

遥感科学与技术专业培养方案

专业名称与代码：遥感科学与技术 (081202)

专业培养目标：

面向我国社会主义现代化建设和发展需要，特别是遥感信息应用专业服务的产业发展需要，培养综合素质优、社会责任感佳、团队合作意识好、学习能力强，掌握坚实的数理、遥感、测绘、地理信息科学专业理论和较强的实践能力，并能将相关理论、方法与技术有效运用于解决遥感领域复杂工程问题的专业高级技术人才。培养目标分解如下：

- 1) 具有求真务实、创新进取精神及高尚职业道德和社会责任感【目标1】；
- 2) 具有扎实的数理、遥感科学专业相关基础以及较强的计算机能力【目标2】；
- 3) 能够独立或负责完成遥感领域相关科研项目的问题发现、路线设计、方法研究等工作并取得一定的创新性成果【目标3】；
- 4) 能够独立或负责完成遥感相关工程项目的设计、实施、组织和管理等专门技术工作【目标4】；
- 5) 能把握和适应遥感科学与技术领域发展趋势，具有一定国际视野【目标5】；
- 6) 能通过自我学习不断进行知识更新，以适应社会与科技快速发展变化【目标6】。

专业毕业要求：

1. **工程知识：**具备扎实的数学、物理基础，掌握遥感科学、测绘科学、地理信息科学、计算机科学的理论、知识，并能综合应用于遥感领域的复杂工程问题。
 - 1.1. 熟练掌握数学、物理的基本概念、基本理论和基本技能；
 - 1.2. 掌握遥感科学、测绘科学、地理信息科学、计算机科学的基础理论和专业知识，并能运用所学专业知识对工程问题进行建模并求解；
 - 1.3. 能综合应用数学、遥感科学、测绘科学、地理信息科学、计算机科学知识用于推演、分析遥感专业工程问题；
 - 1.4. 能够针对遥感工程复杂问题的不同解决方案，综合运用遥感专业知识和数学模型进行分析比较，并优化解决方案。
2. **问题分析：**具备发现遥感领域复杂工程问题的能力，能综合运用数学、物理以及遥感专业知识进行分析并得到有效结论。
 - 2.1. 能运用数学、自然科学、工程科学等基本原理识别和分析复杂遥感科学与技术中的影响因素和关键技术问题；
 - 2.2. 能够用数学和遥感科学的专业知识对复杂工程问题进行表述、剖析和验证；
 - 2.3. 能通过文献检索与分析的方法，寻求复杂遥感科学与技术问题解决的多种解决方案；
 - 2.4. 针对复杂遥感工程问题，能够基于遥感专业的基本原理，查阅文献，分析影响因素，从而获得合理有效结论。
3. **设计与开发：**系统掌握遥感科学与技术的专业技能，并能综合考虑经济、环境、法律、安全、健康、伦理等因素，对遥感领域的复杂工程问题能给出合理的解决方案

与流程。

- 3.1. 能够依据专业知识分析遥感领域的工程问题及影响因素，并设计满足需求的全周期、全流程解决方案；
- 3.2. 能够合理有效的管理遥感实验数据，设计有效的算法、数据处理模块，并能够就设计的算法和软件模块进行评价优化；
- 3.3. 针对遥感工程应用领域复杂工程问题，在设计/开发满足特定需求的解决方案过程中，具有追求创新的态度和意识；
- 3.4. 在解决方案设计选择过程中，能综合考虑经济、环境、法律、安全、健康、伦理等因素，并对解决方案进行优化调整。
- 4. 科学研究：**能够基于科学原理并采用科学方法对遥感应用工程问题进行研究，包括数据采集、处理、分析与建模，并通过信息综合研究得到合理有效的结论。
 - 4.1. 能够综合运用科学原理及遥感专业知识，研究空间信息获取和分析过程中出现的问题和现象；
 - 4.2. 能够结合遥感应用工程项目选择研究路线，进行实验设计，确定所需数据及其有效获取方法，并能进行处理与分析；
 - 4.3. 针对复杂遥感应用工程涉及的建模、预测、优化等问题，能开展实验，并正确的获取实验数据；
 - 4.4. 能够综合各类实验数据信息对复杂遥感工程问题进行分析研究，最终得出合理有效的结论。
- 5. 使用现代工具：**能够科学合理地将当代遥感测绘新仪器、信息技术和相关学科的新技术综合运用于复杂遥感工程问题，掌握新仪器、新技术的使用方法，并能够理解其局限性。
 - 5.1. 掌握常用的测绘遥感新仪器、设备及软件等现代工程工具的基本原理和使用方法；
 - 5.2. 掌握计算机、网络技术、信息检索等与遥感工程领域相关的信息技术工具，具备遥感软件研究、设计与开发的基本技能；
 - 5.3. 能够恰当地选择和使用现代工具，实现复杂遥感工程相关问题的管理、预测和模拟，并能够理解其局限性。
- 6. 工程与社会：**能够针对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进行合理的分析与评价，并理解应承担的责任。
 - 6.1. 熟悉遥感科学与技术专业的技术标准、知识产权和法律法规，理解不同文化对工程问题的影响；
 - 6.2. 基于工程相关背景知识，能够分析遥感工程技术方案对社会、健康、安全、法律及文化的影响并综合评价其合理性；
 - 6.3. 能够理解社会、健康、安全、法律及文化对遥感工程技术方案的影响，并理解应承担的责任。
- 7. 环境和可持续发展：**能够综合运用遥感科学、工程管理等领域知识，研究全球环境变化、社会可持续发展等问题，并理解这些工程活动与环境和可持续发展的关系。

- 7.1. 了解遥感技术在国民经济建设中的作用,熟悉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;
- 7.2. 具备合理分析与评价遥感工程实践对环境、社会可持续发展影响的能力,并用于优化遥感工程应用解决方案。
8. **职业规范:** 了解中国国情,树立正确的价值观,具有人文社会科学素养、社会责任感,理解并履行工程师的社会责任,在工程实践中具有法律法规意识、理解并遵守工程职业道德和规范,诚实公正、诚信守则。
 - 8.1. 能够树立正确的世界观、人生观、价值观,了解中国国情,具有良好的人文社会科学素养和社会责任感;
 - 8.2. 理解遥感工作维护国家利益的重要作用,培养社会责任感和职业荣誉感;
 - 8.3. 理解遥感专业技术人员的基本职业道德含义及法律法规要求,在工程实践中能遵守并履行责任,诚实公正、诚信守则。
9. **个人和团队:** 具有较强的团队合作能力,在多学科背景的团队中能够有效沟通、组织和协调团队开展工作,可以合作或独立工作。
 - 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,理解在复杂遥感工程实践中团结协作的重要性;
 - 9.2. 在多学科背景团队中,具有团队合作意识,能够组织、协作并指挥开展团队工作;
 - 9.3. 在团队工作中,能够承担个体、团队成员以及负责人的角色。
10. **沟通:** 能够就遥感工程问题与业界同行及社会公众进行有效沟通、交流和协作,包括撰写报告和设计文稿、陈述发言、清晰表达,并具备一定的国际视野,理解世界不同文化的差异性和多样性,能够在跨文化背景下进行沟通和交流。
 - 10.1. 具备科技文档的写作能力和科技演讲的基本技能,能够就遥感研究与工程实践中出现的问题做出书面和口头的清晰表达;
 - 10.2. 了解遥感及其相关行业工程问题,并能与业界同行及社会公众进行有效沟通、交流与协作;
 - 10.3. 掌握一门外语,具备一定的国际视野,能够就复杂遥感工程问题在跨文化背景下进行沟通和交流。
11. **项目管理:** 具备一定的工程管理和经济决策方面的基本知识,并能够在专业工程实践中灵活运用。
 - 11.1. 掌握工程管理基本原理与经济决策方法。
 - 11.2. 能够在遥感工程设计、运行及管理中灵活运用工程管理原理与经济决策方法,并能选择恰当的解决方案。
 - 11.3. 在复杂遥感工程问题中,具备对工程全周期进行需求管理、成本管理、进度管理、风险管理、配置管理、质量管理等的初步能力。
12. **终生学习:** 具有自主学习的能力和终身学习的意识,能够持续跟踪国内外本行业科学技术的发展动态,自主学习新理论、新技术和新方法。
 - 12.1. 能够认识到遥感行业发展所面临的新挑战,理解自主学习和终身学习的重要性,

具有自主学习和终身学习的意识；

12.2. 具有自主学习的能力，能够持续跟踪国内外遥感科学与技术的发展动态，自主学习新理论、新技术和新方法。

遥感科学与技术专业毕业要求对培养目标的支撑关系矩阵

毕业要求	培养目标					
	目标 1	目标 2	目标 3	目标 4	目标 5	目标 6
1. 工程知识		√	√			
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. 工程与社会	√		√	√		
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						√

毕业要求实现及途径：

序号	毕业要求	实现途径（教学过程）	
1	具备扎实的数学、物理基础，掌握遥感科学、测绘科学、地理信息科学、计算机科学的理论、知识，并能综合应用于遥感领域的复杂工程问题	① 课堂教学	高等数学 A、线性代数 A、大学物理 C、物理实验 B、概率论与数理统计 A、计算科学基础、测绘学概论、遥感原理与应用、地理信息系统原理、计算机高级语言程序设计(C++)、数据结构、数字图像处理、遥感应用模型、时空数据库、微波遥感、摄影测量学、遥感图像解译、模式识别、地理空间数据可视化原理、航空与航天数据获取、误差理论与测量平差基础 B
		② 课外学习	参加托福、雅思、GRE、CET4、CET6、全国计算机等级考试、计算机软件资格、水平考试等相关认证考级。
2	具备发现遥感领域复杂工程问题的能力，能综合运用数学、物理以及遥感专业知识进行分析并得到有效	① 课堂教学	遥感原理与应用、时空数据库、误差理论与测量平差基础 B、遥感图像解译、微波遥感、航空与航天数据获取、数字图像处理、遥感应用模型、摄影测量学、地理空间数据可视化原理、数字地形测量学、GNSS 原理及其应用 B、大地

	结论		测量学基础、自然灾害遥感、时空数据库课程实习、数字地形测量教学实习、摄影测量学实习、数字图像处理课程实习、遥感应用综合实习、毕业设计(论文)
3	系统掌握遥感科学与技术的专业技能,并能综合考虑经济、环境、法律、安全、健康、伦理等因素,对遥感领域的复杂工程问题能给出合理的解决方案与流程	① 课堂教学	马克思主义基本原理、毛泽东思想与中国特色社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、跨学科选修课、时空数据库、数字地形测量学、遥感原理与应用、航空与航天数据获取、遥感图像解译、数字图像处理、遥感应用模型、地理空间数据可视化原理、生态学概论、测绘法律法规与项目管理、自然灾害遥感、误差理论与测量平差基础 B
4	能够基于科学原理并采用科学方法对遥感应用工程问题进行研究,包括数据采集、处理、分析与建模,并通过信息综合研究得到合理有效的结论	① 课堂教学	创新创业选修课、遥感原理与应用、微波遥感、航空与航天数据获取、误差理论与测量平差基础 B、遥感图像解译、数字图像处理、遥感应用模型、空间统计与分析、激光雷达技术、计算机视觉与机器学习、遥感应用综合实习、其他(学科竞赛、发明创造、科研报告)
		② 课外学习	参加各级创新创业训练项目、艺术类、体育类竞赛。
5	能够科学合理地将当代遥感测绘新仪器、信息技术和相关学科的新技术综合运用用于复杂遥感工程问题,掌握新仪器、新技术的使用方法,并能够理解其局限性	① 课堂教学	计算机高级语言程序设计(C++)、遥感原理与应用、地理信息系统原理、数据结构、模式识别、遥感图像解译、数字图像处理、遥感应用模型、测绘法律法规与项目管理、误差理论与测量平差基础 B、摄影测量学、地理空间数据可视化原理、激光雷达技术、计算机视觉与机器学习、Python 与大数据可视化、遥感前沿知识讲座、创新创业选修课、计算机高级语言课程设计(C++)、数据结构课程设计 A、遥感图像处理综合实习、遥感应用综合实习
6	能够针对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进行合理的分析与评价,并理解应承担的责任	① 课堂教学	马克思主义基本原理、毛泽东思想与中国特色社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、生态学概论、创新创业选修课、跨学科选修课、测绘法律法规与项目管理
7	能够综合运用遥感科	① 课堂	马克思主义基本原理、毛泽东思想与中国特色

	学、工程管理等领域知识,研究全球环境变化、社会可持续发展等问题,并理解这些工程活动与环境和可持续发展的关系	教学	社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、地球科学概论、生态学概论、跨学科选修课、社会调查、其他(学科竞赛、发明创造、科研报告)
		② 课外学习	各级创新创业训练项目、社会实践活动、英语、计算机、普通话考试、学科或创业竞赛、本学科专业领域的论文发表、PCT 国际专利、国家发明专利以及各类知识产权申请、科学研究活动或创业实践活动、科技成果转化、参加创业培训、以及自主创业。
8	了解中国国情,树立正确的价值观,具有人文社会科学素养、社会责任感,理解并履行工程师的社会责任,在工程实践中具有法律法规意识、理解并遵守工程职业道德和规范,诚实公正、诚信守则	① 课堂教学	马克思主义基本原理、毛泽东思想与中国特色社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、体育、大学英语(ABC)、军事理论、创新创业选修课、跨学科选修课、遥感原理与应用、测绘学概论、军事训练、社会调查、其他(学科竞赛、发明创造、科研报告)
		② 课外学习	各级创新创业训练项目、社会实践活动、参加各类英语竞赛、学科或创业竞赛、发表本学科专业领域的论文发表、各类知识产权申请、科学研究活动或创业实践活动、以及自主创业。
9	具有较强的团队合作能力,在多学科背景的团队中能够有效沟通、组织和协调团队开展工作,可以合作或独立工作	① 课堂教学	马克思主义基本原理、毛泽东思想与中国特色社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、体育、军事理论、创新创业选修课、遥感图像处理综合实习、遥感应用综合实习、社会调查、其他(学科竞赛、发明创造、科研报告)
		② 课外学习	各级创新创业训练项目、社会实践活动、英语、计算机、普通话考试、各类竞赛、本学科专业领域的论文发表、宣读或者艺术作品的发表、PCT 国际专利、国家发明专利以及各类知识产权申请、科学研究活动或创业实践活动、科技成果转化、创业培训、以及自主创业。
10	能够就遥感工程问题与业界同行及社会公众进行有效沟通、交流和协作,包括撰写报告和设计文稿、陈	① 课堂教学	遥感原理与应用、航空与航天数据获取、遥感图像解译、数字图像处理、遥感应用模型、遥感应用综合实习、社会调查、其他(学科竞赛、发明创造、科研报告)、微波遥感、计算机视觉与机器学习、文献检索与科技写作、遥感前沿

	述发言、清晰表达，并具备一定的国际视野，理解世界不同文化的差异性和多样性，能够在跨文化背景下进行沟通和交流		知识讲座
		② 课外学习	各级创新创业训练项目、社会实践活动、英语、计算机、普通话考试、本学科专业领域的论文发表、宣读或者艺术作品的发表、PCT 国际专利、国家发明专利以及各类 知识产权申请、科学研究活动或创业实践活动、科技成果转化、以及自主创业。
11	具备一定的工程管理和经济决策方面的基本知识，并能够在专业工程实践中灵活运用	① 课堂教学	马克思主义基本原理、毛泽东思想与中国特色社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、跨学科选修课、测绘法律法规与项目管理、遥感应用综合实习、社会调查、误差理论与测量平差基础 B
		② 课外学习	各级创新创业训练项目、社会实践活动、英语、计算机、普通话考试、本学科专业领域的论文发表、宣读或者艺术作品的发表、PCT 国际专利、国家发明专利以及各类 知识产权申请、科学研究活动或创业实践活动、科技成果转化、以及自主创业。
12	具有自主学习的能力和终身学习的意识，能够持续跟踪国内外本行业科学技术的发展动态，自主学习新理论、新技术和新方法	① 课堂教学	马克思主义基本原理、毛泽东思想与中国特色社会主义理论体系概论、中国近现代史纲要、思想道德修养与法律基础、体育、大学英语(ABC)、计算机高级语言程序设计(C++)、地理信息系统原理、数据结构、地理空间数据可视化原理、毕业设计(论文)、社会调查、其他(学科竞赛、发明创造、科研报告)、遥感前沿知识讲座
		② 课外学习	各级创新创业训练项目、社会实践活动、英语、计算机、普通话考试、本学科专业领域的论文发表、宣读或者艺术作品的发表、PCT 国际专利、国家发明专利以及各类 知识产权申请、科学研究活动或创业实践活动、科技成果转化、以及自主创业。

主干学科：测绘科学与技术；计算机科学与技术；地理学。

专业核心课程：测绘学概论、计算机高级语言程序设计(C++)、数据结构、数字地形测量学、遥感原理与应用、地理信息系统原理、模式识别、时空数据库、航空与航天数据获取、遥感图像解译、数字图像处理、遥感应用模型、测绘法律法规与项目管理、误差理论与测量平差基础 B、GNSS 原理及其应用 B、摄影测量学、地理空间数据可视化

原理、大地测量学基础。

主要专业实验：大地测量学、数据结构课程设计 A、时空数据库、遥感图像解译、数字图像处理、GNSS 原理及其应用 B、测绘法律法规与项目管理。

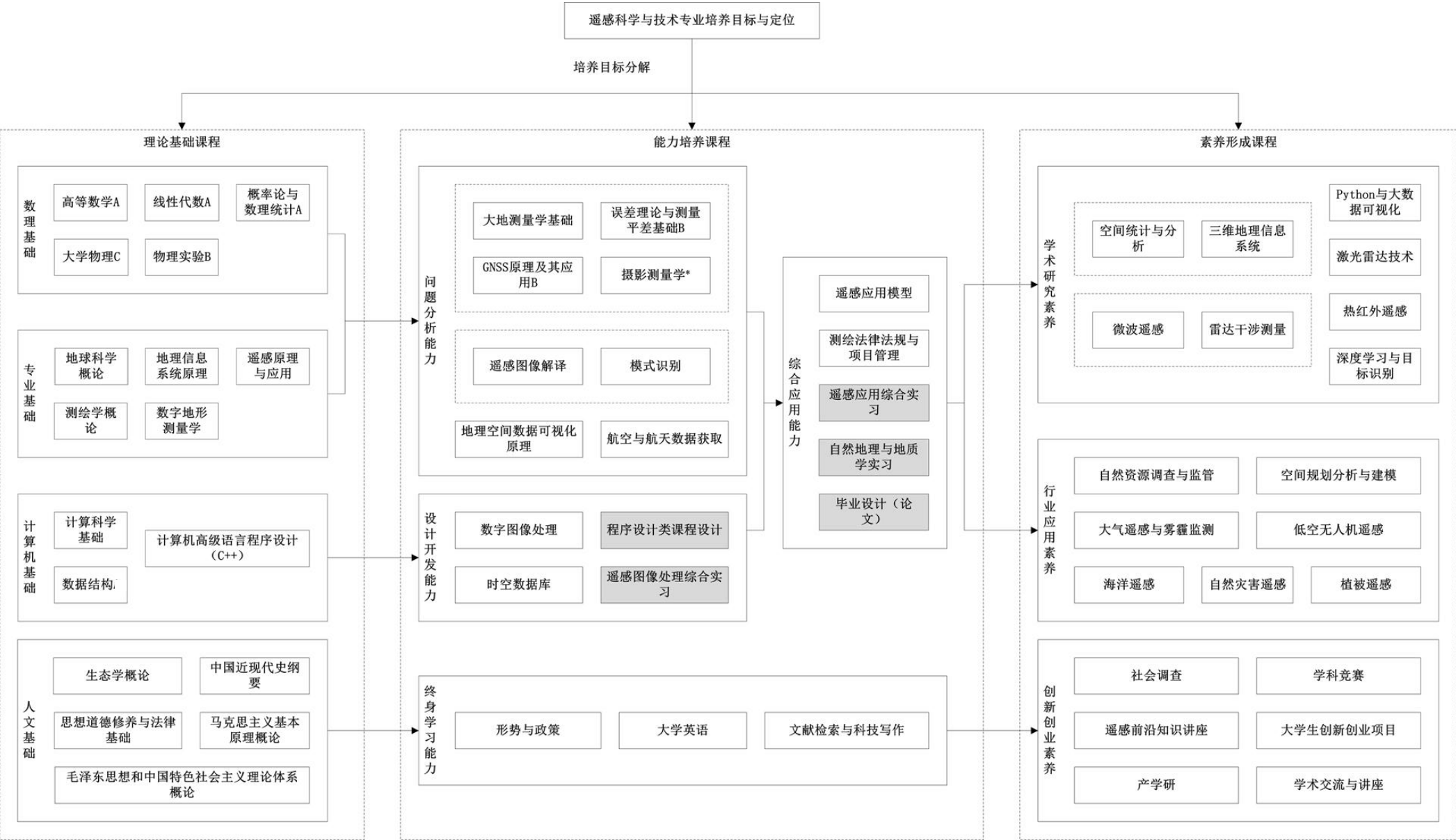
主要实践性教学环节：计算机高级语言课程设计(C++)、自然地理与地质学实习、数字地形测量教学实习、地理信息系统实习、数据结构课程设计、数字图像处理课程实习、摄影测量学实习、遥感应用综合实习、毕业设计（论文）。

毕业学分要求：171。

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：地理信息科学，计算机科学与技术。

相近专业：测绘工程、地理空间信息工程



Program for Remote Sensing Science and Technology

Specialty and Code: Remote Sensing Science and Technology (081202)

Education Objective:

The objective of this training program is to meet the requirements of the construction and development of socialist modernization, especially the requirements of industry development in the specialized services of the application of remote sensing information. The program aims at cultivating senior professional and technical personnel who have excellent comprehensive quality, great sense of social responsibility, strong teamwork spirit and learning ability, and also have solid foundation and strong practical ability in mathematics, physics, remote sensing, surveying and mapping, geographical information science, and also can effectively utilize certain theories, methods and technologies to solve complex engineering problems in the field of remote sensing. The graduates of this program are supposed to be engaged in work of remote sensing information processing and analysis, engineering design and development, project management and new technology development in fields of natural resources, geological and mineral exploration, emergency management, urban planning, national defense and so on. Alternatively, the graduates are also supposed to continue their education in scientific research institutes of related disciplines and fields. Those who graduated from this program for five years are supposed to become technical leaders or core members in their working departments, or technical leaders in teams of implementation or development of remote sensing engineering. At that time, according to the teaching goals, the graduates are supposed to meet the following requirements:

- 1) Have spirits of being realistic and practical as well as innovation and enterprising; have noble professional ethics and great sense of social responsibility [Goal 1];
- 2) Have solid foundation of mathematics, physics, remote sensing and other related areas, and also have strong computer skills [Goal 2];
- 3) By working independently or leading a team, can complete jobs including problem discovery, route design and method research in scientific research projects related with remote sensing, and can obtain certain innovative results [Goal 3];
- 4) By working independently or leading a team, can accomplish special technical works including the design, implementation, organization, management and so on in engineering projects related with remote sensing [Goal 4];
- 5) Be able to grasp and adapt to the development trend of remote sensing science and technology; have certain international perspective [Goal 5];
- 6) Can update their knowledge continuously by self-learning, adapting to the rapid development and changes in society, science and technology [Goal 6].

Graduation Requirements:

1. **Engineering Knowledge:** Have solid foundation of mathematics and physics; grasp the theories and knowledge of remote sensing science, surveying and mapping science, geographic information science and computer science; be able to apply the theories and knowledge to complex engineering problems in the field of remote sensing.
 - 1.1. Proficiency in the basic concepts, theories and skills of mathematics and physics;
 - 1.2. Master the basic theories and professional knowledge of remote sensing science, surveying and mapping science, geographic information science, computer science, and use the professional knowledge to model and solve engineering problems;

- 1.3. Comprehensively applying the knowledge of mathematics, remote sensing science, surveying and mapping science, geographic information science, and computer science to deduct and analyze remote sensing professional engineering problems;
- 1.4. It can comprehensively apply remote sensing expertise and mathematical models to analyze and compare different solutions for remote sensing engineering complex problems and optimize solutions.
- 2. Problem Analysis:** Own the ability to discover complex engineering problems in the field of remote sensing; be able to properly apply mathematics, physics and remote sensing specialties to conduct analysis and draw effective conclusions.
 - 2.1. Be able to identify and analyze influencing factors and key technical issues in complex remote sensing science and technology by using the basic principles of mathematics, natural sciences, and engineering science;
 - 2.2. Ability to express, dissect and validate complex engineering problems with the expertise of mathematics and remote sensing;
 - 2.3. To find a variety of solutions for complex remote sensing scientific and technical problem solving through the methods of literature retrieval and analysis;
 - 2.4. For complex remote sensing engineering problems, it can be obtained reasonable and effective conclusions by consulting literature and analyzing influencing factors based on the basic principles of remote sensing.
- 3. Design and Development:** Systematically master the professional skills of remote sensing science and technology; be able to provide reasonable solutions and procedures for complex engineering problems in remote sensing field after making systematic consideration over economy, environment, law, safety, health, ethics and other factors.
 - 3.1. Be able to analyze engineering problems and influencing factors in remote sensing field based on professional knowledge, and design full cycle and whole process solutions to meet requirements;
 - 3.2. Can reasonably and effectively manage remote sensing experimental data, design effective algorithm, data processing module, and can evaluate and optimize the designed algorithm and software module;
 - 3.3. Aiming at the complex engineering problems in the field of remote sensing application, in the process of designing / developing solutions to meet the specific needs, it has the attitude and consciousness of pursuing innovation;
 - 3.4. In the solution design selection process, can consider the economy, the environment, the law, the safety, the health, the ethics and so on factor synthetically, and carries on the optimization adjustment to the solution.
- 4. Scientific Research:** Be able to conduct research for engineering problems of remote sensing applications by following scientific principles and using scientific methods, the specific requirements include data acquisition, processing, analysis and modeling as well as drawing valid conclusions after making comprehensive study over the collected information.
 - 4.1. Can use the scientific principle and the remote sensing specialized knowledge synthetically to research the question and the phenomenon about spatial information acquisition and the analysis process;
 - 4.2. Be able to select the research route by combining the remote sensing application engineering project, and to design the experiment, determine the needed data and its effective acquisition method, and then process and analyze these data;

- 4.3. Aiming at the problems of modeling, prediction and optimization involved in the complex remote sensing application engineering, be able to carry out the experiments and to collect the experimental data correctly.
- 4.4. Analyze and study the complex problems in remote sensing engineering by synthesizing all kinds of experimental data information, and finally draw a reasonable and effective conclusion.
5. **Utility of Modern Tools:** Be able to comprehensively apply up-to-date instruments and information technologies as well as new technologies of other related disciplines to complicated remote sensing engineering problems; grasp the usages of the new instruments and technologies and also understand their limitations.
 - 5.1. Master the basic principles and use methods of new instruments, equipment, software and other modern engineering tools in surveying mapping and remote sensing;
 - 5.2. Master computer, network technology, information retrieval and other information technology tools related to remote sensing engineering; have the basic skills of research designing and development with the remote sensing software;
 - 5.3. Can select and use modern tools properly to manage, predict and simulate the problems related to complex remote sensing engineering, and can understand its limitations.
6. **Engineering and Society:** Be able to properly analyze and evaluate the impact of professional engineering practices and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities to be undertaken.
 - 6.1. Be familiar with the Remote Sensing Science and technology technical standards, intellectual property rights, laws and regulations, and understand the impact of different cultures on engineering issues;
 - 6.2. Be able to analyze the impact of remote sensing engineering technology on society, health, safety, law and culture and evaluate its rationality comprehensively based on engineering-related background knowledge,
 - 6.3. Be able to understand the impact of society, health, safety, law and culture on remote sensing engineering and technology program; understand the responsibilities to be undertaken.
7. **Environment and Sustainable Development:** Be able to comprehensively apply knowledge of remote sensing science, engineering management and other fields to study global environmental change, social sustainable development and other issues, and understand the relationship between these engineering activities and the environment and sustainable development.
 - 7.1. Understand the role of remote sensing technology in national economic construction, be familiar with relevant national environmental protection policies and regulations, and understand the importance of social sustainable development;
 - 7.2. Be capable of reasonably analyze and evaluate the impact of remote sensing engineering practice on the sustainable development of the environment and society, and to optimize remote sensing engineering application solutions.
8. **Professional Standards:** Understand the national conditions, establish right values; have humanistic quality, scientific literacy as well as sense of social responsibility, understand and fulfill the engineer's social responsibility; have sense of laws and regulations in engineering practices, understand and adhere to the professional ethics and rules of engineering, be honest and fair, have good faith and comply with the regulations.
 - 8.1. Establish a correct outlook on world, life and values, understand China's national conditions, and have a good sense of Humanities and Social Sciences and social responsibility;

- 8.2. Understand the important role of remote sensing in safeguarding national interests and foster a sense of social responsibility and professional honor;
- 8.3. Understand the basic professional ethics of remote sensing professionals and the requirements of laws and regulations, and abide by and fulfill the code of honesty, impartiality and integrity in engineering practice.
- 9. Individual and Group:** Have strong ability of teamwork; be able to conduct effective communication, organization and coordination in multi-disciplinary working teams; adapt to teamwork as well as independent work.
 - 9.1. Understand the composition of the team and the responsibilities of the members of different roles under the multidisciplinary background, and understand the importance of unity and cooperation in complex remote sensing engineering practice;
 - 9.2. Have the sense of teamwork and can organize, collaborate and direct team work in the multidisciplinary background team.
 - 9.3. Be able to assume the roles of individual, team member and leader in team work.
- 10. Communication:** Be able to communicate and cooperate with industry colleagues and the public on engineering issues of remote sensing, the specific requirements include writing reports, designing documents, making clear statements and oral presentations; have certain international perspective, understand the differentiation and diversity of the world cultures, be able to communicate and exchange ideas with others under cross-culture background.
 - 10.1. Own the ability to write scientific and technical documents and do the scientific and technical speech, be able to clearly express in writing and orally the problems in remote sensing research and engineering practice;
 - 10.2. Understand the engineering problems in remote sensing and related industry, be able to effectively communicate, exchange and cooperation with industry colleagues and the public;
 - 10.3. Master one kind of foreign language and have a certain international perspective, be able to communicate and exchange ideas concerning complicated remote sensing engineering problems with others under cross-culture background.
- 11. Project Management:** Have certain basic knowledge of engineering management and economic decision making, be able to make use of them flexibly in the professional practice of engineering.
 - 11.1. Master basic principles of engineering management and economic decision-making methods;
 - 11.2. Be able to flexibly apply engineering management principles and economic decision-making methods in remote sensing engineering design, operation and management, and can choose appropriate solutions;
 - 11.3. In complex remote sensing engineering problems, have the preliminary ability to conduct demand management, cost management, schedule management, risk management, configuration management, quality management and so on in the whole engineering cycle.
- 12. Lifelong learning:** Have self-learning ability and lifelong study consciousness; be able to keep track of the development trend, at home and abroad, of the science and technology in the industry, and independently study the new theories, techniques and methods.
 - 12.1. Be able to recognize the faced new challenges with the development of the remote sensing industry, understand the importance of independent learning and lifelong learning, and have the awareness of independent learning and lifelong learning;
 - 12.2. Have the ability of self-learning, be able to continuously track the development trends of remote sensing science and technology at home and abroad, and independently study new theories,

technologies, and methods.

The Correspondence between the Graduation Requirements and Training Goals of the Specialty of Remote Sensing Science and Technology.

Graduation Requirements	Training Goals					
	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Goal 6
1. Engineering Knowledge		√	√			
2. Problem Analysis		√	√			
3. Design and Development	√		√	√		
4. Scientific Research		√		√		
5. Utility of Modern Tools			√	√		
6. Engineering and Society	√		√	√		
7. Environment and Sustainable Development	√					
8. Professional Standards	√					
9. Individual and Group				√		
10. Communication					√	
11. Project Management				√	√	
12. Lifelong Learning						√

Graduation requirements and pathways:

No.	Graduation Requirements	pathways (Teaching Process)	
1	Have solid foundation of mathematics and physics; grasp the theories and knowledge of remote sensing science, surveying and mapping science, geographic information science and computer science; be able to apply the theories and knowledge to complex engineering problems in the field of remote sensing.	① Classroom teaching	Advanced Mathematics A, Linear Algebra A, College Physics C, Physics Experiments B, Probability and Statics A, Foundation for Computational Science, Introduction to Surveying and Mapping, Principles and Applications of Remote Sensing, Principles of Geographic Information Systems, Programming of Advanced Computer Language (C++), Data Structure, Digital Image Processing, Application Model of Remote Sensing, Spatio-temporal Database, Microwave Remote Sensing, Photogrammetry, Remote Sensing Image Interpretation, Pattern Recognition, Principle of Geographical Spatial Data Visualization, Aerial and Space Data Acquisition, Error Theory and Foundation of Surveying Adjustment
		② Extracurricular learning	Participate in TOEFL, IELTS, GRE, CET4, CET6, National Computer Level Test, Computer Software Qualification, Level Examination and Other Related Certification Grades.

No.	Graduation Requirements	pathways (Teaching Process)	
2	Own the ability to discover complex engineering problems in the field of remote sensing; be able to properly apply mathematics, physics and remote sensing specialties to conduct analysis and draw effective conclusions.	① Classroom teaching	Principles and Applications of Remote Sensing, Spatio-temporal Database, Error Theory and Foundation of Surveying Adjustment, Remote Sensing Image Interpretation, Microwave Remote Sensing, Aerial and Space Data Acquisition, Digital Image Processing, Application Model of Remote Sensing, Photogrammetry, Principle of Geographical Spatial Data Visualization, Digital Topographic Survey, GNSS Principles and Applications B, Foundation of Geodesy, Natural Hazard Remote Sensing, Practice of Spatio-temporal Database, Teaching Practice of Digital Topographic Survey, Practice of Photogrammetry, Practice of Digital Image Processing, Comprehensive Practice of Remote Sensing Application, Graduation Design (Thesis)
3	Systematically master the professional skills of remote sensing science and technology; be able to provide reasonable solutions and procedures for complex engineering problems in remote sensing field after making systematic consideration over economy, environment, law, safety, health, ethics and other factors.	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education and Fundamentals of Law, Interdisciplinary Elective Courses, Spatio-temporal Database, Digital Topographic Survey, Principles and Applications of Remote Sensing, Aerial and Space Data Acquisition, Remote Sensing Image Interpretation, Digital Image Processing, Application Model Of Remote Sensing, Principle of Geographical Spatial Data Visualization, Principle of Geographical Spatial Data Visualization, Introduction to Ecology, Laws, Regulations and Project Management of Surveying and Mapping, Natural Hazard Remote Sensing, Error Theory and Foundation of Surveying Adjustment B
4	Be able to conduct research for engineering problems of remote sensing applications by following scientific principles and using scientific methods, the specific requirements include data acquisition,	① Classroom teaching	Innovation and Entrepreneurship Elective Course, Principles and Applications of Remote Sensing, Microwave Remote Sensing, Aerial and Space Data Acquisition, Error Theory and Foundation of Surveying Adjustment B, Remote Sensing Image Interpretation, Digital Image Processing, Application Model of Remote Sensing, Spatial Statistical Analysis, Technique of Light Detection and Ranging, Computer Vision and Machine Learning, Radar Interferometry, Technique of Light Detection and Ranging, Comprehensive Practice of Remote Sensing Application, Others

No.	Graduation Requirements	pathways (Teaching Process)	
	processing, analysis and modeling as well as drawing valid conclusions after making comprehensive study over the collected information.		(Contest, Invention, Innovation and Research Presentation)
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs, arts and sports competitions at all levels.
5	Be able to comprehensively apply up-to-date instruments and information technologies as well as new technologies of other related disciplines to complicated remote sensing engineering problems; grasp the usages of the new instruments and technologies and also understand their limitations.	① Classroom teaching	Programming of Advanced Computer Language (C++), Principles and Applications of Remote Sensing, Principles of Geographic Information Systems, Data Structure, Pattern Recognition, Remote Sensing Image Interpretation, Digital Image Processing, Application Model of Remote Sensing, Laws, Regulations and Project Management of Surveying and Mapping, Error Theory and Foundation of Surveying Adjustment, Photogrammetry, Principle of Geographical Spatial Data Visualization, Technique of Light Detection and Ranging, Computer Vision and Machine Learning, Big Data Visualization with Python, Knowledge Lectures of the State-of-the-Art Remote Sensing, Innovation and Entrepreneurship Elective Course, Course Projects for Programming of Advanced Computer Language (C++), Course Projects of Data Structure A, Comprehensive Practice of Remote Sensing Image Processing, Comprehensive Practice of Remote Sensing Application
6	Be able to properly analyze and evaluate the impact of professional engineering practices and complex engineering problem solutions on society, health, safety, law and culture, and understand the responsibilities to be undertaken.	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education and Fundamentals of Law, Introduction to Ecology, Innovation and Entrepreneurship Elective Course, Interdisciplinary Elective Courses, Laws, Regulations and Project Management of Surveying and Mapping
7	Be able to comprehensively apply knowledge of remote	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education

No.	Graduation Requirements	pathways (Teaching Process)	
	sensing science, engineering management and other fields to study global environmental change, social sustainable development and other issues, and understand the relationship between these engineering activities and the environment and sustainable development.		and Fundamentals of Law, Introduction to Earth Sciences, Introduction to Ecology, Interdisciplinary Elective Courses, Social Investigation, Others (Contest, Invention, Innovation and Research Presentation)
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs at all levels, social practice activities, various English competitions, disciplines or entrepreneurship competitions, paper publication in the professional field of the discipline, PCT international patent, national invention patent and various intellectual property applications, scientific research activities or entrepreneurial practice activities, transformation of scientific and technological achievements, enterprise training and entrepreneurship
8	Understand the national conditions, establish right values; have humanistic quality, scientific literacy as well as sense of social responsibility, understand and fulfill the engineer's social responsibility; have sense of laws and regulations in engineering practices, understand and adhere to the professional ethics and rules of engineering, be honest and fair, have good faith and comply with the regulations.	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education and Fundamentals of Law, Physical Education, College English (ABC), Military Theory, Innovation and Entrepreneurship Elective Course, Interdisciplinary Elective Courses, Principles and Applications of Remote Sensing, Introduction to Surveying and Mapping, Military Training, Social Investigation, Others (Contest, Invention, Innovation and Research Presentation)
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs at all levels, social practice activities, various English competitions, disciplines or entrepreneurship competitions, paper publication in the professional field of the discipline, various intellectual property applications, scientific research activities or entrepreneurial practice activities, and entrepreneurship.

No.	Graduation Requirements	pathways (Teaching Process)	
9	Have strong ability of teamwork; be able to conduct effective communication, organization and coordination in multi-disciplinary working teams; adapt to teamwork as well as independent work.	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education and Fundamentals of Law, Physical Education, Military Theory, Innovation and Entrepreneurship Elective Course, Comprehensive Practice of Remote Sensing Image Processing, Comprehensive Practice of Remote Sensing Application, Social Investigation, Others (Contest, Invention, Innovation and Research Presentation)
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs at all levels, social practice activities, English, computer, mandarin examination, paper publication, reading or publication of artistic works in the professional field of the discipline, PCT international patent, national invention patent and various intellectual property applications, scientific research activities or entrepreneurial practice activities, transformation of scientific and technological achievements, enterprise training and entrepreneurship.
10	Be able to communicate and cooperate with industry colleagues and the public on engineering issues of remote sensing, the specific requirements include writing reports, designing documents, making clear statements and oral presentations; have certain international perspective, understand the differentiation and diversity of the world cultures, be able to communicate and exchange ideas with others under cross-culture background.	① Classroom teaching	Principles and Applications of Remote Sensing, Aerial and Space Data Acquisition, Remote Sensing Image Interpretation, Digital Image Processing, Application Model of Remote Sensing, Comprehensive Practice of Remote Sensing Application, Social Investigation, Others (Contest, Invention, Innovation and Research Presentation), Microwave Remote Sensing, Computer Vision and Machine Learning, Literature Retrieval and Scientific Writing, Knowledge Lectures of the State-of-the-Art Remote Sensing
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs at all levels, social practice activities, English, computer, mandarin examination, paper publication, reading or publication of artistic works in the professional field of the discipline, PCT international patent, national invention patent and various intellectual property applications, scientific research activities or entrepreneurial practice activities, transformation of scientific and technological achievements, and entrepreneurship.

No.	Graduation Requirements	pathways (Teaching Process)	
11	Have certain basic knowledge of engineering management and economic decision making, be able to make use of them flexibly in the professional practice of engineering.	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education and Fundamentals of Law, Interdisciplinary Elective Courses, Laws, Regulations and Project Management of Surveying and Mapping, Comprehensive Practice of Remote Sensing Application, Social Investigation, Error Theory and Foundation of Surveying Adjustment
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs at all levels, social practice activities, English, computer, mandarin examination, paper publication, reading or publication of artistic works in the professional field of the discipline, PCT international patent, national invention patent and various intellectual property applications, scientific research activities or entrepreneurial practice activities, transformation of scientific and technological achievements, and entrepreneurship.
12	Have self-learning ability and lifelong study consciousness; be able to keep track of the development trend, at home and abroad, of the science and technology in the industry, and independently study the new theories, techniques and methods.	① Classroom teaching	Principles of Marxism, Introduction to Mao Tse-tung Thought and the Theoretical System of Socialism with Chinese Characteristics, The Essentials of Modern Chinese History, Morality Education and Fundamentals of Law, Physical Education, College English (ABC), Programming of Advanced Computer Language (C++), Principles of Geographic Information Systems, Data Structure, Principle of Geographical Spatial Data Visualization, Graduation Design (Thesis), Social Investigation, Others (Contest, Invention, Innovation and Research Presentation), Knowledge Lectures of the State-of-the-Art Remote Sensing
		② Extracurricular learning	Participate in innovation and entrepreneurship training programs at all levels, social practice activities, English, computer, mandarin examination, paper publication, reading or publication of artistic works in the professional field of the discipline, PCT international patent, national invention patent and various intellectual property applications, scientific research activities or entrepreneurial practice activities, transformation of scientific and technological achievements, and entrepreneurship.

Major Disciplines: Surveying and Mapping Science and Technology, Computer Science and Technology, Geography.

Core Courses: Introduction to Surveying and Mapping, Programming of Advanced Computer Language (C++), Data Structure, Digital Topographic Survey, Principles and Applications of Remote Sensing, Principles of Geographic Information Systems, Pattern Recognition, Spatio-temporal Database, Aerial and Space Data Acquisition, Remote Sensing Image Interpretation, Digital Image Processing, Application Model of Remote Sensing, Laws, Regulations and Project Management of Surveying and Mapping, Error Theory and Foundation of Surveying Adjustment, GNSS Principles and Applications B, Photogrammetry, Principle of Geographical Spatial Data Visualization, Foundation of Geodesy.

Lab Experiments: Geodesy, Course Projects of Data Structure A, Spatio-temporal Database, Remote Sensing Image Interpretation, Digital Image Processing, Laws, Regulations and Project Management of Surveying and Mapping, GNSS Principles and Applications B.

Practical Work: Course Projects for Programming of Advanced Computer Language (C++), Practice of Physical Geography and Geology, Geodesy, Course Projects of Data Structure A, Teaching Practice of Digital Topographic Survey, Practice of Practice of Geographic Information Systems B, Practice of Digital Image Processing, Practice of Photogrammetry, Comprehensive Practice of Remote Sensing Application, Graduation Design (Thesis).

Credit Requirement for Graduation: 171.

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

Recommended minor: Surveying and Mapping Engineering, Geographic Information Science, Computer Science and Technology.

Related Specialties: Surveying and Mapping Engineering, Geospatial information engineering.

遥感科学与技术专业课程教学计划表

Course Descriptions of Remote Sensing Science and Technology

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				一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
						讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp									
通识教育课 Liberal Education Courses	必修 Compulsory	11706200	马克思主义基本原理概论 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 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 The Essentials of Modern Chinese History	2	32	32						2							
		12005200	思想道德修养与法律基础 Morality Education and Fundamentals 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							
	选修 Elective	70100300	地球科学概论 Introduction to Earth Sciences	1.5	24	24		8											
		70400600	生态学概论 Introduction to Ecology	1.5	24	24													
				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	9	144													
		小计 Sum		41	740	596		8		48		11	7	4	5				
大类平台课 Platform Courses	21121100	测绘学概论 Introduction to Geomatics	1	16	16						1								
	21130500	计算科学基础 Fundamentals of for Computational Science	2	32	32						2								
	21930900	计算机高级语言程序设计(C/C++) Programming of Advanced Computer Language (C/C++)	3	48	48		16			计算科学基础		3							
	21944900	数据结构 Data Structure	3	48	48					计算机高级语言程序设计(C++)			3						
	21131200	数字地形测量学 Digital Topographic Surveying	2.5	40	40					概率论与数理统计 A			2.5						

课程类别 Classification	课程编号 Code	课程名称 Course Name	学分 Cr	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				一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp									
	21131300	遥感原理与应用 Principles and Applications of Remote Sensing	2.5	40	40				8				2.5					
	21130702	地理信息系统原理 B Principles of Geographic Information System	2	32	32								2					
	小计 Sum		16	256	256		16		8		3	3	10					
Disciplinary Fundamental Courses 学科基础课	212127*1	高等数学 A Advanced Mathematics A	11.5	184	184						5	6.5						
	21212801	线性代数 A Linear Algebra A	3.5	56	56						3.5							
	212130*3	大学物理 C College Physics C	6	96	96							3.5	2.5					
	21216902	物理实验 B Physics Experiments B	1.5	48	4	44						1.5						
	21213501	概率论与数理统计 A Probability and Statics A	3.5	56	56								3.5					
	小计 Sum		26	440	396	44					8.5	11.5	6					
Main Specialty Courses 专业主干课	21144700	模式识别 Pattern Recognition	2	32	32					数字图像处理					2			
	21144800	时空数据库 Spatio-temporal Database	2.5	40	40					数据结构				2.5				
	21123300	航空与航天数据获取 Aerial and Space Data Acquisition	1.5	24	24					遥感原理与应用				1.5				
	21144900	遥感图像解译 Remote Sensing Image Interpretation	1	16	16					遥感原理与应用				1				
	21131900	数字图像处理 Digital Image Processing	2	32	32					遥感原理与应用				2				
	21145000	遥感应用模型 Application Model of Remote Sensing	2.5	40	40					遥感原理与应用					2.5			
	21138100	测绘法律法规与项目管理 Geomatics Laws and Regulations & Project Management	1.5	24	24					遥感原理与应用						1.5		
	21137702	误差理论与测量平差基础 B Error Theory and Foundation of Surveying Adjustment	2.5	40	40					数字地形测量学				2.5				
	21135202	GNSS 原理及其应用 B GNSS Principles and Applications B	2	32	32					大地测量学基础						2		
	21137800	摄影测量学* Photogrammetry*	3	48	48					误差理论与测量平差基础 B					3			
	21145100	地理空间数据可视化原理 Principle of Geographical Spatial Data Visualization	2	32	32					地理信息系统原理				2				
	21137602	大地测量学基础 B Fundamentals of Geodesy B	2.5	40	40					数字地形测量学				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				一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp									
	小计 Sum		25	400	400									14	7.5	3.5		
Specialty 专业选修课 Elective Courses		可按方向设课，具体见专业选修课列表	15	240														
合计 Sub-total			123	2076	1648	44	24		56		22.5	21.5	20	19	7.5	3.5		
实践环节 Practical Work	44300400	军事训练 Military Training	2	2 周							2							
	41931000	计算机高级语言课程设计（C/C++） Projects of Advanced Computer Language（C/C++）	2	2 周					计算机高级 语言程序设 计 C/(C++)		2							
	41131400	数字地形测量教学实习 Practice of Digital Topographic Survey	3	3 周					数字地形 测量学			3						
	41931300	数据结构课程设计 Projects of Data Structure	3	3 周					数据结构			3						
	41130800	地理信息系统实习 Practice of Geographic Information Systems	2	2 周					地理信息 系统原理			2						
	41131500	遥感原理与应用课程实习 Practice ofPrinciples and Applications of Remote Sensing	2	2 周					遥感原理与 应用			2						
	41124100	自然地理与地质学实习 Practice of Physical Geography and Geology	2	2 周					地球科学 概论		2							
	41145200	时空数据库课程实习 Practice of Spatio-temporal Database	2	2 周					时空数据库				2					
	41138500	摄影测量学课程实习 Practice of PhotogrammetryB	3	3 周					摄影测量学					3				
	41145300	微波遥感课程实习 Practice of Microwave Remote Sensing	1	1 周					微波遥感						1			
	41141000	GNSS 原理及其应用实习 Practice of GNSS Principles and Applications	1	1 周					GNSS 原理 及其应用							1		
	41145400	遥感图像解译课程实习 Practice of Remote Sensing Image Interpretation	1	1 周					遥感图像 解译				1					
	41145500	遥感应用模型课程实习 Practice of Application Model of Remote Sensing	1	1 周					遥感应用 模型						1			
	41145600	空间统计与分析课程实习 Practice of Spatial Statistical Analysis	1	1 周					空间统计与 分析						1			

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				一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th	
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp										
	41145700	地理空间数据可视化实习 Practice of Geographical Spatial Data Visualization	1	1 周						地理空间数据可视化				1					
	41145800	数字图像处理课程实习 Practice of Digital Image Processing	1	1 周						数字图像处理				1					
	41145900	遥感图像处理综合实习 Comprehensive Practice of Remote Sensing Image Processing	2	2 周						模式识别					2				
	41146000	遥感应用综合实习 Comprehensive Practice of Remote Sensing Application	2	2 周						遥感应用模型						2			
	41132600	毕业设计（论文） Graduation Design (Thesis)	8	16 周														8	
	小计 Sum		40	48 周							2	4	10	5	8	3		8	
创新创业自主学习 Freedom study	ZZ35000S	社会调查 Social Investigation	2																
		创新创业实践 Practice of Innovation and Entrepreneurship	2																
		其他(学科竞赛、发明创造、科研报告) Others (Contest, Invention, Innovation and Research Presentation)	4																
	小计 Sum		8																
总计 Total			171	2076+48周	1648	44	24		56		24.5	25.5	30	24	15.5	6.5		8	
可开出专业选修课列表 Specialty Elective Courses	遥感信息工程																		
	21146100	Python 与大数据可视化 Big Data Visualization with Python	1.5	24	24		8									1.5			
	21146200	低空无人机遥感 Low-Altitude Remote Sensing with UAV	1.5	24	24		8			航空与航天数据获取						1.5			
	21139600	雷达干涉测量 Radar Interferometry	1.5	24	24		8			微波遥感						1.5			
	21118300	热红外遥感 Thermal Infrared Remote Sensing	1.5	24	24		8			遥感原理与应用						1.5			
	21138900	激光雷达技术 Technique of Light Detection and Ranging	1.5	24	24		8			数字摄影测量					1.5				
	21146300	三维地理信息系统 3D Geographic Information System	1.5	24	24		8			地理信息系统原理						1.5			
	自然资源调查																		
	21146400	自然资源调查与监管 Surveying and Monitoring of Natural Resources	1.5	24	24		8			遥感应用模型							1.5		
	21146500	空间规划分析与建模 Spatial Planning Analysis and Modeling	1.5	24	24		8			遥感应用模型						1.5			

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				一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp									
	21146600	海洋遥感 Ocean Remote Sensing	1.5	24	24		8									1.5		
	21146700	自然灾害遥感 Natural Hazard Remote Sensing	1.5	24	24					遥感原理与应用						1.5		
	21146800	大气遥感与雾霾监测 Atmospheric Remote Sensing and Haze Monitoring	1.5	24	24		8			遥感原理与应用						1.5		
	21146900	植被遥感 Vegetation Remote Sensing	1.5	24	24		8									1.5		
	21139500	文献检索与科技写作 [†] Literature Retrieval and Scientific Writing [†]	1.5	24	24			8		大学英语						1.5		
	21134202	空间统计与分析 B [†] Spatial Statistical and Analysis B [†]	1.5	24	24		8			地理信息系统原理					1.5			
	21147000	微波遥感 [†] Microwave Remote Sensing [†]	2	32	32			8							2			
	21147100	计算机视觉与机器学习 [†] Computer Vision and Machine Learning [†]	2	32	32		8			模式识别					2			
创新创业课程																		
	21147200	遥感前沿知识讲座 [†] Knowledge Lectures of the State-of-the-Art Remote Sensing [†]	1	16	16				4							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。

遥感科学与技术专业课程分类统计

Course Classifications and Statistics of Remote Sensing Science and Technology

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	选修							
学时/学分	548/29	192/12	696/42	400/25	240/15	48 周/40	8	2076+48 周	171
学分所占比例	23.7%		24.8%	14.8%	8.9%	23.0%	4.8%		100.0%

附：

学校与企事业单位联合培养阶段实施方案

一、培训目标和要求

本次实习是遥感科学与专业高年级学生的一次综合实习，其目的是巩固专业知识，培养学生实践操作能力。通过本实践课程的训练，使学生进一步理解和领会专业知识、了解行业及相关学科的发展动态、初步具备分析解决本专业工程实际问题及进行新技术研发和工程设计的能力、培养学生语言表达和沟通能力、较强的团队合作意识和自主学习能力，使学生能学有所用，适应未来行业发展的需要。

要求学生掌握摄影测量与遥感的基础理论知识，具备遥感数据采集、数据加工、信息提取及遥感应用的技能，了解行业对遥感科学与技术发展的最新需求及发展趋势。能够综合运用所学基础理论、专业知识和技术手段分析并解决遥感应用工程领域的实际问题，具有较高的遥感应用综合设计能力。

二、培训内容和形式

实习的主要内容是利用遥感影像处理系统，结合实际生产需要，完成不同数据来源、不同硬件环境、不同任务需求下的数据处理工艺流程；了解基础测绘航测生产机构、人员和设备等情况；掌握面向信息化测绘条件下航测 DLG 数据生产与更新一体化流程，操作相关的软件系统，掌握航测外业调绘、内业采集、编辑、成图、质检等一体化的工作流程和标准规范，能独立完成符合规范要求的测图产品。

实习形式以理论课与上机操作相结合的方式进行。

三、培训内容和考核方法

1. 大二阶段进行认知实习。主要进入行业内企业公司参观，了解企业结构，并参与企业实际项目，提升眼界。了解遥感专业领域就业、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，完成具体项目的开发。

3. 大四阶段进行生产实习。主要进入企业实习，进行产业深度考察、实习训练、项目训练等内容，企业对学生就业指导和训练，便于学生就业。

实习成绩考核的内容包括实习过程中的学习态度和考勤、实习成果、实习报告、考核答辩等；考核方法百分制进行评定，其中：

1. 考勤 (20%)：要求学生每天都要签到，并要求认真实习。根据平时考勤情况与课堂表现打分。
2. 考核答辩 (40%)：对实习小组的实习成果进行考核，要求讲解系统设计思想，演示管理系统软件，并对关键功能的原理进行解释说明。
3. 实习成果 (40%)：根据设计文档、代码、实习报告成果进行综合评分。

四、工作、生活及安全保障管理

1. 学院负责人是企业实习教学安全工作的第一责任人，主管教学的院长和学生主管书记是企业实习教学安全管理的具体负责人。
2. 教学系负责确定每届学生的企业实习课程负责人和校内指导教师，原则上每个班的课程负责人由班主任担任，负责审核和汇总学生提交的企业实习申请以及组织进行实习过程管理和考评，另每个班按师生比不低于 1:10 配备若干校内指导教师，与课程负责人共同完成学生企业实习过程管理和考评。
3. 学生参加企业实习实训期间，所在单位应与学生（及家长）、学院共同签署关于安全责任的三方协议（协议中必须有保障安全的详细条款，由学生辅导员保管）。在校内实训期间，按照中国地质大学学生管理条例，由学院指导教师进行管理。
4. 学生企业实习期间由所在单位参照单位员工管理办法予以管理，学生实习由企业导师与学院指派的校内指导教师共同指导和考核。实习期间，学生要每周向校内指导教师提交企业实习周记（电子版）。
5. 学生实习期满，由所在单位出具学生实习期间的考核意见并加盖公章。
6. 参加校内外企业实习实训后，须提交实习报告并参加答辩，审核通过后由教务科登记。
7. 外出实习学生要明确实习的离校和返校时间，要与辅导员保持联系，学生要严格遵守学校及企业的安全管理规定。
8. 如出现特殊情况，经学院核实审批并取得实习实训单位同意后可中断实习实训。

遥感科学与技术专业辅修课程教学计划表

Course Descriptions of Remote Sensing Science and Technology (Minor)

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				一 1st	二 2nd	三 3rd	四 4th	五 5th	六 6th	七 7th	八 8th
					讲课 Lec.	课内实验 Lab	实验/科研实践 Lab/Res.	研讨 Dis	素质拓展 Exp									
学科基础课 Disciplinary Fundamental Courses	21121100	测绘学概论 Introduction to Surveying and Mapping	1	16	16								1					
	21944900	数据结构 Data Structure	3	48	48								3					
	21131200	数字地形测量学 Digital Topographic Survey	2.5	40	40							2.5						
	21131300	遥感原理与应用 Principles and Applications of Remote Sensing	2.5	48	40				8			2.5						
	21130702	地理信息系统原理 B Principles of Geographic Information Systems B	2	32	32										2			
	小计 Sum		11	184	176				8			6	3		2			
专业主干课 Main Specialty Courses	21123300	航空与航天数据获取 Aerial and Space Data Acquisition	1.5	24	24										1.5			
	21144900	遥感图像解译 Remote Sensing Image Interpretation	1	16	16								1					
	21131900	数字图像处理 Digital Image Processing	2	32	32								2					
	21145000	遥感应用模型 Application Model of Remote Sensing	2.5	40	40									2.5				
	21137800	摄影测量学* Digital Photogrammetry*	3	48	48									3				
	小计 Sum		10	160	160								3	5.5	1.5			
实践环节 Practical Work	41146000	遥感应用综合实习 Comprehensive Practice of Remote Sensing Application	2	2 周		2 周										2		
	小计 Sum		2	2 周		2 周										2		
总计 Total			23	344+2 周	336	2 周			8				6	6	5.5	5.5		

遥感科学与技术辅修专业课程分类统计

Course Classifications and Statistics of Remote Sensing Science and Technology (Minor)

课程类别 统计	学科基础课 Disciplinary Fundamental Courses	专业主干课 Main Specialty Courses	实践环节 Practical Work	学时总计 Total Hour	学分总计 Total Credits
学时/学分	176/11	160/10	2 周/2	336+2 周	23
学分所占比例	47.8%	43.5%	8.7%		100%