | <b>48</b>   |                              | <b>20.5</b>                | <b>25.5</b> | <b>29</b> | <b>17.5</b> | <b>13</b>  | <b>15</b> | <b>2.5</b> | <b>16</b>  |          |            |           |
| 可开出专业选修课列表<br>Specialty Elective Courses | 22312400          | 地球探测智能仪器(选该方向的学生不少于6门)<br>电子电路仿真与电磁兼容<br>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<br>Virtual Instrument   | 1.5         | 24                     | 16                  | 8           | 8                   |           |             | 智能仪器仪表设计基础                   |                            |             |           | 1.5         |            |           |            |            |          |            |           |
|  | 22312500          | 计算机网络与现场总线<br>Computers Network and Fieldbus   | 2           | 32                     | 32                  |             |                     |           |             |                              |                            |             |           |             |            | 2         |            |            |          |            |           |
|  | 22310200          | DSP 原理及应用<br>Principle & Application of DSP  | 1.5         | 24                     | 16                  | 8           | 8                   |           |             | 数字信号处理                       |                            |             |           |             | 1.5        |           |            |            |          |            |           |
|  | 20605500          | 微弱信号检测基础<br>Introduction to Weak Signal Detection  | 2           | 32                     | 32                  |             |                     |           |             | 概率统计与随机过程                    |                            |             |           |             |            | 2         |            |            |          |            |           |
|  | 22304700          | 物理探测理论与检测技术<br>Physical Detection Theory and Technology  | 2           | 32                     | 24                  | 8           |                     |           |             | 大学物理 A、传感器原理及技术              |                            |             |           |             |            |           | 2          |            |          |            |           |

| 课程类别<br>Classification | 课程编号<br>Code | 课程名称<br>Course Name  | 学分<br>Crts | 课内总学时<br>Hrs | 学时分类<br>Class Hours |             |                                 |               |                 | 先修课程<br>Prerequisite courses | 学期学分分配<br>Semester Credits |          |          |          |          |          |          |          |
|------------------------|--------------|--|------------|--------------|---------------------|-------------|---------------------------------|---------------|-----------------|------------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|
|                        |              |  |            |              | 课内学时                |             | 课外学时                            |               |                 |                              | 一<br>1st                   | 二<br>2nd | 三<br>3rd | 四<br>4th | 五<br>5th | 六<br>6th | 七<br>7th | 八<br>8th |
|                        |              |  |            |              | 讲课<br>Lec.          | 课内实验<br>Lab | 实验/<br>科研<br>实践<br>Lab/R<br>es. | 研<br>讨<br>Dis | 素质<br>拓展<br>Exp |                              |                            |          |          |          |          |          |          |          |
|                        |              |  |            |              |                     |             |                                 |               |                 |                              |                            |          |          |          |          |          |          |          |
|                        | 20626100     | 地球物理方法概论<br>Introduction of Geophysical Method                           | 2          | 32           | 32                  |             |                                 |               |                 |                              |                            |          |          |          |          |          | 2        |          |
|                        | 22304600     | 地球物理仪器<br>Geophysical Instrument   | 2          | 32           | 20                  | 12          |                                 |               |                 |                              |                            |          |          |          |          |          |          | 2        |
|                        | 22312600     | 测控软件设计基础<br>Introduction to Measuring and Controlling Software Design    | 2          | 32           | 32                  |             |                                 | 16            |                 |                              |                            |          |          |          |          |          |          | 2        |
|                        | 22310500     | 电力电子技术<br>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<br>Fundamentals of Artificial Intelligence                        | 2          | 32           | 28                  | 4           | 4                               |               |                 |                              |                            |          |          |          |          |          |          | 2        |
|                        | 22310800     | 数字图像处理<br>Digital Image Processing                                       | 2          | 32           | 24                  | 8           |                                 |               |                 | 数字信号处理                       |                            |          |          |          |          |          |          | 2        |
|                        | 22303800     | 测控系统设计与应用<br>Design & Application of Measurement and Control System      | 2          | 32           | 32                  |             |                                 |               |                 | 模拟电子技术、数字电子技术                |                            |          |          |          |          |          |          | 2        |
|                        | 22312900     | 计算机控制技术<br>Computer Control Technology                                   | 1.5        | 24           | 24                  |             |                                 | 16            |                 | 微机原理与接口技术                    |                            |          |          |          |          |          |          | 1.5      |
|                        | 22311000     | 模式识别与机器学习<br>Pattern Recognition and Machine Learning                    | 2          | 32           | 28                  | 4           |                                 |               |                 | 人工智能基础                       |                            |          |          |          |          |          |          | 2        |
|                        | 22310900     | 物联网技术<br>Networking Technology   | 1.5        | 24           | 16                  | 8           |                                 |               |                 | 单片机技术及应用                     |                            |          |          |          |          |          |          | 1.5      |
|                        | 22311410     | 创新创业类课程(不多于1门)<br>创新工程实践 I(智能车方向)<br>Innovative Engineering Practice I   | 1          | 16           | 4                   | 12          | 16                              |               |                 |                              |                            |          |          |          |          |          |          | 1        |
|                        | 22311420     | 创新创业类课程(不多于1门)<br>创新工程实践 II(机器人方向)<br>Innovative Engineering Practice II | 1          | 16           | 4                   | 12          | 16                              |               |                 |                              |                            |          |          |          |          |          |          | 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

测控技术与仪器专业

|                            | 通识教育课程<br>Liberal Education Courses |                     | 大类平台课+<br>学科基础课<br>Platform &<br>Disciplinary<br>Fundamental<br>Courses | 专业主干课<br>Main<br>Specialty<br>Courses | 专业选修课<br>Specialty<br>Elective<br>Courses | 实践环节<br>Practical<br>Work | 创新创业自<br>主学习<br>Freedom<br>Study | 学时总计<br>Total<br>Hours | 学分总计<br>Total<br>Credits |
|----------------------------|-------------------------------------|---------------------|---|---------------------------------------|---|---------------------------|----------------------------------|------------------------|--------------------------|
|                            | 必修<br>Comp-<br>lsory                | 选修<br>Elec-<br>tive |   |                                       |   |                           |                                  |                        |                          |
| 学时/学分<br>Hours/Credits     | 548/29                              | 192/12              | 808/48.5  | 432/27                                | 272/17                                    | 33.5 周<br>/33.5           | 5                                | 2252<br>+33.5 周        | 172                      |
| 学分所占比例<br>Ratio of Credits | 23.8%                               |                     | 28.2%   | 15.7%                                 | 9.9%                                      | 19.5%                     | 2.9%                             | 100%                   | 100%                     |

注：实践环节占比计算未包含创新创业学分、选修课实验、课外实验学时。

## 《学校与企事业单位联合培养阶段实施方案》

### 培养目标：

本专业在联合培养阶段着重培养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，具有较强的创新意识和工程实践能力，拥有良好的交流、沟通和组织管理能力，能够在智能地学仪器与装备、测量控制与仪器等领域从事技术开发、设计制造和生产管理等方面工作的复合型工程技术人才。

### 培训重点：

#### 专业设计与应用

1. C 语言程序设计能力
2. 电路图和 PCB 设计能力
3. 温度、湿度、光强、红外等常用传感器的应用技术
4. 电子元件焊接及电路板装配技术
5. 微控制器接口技术
6. 基于蓝牙模块的串口通信技术
7. 基于 Zigbee 的无线组网技术
8. 嵌入式仪器设计与集成

#### 生产与运营管理

1. 用户需求分析能力
2. 项目管理能力
3. 产品质量管理能力
4. 成本管理能力
5. 现场生产指导能力

### 培训阶段：

1. 大二阶段进行认知实习。主要进入企业参观，了解企业结构，并参与企业实际项目，提升眼界。了解测控技术与仪器领域就业、工作状况等内容。

2. 大三阶段进行项目协同开发实践。主要进行专业训练、大赛竞技训练，通过学校和企业构建的校企合作平台，在学校导师和企业导师的指导下，完成具体产品或项目的开发，同时，也可以了解测控技术与仪器行业的产业发展深度、供应链环节、市场结构配置等内容。

3. 大四阶段进行生产实习。主要进入企业参观和实习。学生参观电路设计部门、元件装配部门、测试部门、整机装配部门等。之后，学生再展开实习工作，进行产业深度考察、实习训练、项目训练等内容，企业对学生进行就业指导和训练，便于学生就业。

课程及学分设置：

| 课程名称     | 学分  | 课内总学时 | 内容 |   |
|----------|-----|-------|----|---|
|          |     |       | 序次 | 教学基本内容、重点、难点  |
| 认知实习     | 1.5 | 1.5 周 | 1  | 布置课程设计任务书<br>进入实习企业参观，了解企业结构，(0.3 周)<br>重点：认真做好参观感想，记录参观内容和过程。  |
|          |     |       | 2  | 参与企业实际项目 1 项 (1 周)<br>重点：了解企业项目开发流程。掌握项目的计划性和目的性。<br>难点：对项目实际操作做出贡献。  |
|          |     |       | 3  | 返校进行实习报告编写 (0.2 周)<br>进行项目内容的分享，汇报工作。<br>重点：对实习阶段的总结和归纳。  |
| 项目协同开发实践 | 2.5 | 2.5 周 | 1  | 启动：制定项目章程，企业征集课题，学生报名参与，导师甄选并组织学生参与项目开题报告。(0.2 周)<br>难点：吸引学生并调动学生的积极性。  |
|          |     |       | 2  | 规划：制定项目计划 (0.3 周)<br>重点：项目计划制定过程中必须严格把控时间，避免拖拉现象出现。小组划分时，每组的人数也必须严格把控，项目任务必须细化到个人，争取锻炼到每个学生。                          |
|          |     |       | 3  | 执行：指导项目工作，学校导师和企业导师进行线上实习互动。(0.5 周)   |
|          |     |       | 4  | 监督：监督项目工作，学校导师和企业导师进行中期方案评审。(1 周)<br>重点：对于项目的进展，导师需要认真进行评估，并给学生提出指导性的意见和建议。   |
|          |     |       | 5  | 收尾：项目评估和收尾，学校导师和企业导师同时进行方案评审。(0.5 周)<br>重点：评估过程中，需要认真审查学生的项目产品，从所呈现的 PPT 中细分需求、调研、电路图设计、PCB 设计、实际生产产品，对学生的工作进行客观性的评价。 |
|          |     |       | 6  | 企业和学校老师进行本次合作以及后续合作的交流与洽谈。  |
| 生产实习     | 4   | 4 周   | 参观 | 参观电路设计部门、元件装配部门、测试部门、整机装配部门等 (0.5 周)  |
|          |     |       | 实习 | 选择生产企业、设计公司展开实习工作，企业对学生进行就业指导 and 训练，便于学生就业。(3.5 周)   |

## 考核标准及成绩评定:

| 作业评价细则及得分  |  |  |  |  |
|--|--|--|--|--|
| 100~90   | 89~80  | 79~70  | 69~60  | 59~0   |
| 按时交作业;前期调研条理清楚,设计方案合理;电路图设计正确、美观;PCB板布局合理、设计正确;最终产品完整实现初期目标;PPT版式合理,格式规范等。 | 按时交作业;前期调研、设计方案较合理;电路图设计正确;PCB板布局比较合理、设计正确;最终产品基本实现初期目标;PPT版式比较合理,格式比较规范等。 | 按时交作业;前期调研、设计方案基本合理;电路图设计正确;PCB板设计正确;最终产品实现初期目标;PPT版式比较合理,格式基本规范等。 | 短时迟交作业;前期调研、设计方案基本合理;电路图设计正确;最终产品基本实现初期目标;PPT版式基本合理,格式基本规范等。 | 不交或严重超时迟交作业;前期调研、设计方案不太合理;电路图设计存在错误;最终产品达不到初期目标;PPT版式不合理,基本格式不规范等。 |

## 工作、生活及安全保障管理:

## 1、后勤工作安排

考虑到学生集体外出实习,后勤工作最为重要的就在于必备物资的准备,必要物资清单如下:

| 项目   | 必备物品   |
|------|--|
| 医药用品 | 晕车药、四季感冒片、止痛药、消毒水、盐酸小檗碱片(止泻)安瑞克(发烧)、补中益气丸(防中暑)、牛黄解毒丸(防虫,防上火)、藿香正气水、红花油、葡萄糖、创口贴、棉棒、纱布、花露水 |
| 日常用品 | 换洗衣物、鞋袜、洗簌用品、洗衣液、钱包、银行卡等   |
|      | 毛巾、水杯、卫生纸、伞等   |
|      | 手机、电脑、相机、充电器等  |
|      | 面包、巧克力、压缩饼干、饮用水等   |
| 活动物品 | 宣传手册、队旗、队服等  |
| 必备证件 | 身份证、学生证、学校证明、车票等   |
| 其他   | 地图、指南针、旅行日程表、手电筒等  |

## 2、学生管理制度

## 《学生纪律守则》

1) 指导老师应对活动全权负责,遇到意外事故应及时采取措施,保证学生实习的顺利进行。

2) 各学生必须遵照指导老师的安排,认真按计划完成各项工作,不得擅自行动,如果需要离开,应及时向指导老师报告。

3) 学生实习时,应衣着得体,举止文明,谦虚有礼,自觉维护中国地质大学(武汉)的声誉和形象,保持大学生应有的素质和健康的精神风貌,谦虚谨慎,不耻下问。

4) 每位学生注意自身安全,不得擅自离开。在实习过程或日常生活应提高警惕,保

管好自己的财务，注意个人饮食卫生和交通安全。

5) 各项事务应由集体讨论决定，实行少数服从多数的民主集中制原则，学生要服从指导老师的安排。

《安全性原则》

- 1) 学生在出发前应有一定的心理准备，学生必须明确实习期间的艰苦。
- 2) 学生在实习过程中的每一天的生活起居必须由自己独立完成。
- 3) 如果有不适应当地生活条件，应当尽快自我调节，以免给身体造成不必要的伤害。
- 4) 在身体不适的情况下应及时向指导老师反映，不能隐瞒病情。
- 5) 牢记紧急电话：如当地的医院，公安局，政府和支持单位的电话号码和其它紧急号码（报警：110；急救：120；火警：119）。



测控技术与仪器专业辅修课程教学计划表

Course Descriptions of Measuring &amp; Control Technology and Instrumentation (Minor)

| 课程类别<br>Classification                    | 课程编号<br>Code | 课程名称<br>Course Name                                       | 学分<br>Crs | 课内总学时<br>Hrs | 学时分类<br>Class Hours |             |                                |           |                 | 先修课程<br>Prerequisite courses | 学期学分分配<br>Semester Credits |          |          |          |          |          |          |          |
|---|--------------|---|-----------|--------------|---------------------|-------------|--------------------------------|-----------|-----------------|------------------------------|----------------------------|----------|----------|----------|----------|----------|----------|----------|
|   |              |   |           |              | 课内学时                |             | 课外学时                           |           |                 |                              | 一<br>1st                   | 二<br>2nd | 三<br>3rd | 四<br>4th | 五<br>5th | 六<br>6th | 七<br>7th | 八<br>8th |
|   |              |   |           |              | 讲课<br>Lec.          | 课内实验<br>Lab | 实验/<br>科研<br>实践<br>Lab/R<br>es | 研讨<br>Dis | 素质<br>拓展<br>Exp |                              |                            |          |          |          |          |          |          |          |
| 学科基础课<br>Disciplinary Fundamental Courses | 22308100     | 模拟电子技术<br>Analog Electronics                              | 3         | 48           | 40                  | 8           | 8                              | 4         |                 |                              |                            | 3        |          |          |          |          |          |          |
|   | 22308200     | 数字电子技术<br>Digital Electronics                             | 2.5       | 40           | 32                  | 8           | 4                              | 4         |                 |                              |                            | 2.5      |          |          |          |          |          |          |
|   | 22309800     | 传感器原理及检测技术<br>Sensors Principle and Detection Technology  | 3         | 48           | 48                  |             |                                | 16        |                 |                              |                            |          |          | 3        |          |          |          |          |
|   | 小计<br>Sum    |   | 8.5       | 136          | 120                 | 16          | 28                             | 8         |                 |                              |                            | 5.5      | 3        |          |          |          |          |          |
| 专业主干课<br>Main Specialty Courses           | 22311200     | 单片机技术及应用<br>Technology and Application of Microcontroller | 2         | 32           | 32                  |             |                                | 16        |                 |                              |                            |          |          | 2        |          |          |          |          |
|   | 22311500     | 计量误差理论*<br>Metrology Error Theory                         | 1.5       | 24           | 24                  |             |                                | 8         |                 |                              |                            |          | 1.5      |          |          |          |          |          |
|   | 22312300     | 数字信号处理<br>Digital Signal Processing                       | 2         | 32           | 32                  |             |                                | 16        |                 |                              |                            |          |          |          | 2        |          |          |          |
|   | 20703100     | 电子测量原理<br>Principles of Electronic Measurement            | 3         | 48           | 40                  | 8           |                                |           |                 |                              |                            |          |          |          |          | 3        |          |          |
|   | 22312100     | 智能仪器仪表设计基础<br>The Basis of Intelligent Instrument Design  | 2         | 32           | 32                  |             |                                | 8         |                 |                              |                            |          |          |          |          |          | 2        |          |
|   | 小计<br>Sum    |   | 10.5      | 168          | 160                 | 8           | 48                             |           |                 |                              |                            |          | 3.5      | 5        | 2        |          |          |          |
| 实践环节<br>Practical Work                    | 42312700     | 检测技术实习<br>Detection Technology Training                   | 4         | 4周           |                     |             |                                |           |                 |                              |                            |          |          |          |          |          | 4        |          |
|   | 小计<br>Sum    |   | 4         | 4周           |                     |             |                                |           |                 |                              |                            |          |          |          |          |          | 4        |          |
| 总计<br>Total                               |              |   | 23        | 304+4周       | 280                 | 24          | 76                             | 8         |                 |                              |                            | 5.5      | 3.5      | 8        | 6        |          |          |          |

测控技术与仪器辅修专业课程分类统计

| 课程类别<br>统计 | 学科基础课<br>Disciplinary Fundamental Courses | 专业主干课<br>Main Specialty Courses | 实践环节<br>Practical Work | 学时总计<br>Total Hours | 学分总计<br>Total Credits |
|------------|---|---------------------------------|------------------------|---------------------|-----------------------|
| 学时/学分      | 136/8.5                                   | 168/10.5                        | 4周/4                   | 304+4周              | 23                    |

测控技术与仪器专业

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|        |       |       |       |  |      |
|--------|-------|-------|-------|--|------|
| 学分所占比例 | 37.0% | 45.6% | 17.4% |  | 100% |
|--------|-------|-------|-------|--|------|