北京建筑大学

2019 级本科培养方案

测绘学院分册

教务处

2019 年 9 月

2019 级测绘工程专业本科培养方案

一、专业基本信息

英文名称	Surveying and Mapping Engineering		
专业代码	081201	学科门类	工学
学　　制	4 年	授予学位	工学学士

二、培养目标和专业特色

1.培养目标

培养具有德、智、体、美全面发展，具备数理基础和人文社科知识，掌握测绘工程基础理论、基本知识和基本技能，接受科学思维和工程实践训练，胜任国家基础测绘、城乡建设、自然资源、应急管理等领域测绘项目的设计、生产、研发及管理工作，具有较强的组织管理能力、创新意识、继续学习能力、国际视野和城市测绘特色的应用型工程技术人才。毕业后经过 5 年左右的工作和学习，能够达到如下目标:

（1）掌握数学、自然科学、工程基础及先进的测绘理论与技术，胜任工程勘测、设计、施工及管理等专业技术工作；

（2）具有良好专业素养、丰富的工程管理经验和极强工作责任心，成为测绘地理信息企事业单位中的技术负责人或技术骨干；

（3）具有继续学习适应发展的能力，能够独立或协同承担测绘地理信息科研工作；

（4）具有良好的团队意识、国际化视野和沟通能力，能够承担团队中的领导角色；

（5）具有良好的思想道德修养和科学文化素养，能够承担和履行社会责任。

2.专业特色

本专业依托首都建设和学校土木建筑类学科优势，培养服务首都、面向全国、依托建筑行业、服务城乡建设的专业测绘人才。适应测绘高新科技发展，融教学、科研和生产为一体，强调理论与实践密切结合，突出城市测绘特色，培养测绘新技术、新方法、新工艺的应用能力，满足城乡建设、古建筑保护、复杂结构精密测量等测绘人才需求。

三、主干学科

测绘科学与技术

四、主干课程

1．主干基础课程

测绘地理信息概论、工程制图与识图、C 语言与数据结构、自然地理学、数字地形测量学、地图学、CAD 基础与应用、误差理论与测量平差基础、地理信息系统原理（双语）、遥感原理、摄影测量基础。

2．主干专业课程

卫星导航定位技术、大地测量学基础、工程测量学、变形监测与灾害预报、不动产测量与管理、激光雷达测量技术与应用。

五、主要实践教学环节

1．主要实验

数字地形测量学实验 、卫星导航定位技术实验 、摄影测量基础实验、地理信息系统原理实验、大地测量学基础实验、工程测量学实验、变形监测实验、不动产测量与管理实验、激光雷达测量技术实验。

2．主要实践环节

数字地形测量实习、卫星导航定位实习、遥感原理实习、摄影测量实习、地理信息系统实习、地图学实习、控制测量实习、自然地理地貌及遥感图像解译实习、工程测量综合实习、空间信息综合实习、不动产测量与管理实习、激光雷达测量实习。

六、毕业学分要求

参照北京建筑大学本科学生学业修读管理规定及学士学位授予细则，修满本专业最低计划学分应达到 166 学分，其中理论课程 124 学分，实践教学环节 42 学分(含创新实践及科研训练必修 2 学分)。

七、各类课程结构比例

课程类别	课程属性	学分	学时	学分比例
通识教育课	必修	41.5	616	25.00%
	选修	2	32	1.20%
大类基础课	必修	46	804	27.71%
	选修	1	16	0.60%
专业核心课	必修	17	272	10.24%
专业方向课	必修	6	96	3.61%
	选修	10.5	168	6.33%
独立实践环节	必修	40	796	24.10%
	选修	2	40	1.20%
总计		166	2840	100%

八、教学进程表

学期	教学周	考试	实践	学期	教学周	考试	实践
1	4-19 周	20 周	1-3 周	2	1-16 周	17 周	18-20 周
3	1-15 周	16 周	17-20 周	4	1-15 周	16 周	17-20 周
5	1-16 周	17-18 周	19-20 周	6	1-14 周	15 周	16-20 周
7	7-15 周	16 周	1-6 周 17-20 周	8	1-16 毕业设计/实习 17 周答辩		

九、毕业生应具备的知识能力及实现矩阵

毕业生应具备的知识能力	相关知识领域	实现途径（课程支撑）
1.工程知识: 能够将数学、自然科学、工程基础和专业知识用于解决复杂测绘工程问题。	1.1 能够将数学、自然科学、工程科学的语言工具用于测绘工程问题的表述	计算思维导论、C 语言与数据结构、CAD 基础与应用、工程制图与识图、高等数学 A(1-2)、概率与数理统计 B、普通物理 A(1-2)、物理实验（1-2)、线性代数、土木工程概论、地图学、自然地理学、计算机图形学等。

	1.2 能针对具体的测绘对象建立数学模型并求解	高等数学 A(1-2)、线性代数、数字地形测量学、地理信息系统原理（双语）、摄影测量基础、变形监测与灾害预报、大地测量学基础、误差理论与测量平差基础等。
	1.3 能够将相关知识和数学模型方法用于推演、分析测绘专业复杂工程问题	计算思维导论、CAD 基础与应用、工程制 2 图与识图、线性代数、卫星导航定位技术、激光雷达测量技术与应用、计算机图形学、城市地下管线测量、工程测量学、城市空间信息学等。
	1.4 能够将相关知识和数学模型方法用于测绘专业复杂工程问题解决方案的比较与综合	C 语言与数据结构、概率与数理统计 B、三维地理信息技术、近景摄影测量、数字地形测量实习、地图学实习、摄影测量基础实习、空间信息综合实习、毕业设计等。
2.问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析复杂测绘工程问题，以获得有效结论。	2.1 能够将数学、自然科学与工程科学的基本理论运用到识别、分析与表达	计算思维导论、C 语言与数据结构、高等数学 A(1-2)、概率与数理统计 B、物理实验（1-2)、线性代数、土木工程概论、C# 程序设计、地图学、地理信息系统原理(双语)、自然地理学、变形监测与灾害预报、空间分析与建模、摄影测量基础实习等。
	2.2 能够基于相关科学原理和数学模型方法正确表达复杂测绘工程问题	CAD 基础与应用、数字地形测量学、误差理论与测量平差基础、测量数据处理与程序设计大赛实训、激光雷达测量技术与应用、三维地理信息技术、城市地下管线测量、GIS 基础应用技能、工程测量学、移动道路测量技术及应用等。
	2.3 能够认识到解决问题有多种方案可选择，会通过文献研究寻求可替代的解决方案	C 语言与数据结构、科技文献检索、摄影测量基础、大地测量学基础、工程测量学、地理信息系统原理实习、不动产测量与管理实习等。
	2.4 能运用基本原理，借助文献研究，分析过程的影响因素，获得有效结论	普通物理 A(1-2)、科技文献检索、卫星导航定位技术、控制测量实习、工程测量综合实习、毕业设计、科研训练等。

3.设计/开发解决方案：能够设计针对复杂测绘工程问题的解决方案，设计满足特定需求的系统、生产流程，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。	3.1 掌握测绘工程设计/开发全周期、全流程的基本设计/开发方法和技术，了解影响设计目标和技术方案的各种因素	计算思维导论、CAD 基础与应用、GIS 基础应用技能、不动产测量与管理、智慧城市导论、空间分析与建模、工程测量学、摄影测量基础实习、工程测量综合实习、空间信息综合实习等。
	3.2 能够设计开发满足特定测绘需求的生产流程及系统	C 语言与数据结构、CAD 基础与应用、遥感原理、地理信息系统原理（双语）、摄影测量基础、卫星导航定位技术、激光雷达测量技术与应用、工程测量学、地图设计与编绘、地图学实习、卫星导航定位实习、地理信息系统原理实习、测量数据处理与程序设计大赛实训等。
	3.3 能够在测绘工程解决方案设计中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素	测绘地理信息概论、数字地形测量学、工程测量学、移动道路测量技术及应用、地理国情监测、创新实践（测绘技能大赛、测绘科技论文大赛）、数字地形测量实习、工程测量综合实习、创新创业类、毕业设计等。
4.研究：能够基于科学原理并采用科学方法对复杂测绘工程问题进行研究，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。	4.1能够运用科学原理对复杂测绘工程问题提出研究方案	地图学、地理信息系统原理（双语）、大地测量学基础、城市地下管线测量、工程测量学、智慧城市导论、地理国情监测、遥感原理实习、地图学实习、卫星导航定位实习等。
	4.2能够基于专业理论知识对研究方案进行设计、论证与预测	计算思维导论、工程制图与识图、遥感原理、摄影测量基础、卫星导航定位技术、工程测量综合实习等。
	4.3能够采用科学方法实施数据采集与分析处理	C#程序设计、C 语言与数据结构、误差理论与测量平差基础、测量数据处理与程序设计、激光雷达测量技术与应用、变形监测与灾害预报、工程测量学、遥感数字图像处理、近景摄影测量、卫星导航定位实习、测量数据处理与程序设计大赛实训、控制测量实习、摄影测量基础实习、激光雷达测量技术实习等。

	4.4能够对实验结果进行信息综合与评判，取得合理有效结论	科技文献检索、地图学、科技论文写作(双语)、工程测量学、空间分析与建模、不动产测量与管理实习、激光雷达测量技术实习、空间信息综合实习、毕业设计等。
5.使用现代工具：能够针对复杂测绘工程问题，开发、选择与使用恰当的测绘技术、资源、现代测绘仪器和信息技术，包括对复杂测绘工程问题的预测与模拟，并能够理解其局限性。	5.1 能够针对复杂测绘工程问题，选择恰当的现代测绘技术与仪器	大学英语（1-2)、计算思维导论、C 语言与数据结构、CAD 基础与应用、C#程序设计、数字地形测量学、激光雷达测量技术与应用、三维地理信息技术、计算机图形学、城市地下管线测量、GIS 基础应用技能、变形监测与灾害预报、工程测量学、不动产测量与管理、智慧城市导论、移动道路测量技术及应用、测绘地理信息技术前沿、数字地形测量实习、遥感原理实习、地图学实习、工程测量综合实习、不动产测量与管理实习、激光雷达测量技术实习、测绘技能大赛实训、GIS 软件开发大赛实训等。
	5.2 能够使用现代测绘仪器和信息技术软件完成测绘数据采集、数据处理与精度分析	工程制图与识图、高等数学 A（1-2)、概率与数理统计 B、数字地形测量学、遥感原理、地图学、摄影测量基础、大地测量学基础、卫星导航定位技术、误差理论与测量平差基础、工程测量学、变形监测与灾害预报、不动产测量与管理、遥感数字图像处理、近景摄影测量、数字地形测量实习、遥感原理实习、卫星导航定位实习、地理信息系统原理实习、控制测量实习、工程测量综合实习、不动产测量与管理实习、激光雷达测量技术实习、空间信息综合实习、毕业设计、测绘技能大赛实训、GIS 软件开发大赛实训等。
	5.3 能够使用现代工具，对复杂测绘工程问题进行预测与模拟，并理解其局限性	概率与数理统计 B、普通物理（1-2)、线性代数、科技文献检索、误差理论与测量平差基础、测量数据处理与程序设计、地下工程测量、摄影测量基础实习、毕业设计、创新实践（测绘技能大赛、测绘科技论文大赛）等。
6.工程与社会：能够基于工程相关背景知识进行合	6.1 熟悉测绘专业相关技术标准、法	思想道德修养与法律基础、土木工程概论、数字地形测量学、遥感原理、大地测

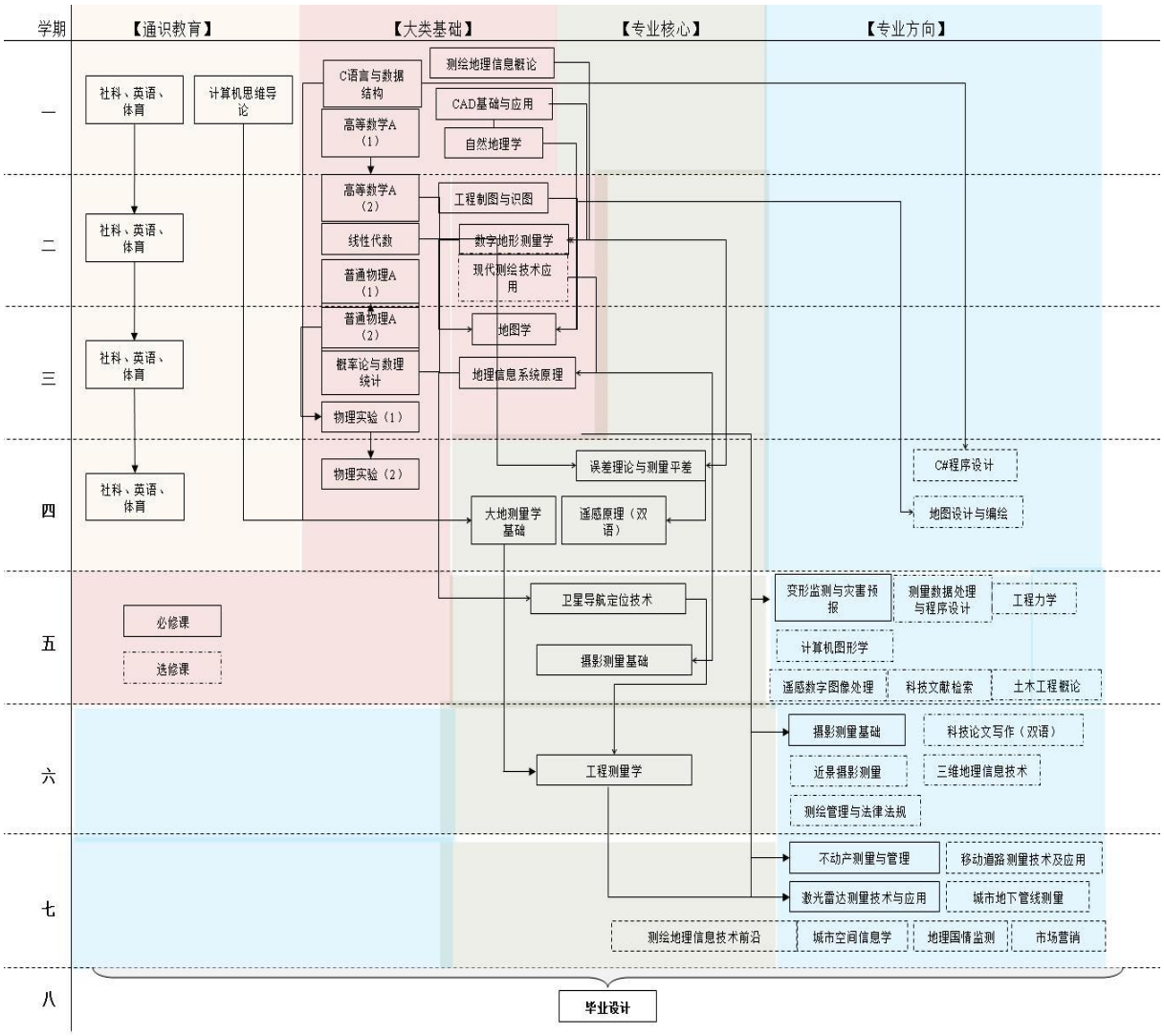
理分析，评价测绘工程实践和复杂测绘工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	律法规及管理规定，能够基于工程相关背景知识进行合理分析	量学基础、卫星导航定位技术、测绘管理与法律法规、数字地形测量实习、地理信息系统原理实习、工程测量综合实习、工程实践类、毕业设计等。
	6.2 能够评价测绘工程实践和复杂测绘工程问题解决方案对社会、健康、安全、法律以及文化的影响，以及这些制约因素对项目实施的影响，并理解应承担的责任	中国近现代史纲要、马克思主义基本原理概论、毛泽东思想和中国特色社会主义体系理论概论、军事理论、工程测量学、不动产管理与测量、测绘管理与法律法规、城市空间信息学、变形监测与灾害预报、工程测量学、经典赏析与文化传承、哲学视野与文明对话、科技革命与社会发展、建筑艺术与审美教育、生态文明与未来城市等。
7.环境和可持续发展：能够理解和评价针对复杂测绘工程问题的测绘工程实践对环境、社会可持续发展的影响。	7.1 知晓和理解环境保护和可持续发展的理念和内涵	物理实验（1-2）、测绘地理信息概论、自然地理学、遥感数字图像处理、地理国情监测、形势与政策（1-2）等。
	7.2 能够从环境保护和可持续发展的角度认知测绘工程实践活动的可持续性，以及评价测绘工程生产实践中可能对环境及社会造成的损害和隐患	市场营销、自然地理学、不动产测量与管理、智慧城市导论、地理国情监测、变形监测与灾害预报、控制测量实习、不动产测量与管理实习、复合培养类、毕业设计等。
8.职业规范：具有人文社会科学素养、社会责任感，能够在测绘工程实践中理解并遵守测绘行业职业道德和规范，履行责任。	8.1 具有人文社会科学素养，树立正确的世界观、人生观和价值观	思想道德修养与法律基础、中国近现代史纲要、马克思主义基本原理概论、毛泽东思想和中国特色社会主义体系理论概论、军事理论、体育（1-4）、军训等。
	8.2 理解诚实公正、诚信守则的测绘行业职业道德和规范，并能在测绘工程实践中自觉遵守	思想道德修养与法律基础、中国近现代史纲要、毛泽东思想和中国特色社会主义体系理论概论、大学生职业生涯与发展规划、测绘地理信息概论、测绘管理与法律法规、形势与政策（1-2）、数字地形测量实习、不动产测量与管理实习、空间信息综合实习等。

	8.3 理解测绘工作人员对公众的安全、健康、福祉、环境保护的社会责任，能够在测绘工程实践中自觉履行责任	马克思主义基本原理概论、大学生职业生涯与发展规划、测绘地理信息概论、自然地理学、测绘管理与法律法规、毕业设计等。
9.个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及责任人的角色。	9.1 能与建筑、土木等学科的成员有效沟通，合作共事	大学生职业生涯与发展规划、体育(1-4)、土木工程概论、工程力学、城市规划概论、测量数据处理与程序设计、毕业设计等。
	9.2 能够在团队中独立或合作开展工作	军事理论、军训、创新实践（测绘技能大赛、测绘科技论文大赛)、数字地形测量实习、遥感原理实习、卫星导航定位实习、控制测量实习、工程测量综合实习、激光雷达测量技术实习、测绘技能大赛实训、GIS 软件开发大赛实训、等。
	9.3 能够组织、协调和指挥团队开展工作	中国近现代史纲要、军事理论、地图学实习、地理信息系统原理实习、空间信息综合实习、激光雷达测量技术实习、毕业设计等。
10.沟通：能够就复杂测绘工程问题与测绘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。	10.1 能够在撰写设计书、技术报告以及陈述发言中，就复杂测绘工程问题与测绘同行及社会公众进行有效沟通和交流	地图学实习、控制测量实习、工程测量综合实习、毕业设计等。
	10.2 具备一定的国际视野，了解测绘领域的国际前沿发展趋势和研究热点	大学英语（1-2）、遥感原理、地理信息系统原理（双语）、空间信息综合实习、大学英语拓展系列课程（1-8）、现代测绘技术应用、GIS 基础应用技能、遥感应用前景等。
	10.3 具有跨文化交流的语言和书面表达能力，能够就测绘问题在跨文化背景下进行	大学英语（1-2）、科技论文写作（双语)、大学英语拓展系列课程（1-8）等。

	沟通和交流	
11.项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	11.1 掌握工程项目中涉及的管理与经济决策方法	土木工程概论、工程力学、市场营销、不动产测量与管理、数字地形测量实习、控制测量实习、工程测量综合实习、毕业设计等。
	11.2 了解测绘生产的成本构成，理解其中涉及的工程管理与经济决策问题	市场营销、测绘管理与法律法规、卫星导航定位实习、毕业设计等。
	11.3 能在多学科环境下，在设计开发的过程中，运用工程管理与经济决策方法	工程测量综合实习、不动产测量与管理实习、城市规划概论、毕业设计等。
12.终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12.1 具有自主学习和终身学习的意识	思想道德修养与法律基础、大学生职业生涯与发展规划、大学英语（1-2）、测绘地理信息概论、误差理论与测量平差基础、测绘管理与法律法规、测绘地理信息技术前沿、大学英语拓展系列课程（1-8）等。
	12.2 具有不断学习和适应发展的能力	马克思主义基本原理概论、毛泽东思想和中国特色社会主义体系理论概论、测绘地理信息概论、科技论文写作（双语）、智慧城市导论、测绘地理信息技术前沿、毕业设计、创新实践（测绘技能大赛、测绘科技论文大赛）等。

十、指导性教学计划（见附表）

十一、主要课程逻辑关系结构图


学期
【通识教育】
【大类基础】
【专业核心】
【专业方向】
一
二
三
四
五
六
七
八
社科、英语、体育
计算机思维导论
C语言与数据结构
测绘地理信息概论
CAD基础与应用
高等数学A（1）
自然地理学
高等数学A（2）
工程制图与识图
线性代数
数字地形测量学
普通物理A（1）
现代测绘技术应用
普通物理A（2）
地图学
概率论与数理统计
地理信息系统原理
物理实验（1）
物理实验（2）
误差理论与测量平差
C#程序设计
大地测量学基础
遥感原理（双语）
地图设计与编绘
必修课
选修课
卫星导航定位技术
变形监测与灾害预报
测量数据处理与程序设计
工程力学
计算机图形学
摄影测量基础
遥感数字图像处理
科技文献检索
土木工程概论
工程测量学
摄影测量基础
科技论文写作（双语）
近景摄影测量
三维地理信息技术
测绘管理与法律法规
不动产测量与管理
移动道路测量技术及应用
激光雷达测量技术与应用
城市地下管线测量
测绘地理信息技术前沿
城市空间信息学
地理国情监测
市场营销
毕业设计

2019 Undergraduate Program for Specialty in Surveying and Mapping Engineering

I. Specialty Name and Code

English Name	Surveying and Mapping Engineering		
Code	081201	Disciplines	Engineering
Length of Schooling	Four years	Degree	Bachelor of Engineering

II. Educational Objectives and Features

1.Objectives

This program is to cultivate inter-disciplinary engineering talents, fully developed in morality, intelligence and physique, well equipped with mathematical science and social science, and highly skilled in basic theory, knowledge and profession of surveying and mapping engineering. The students are required to have the systematic training of scientific thinking and engineering practice, so that they are competent in design, production, R&D and management of surveying and mapping engineering, including basic state surveying and mapping, urban and rural development, land resources and urban emergency. It is practical engineering technical personnel with strong organizational management ability, innovative consciousness, continuous learning ability, international vision and urban surveying and mapping characteristics. After five years after graduation to work and study, can achieve the following goals:

(1) the knowledge of mathematics, natural science, engineering foundation and advanced theory and technology of surveying and mapping, competent for engineering reconnaissance, design, construction and management, and other professional and technical work;

(2) Have good professional quality, rich engineering management experience and strong sense of responsibility, and become the technical leader or technical backbone of surveying and mapping geographic information enterprises and institutions;

(3) Have the ability to continue learning and adapt to development, and can independently or jointly undertake the research work of surveying and mapping geographic information;

(4) Good team awareness, international vision and communication skills, capable of taking the leading role in the team;

(5) Have good ideological and moral cultivation, scientific and cultural literacy, and can assume and fulfill social responsibilities.

2. Features

This program features integrating the teaching, research and production together with the development of high-technology, stressing the combination of theory and practice, highlighting the city surveying and mapping characteristics, and pinpointing the comprehensive ability of application of new surveying and mapping technologies. Based on the construction of Beijing and with the advantages of the civil construction disciplines of the University, this program aims to

cultivate professional surveying and mapping talents for the urban and rural construction, protection of historic buildings and accurate measurement of complex structures of Beijing and the whole country.

III. Major Disciplines

Science and Technology of Surveying and Mapping

IV. Major Courses

1. Basic Courses

Introduction to Geomatics, Engineering Drawing and Read Drawing, C Language and Data Structure, Physical Geography, Digital Topographic Surveying, CAD Basic and Application, Fundamentals of Error Theory and Surveying Adjustment, The Principle of Geographic Information System (Bilingual), Principles of Remote Sensing, Photogrammetry Fundamental

2. Specialty Courses

Satellite Navigation and Positioning Technology, Foundation of Geodesy, Engineering Surveying, Deformation Monitoring and Disasters Predicting, Real Estate Surveying and Management, Laser Radar Surveying Technology and Application

V. Major Practical Training

1. Major experiment

Experiment of Digital Topographic Surveying, experiment of Satellite Navigation and Positioning Technology, experiment of Fundamentals of Photogrammetry, experiment of GIS Principles, experiment of Geodesy, experiment of Engineering Surveying, experiment of Deformation Monitoring, experiment of Real Estate Surveying and Management, experiment of Laser Radar Surveying Technology and Application

2. Major Practical Training

Digital Topographic Surveying Practice, Satellite Navigation and Positioning Practice, Principles of Remote Sensing Practice, Fundamentals of Photogrammetry Practice, GIS Practice, Cartography Practice, Control Surveying Practice, Comprehensive Training for Engineering Surveying, Comprehensive Training for Spatial Information, Real Estate Surveying and Management Practice, Laser Radar Surveying Practice.

VI. Graduation Requirements

In accordance with "Management Regulations for the Undergraduate Students of Beijing University of Civil Engineering and Architecture" and "Bachelor's Degree Awarding Regulations", the minimum credits required by specialty for graduate is 166, including 124credits of theoretical courses and 42 credits of practice teaching (2 credits of compulsory innovation practice and scientific research training included).

Ⅶ. Proportion of Course

Course Category	Course Type	Credits	Class Hour	Proportion
General Education	Compulsory	41.5	616	25.00%
	Optional	2	32	1.20%
Big Academic Subjects	Compulsory	46	804	27.71%
	Optional	1	16	0.60%
Professional Core	Compulsory	17	272	10.24%
Professional Direction	Compulsory	6	96	3.61%
	Optional	10.5	168	6.33%
Practice	Compulsory	40	796	24.10%
	Optional	2	40	1.20%
Total		166	2840	100%

VIII. Table of Teaching Program

Semester	Teaching	Exam	Practice	Semester	Teaching	Exam	Practice
1	4-19	20	1-3	2	1-16	17	18-20
3	1-14	15-16	17-20	4	1-14	15-16	17-20
5	1-16	19-20	17-18	6	1-14	15-16	17-20
7	7-15	16	1-6 17-20	8	1-16 graduation project 17 defence		

IX. Graduate Abilities and Matrices

Graduate Abilities	Related Knowledge	Course Supports
1. Engineering knowledge: have the ability of solving complex Survey and Mapping engineering issues with mathematics, natural science, engineering foundation and professional knowledge.	1.1 Use language tools of mathematics, natural science and engineering science to formulate surveying and mapping engineering issues.	Introduction to Computational Thinking、C Programming Language and Data Structure、CAD Basic and Application、Engineering Drawing and Interpreting、Advanced Mathematics A(1-2)、Theory of Probability and Statistics (B)、College physics A(1-2)、Physics Experiment(1-2)、Linear Algebra、Introduction to Civil Engineering、Cartography、Physical geography、Computer Graphics.
	1.2 set up and solve mathematical models for specific surveying objects	Advanced Mathematics A(1-2)、Linear Algebra、Digital Topographic Surveying、The Principle of Geographic Information System、Photogrammetry Fundamental、Deformation Monitoring and Disasters Predicting、Foundation o

		f Geodesy、Fundamentals of Error Theory and Surveying Adjustment.
	1.3 use relevant knowledge and mathematical models to deduce and analyze complex engineering problems in surveying and mapping.	Introduction to Computational Thinking、CAD Basic and Application、Engineering Drawing and Interpreting、Linear Algebra、Technology of Satellite navigation and positioning、The Laser Radar Surveying Technology、Computer Graphics、The Detecting and Surveying for underground pipelines in City、Engineering Surveying、Urban Spatial Information Science.
	1.4 Solution comparison and synthesis of complex surveying and Mapping engineering problems by using relevant knowledge and mathematical modeling methods.	C Programming Language and Data Structure、Theory of Probability and Statistics (B)、Technology of 3D GIS、 Close-range Photogrammetry、Digital Topographic Surveying Practice、Cartography Practice、Practical Training for Photogrammetry Fundamental、Graduation design.
2. Problem analysis: Be able to apply the basic principles of mathematics, natural science and Engineering Science to identify, express, and analyze the complex engineering problems through literature research to obtain the effective conclusion.	2.1 Be able to apply the basic principles of mathematics, natural science and Engineering Science, to identify, analyze and express.	Introduction to Computational Thinking、C Programming Language and Data Structure、Advanced Mathematics A(1-2)、Theory of Probability and Statistics (B)、Physics Experiment(1-2)、Linear Algebra、Introduction to Civil Engineering、C# Programming、Cartography、The Principle of Geographic Information System、Physical geography、Deformation Monitoring and Disasters Predicting、Spatial Analysis and Modeling、Practical Training for Photogrammetry Fundamental.
	2.2 correctly express complex surveying and mapping engineering problems based on relevant scientific principles and mathematical models.	CAD Basic and Application、Digital Topographic Surveying、Fundamentals of Error Theory and Surveying Adjustment、Surveying Data Processing and Program Design Practice Contest、The Laser Radar Surveying Technology、Technology of 3D GIS、The Detecting and Surveying for underground pipelines in Cit

		y、GIS base Application Skill、Engineering Surveying、Technology and Application of Mobile Mapping System.
	2.3 recognize alternatives ways to solve problems, and can seek alternative solutions through literature research.	C Programming Language and Data Structure、Document Retrieval of Science and Technology、Photogrammetry Fundamental、Foundation of Geodesy、Engineering Surveying、GIS Practice、Practical Training for Real Estate Surveying and Management.
	2.4 use the basic principles and literature research to analyze the influencing factors of the process and get effective conclusions.	College physics A(1-2)、Document Retrieval of Science and Technology、Technology of Satellite navigation and positioning、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Graduation design、Scientific research training.
3. Design/Develop solutions: Be able to design solutions for complex engineering problems. The design meets the specific needs of system, the unit (components) or process, and can embody the sense of innovation in the design process, considering the society, health, safety, law, culture and environment factors.	3.1 Master the basic design/development methods and techniques of the whole cycle and whole process of Surveying and mapping engineering design/development, and understand various factors that affect design objectives and technical solutions.	Introduction to Computational Thinking、CAD Basic and Application、GIS base Application Skill、Real Estate Surveying and Management、Introduction to Smart City、Spatial Analysis and Modeling、Engineering Surveying、Practical Training for Photogrammetry Fundamental、Practical Training for Engineering Surveying、Comprehensive Practice for Spatial Information.
	3.2 Able to design and develop workflow and systems that meet specific needs of surveying.	C Programming Language and Data Structure、CAD Basic and Application、Principles of Remote Sensing、The Principle of Geographic Information System、Photogrammetry Fundamental、Technology of Satellite navigation and positioning、The Laser Radar Surveying Technology、Engineering Surveying、Map Design and Compilation、Cartography Practice、Practical Training for Satellite Navigation and

		Positioning、GIS Practice、Surveying Data Processing and Program Design Practice Contest.
	3.3 Be able to demonstrate innovation awareness in the design of Surveying and mapping projects, taking into account social, health, safety, law, culture and environmental factors.	Introduction to Geomatics、Digital Topographic Surveying、Engineering Surveying、Technology and Application of Mobile Mapping System、Geographic Conditions Monitoring、Invocation Practice(School of Surveying and Mapping Skills Contest、School of Surveying and Mapping Paper Contest)、Digital Topographic Surveying Practice、Practical Training for Engineering Surveying、Innovation and Entrepreneurship、Graduation design.
4. Research: Be able to study complex engineering problems, including the design of experiments, analysis and interpretation of data, and get a reasonable and effective conclusion through using scientific methods and based on scientific theory.	4.1 use scientific principles to propose a research scheme for complex surveying and mapping engineering problems.	Cartography、The Principle of Geographic Information System、Foundation of Geodesy、The Detecting and Surveying for underground pipelines in City、Engineering Surveying、Introduction to Smart City、Geographic Conditions Monitoring、Practical Training for Control Surveying、Cartography Practice、Practical Training for Satellite Navigation and Positioning.
	4.2 design, demonstrate and predict the research plan based on professional theoretical knowledge.	Introduction to Computational Thinking、Engineering Drawing and Interpreting、Principles of Remote Sensing、Photogrammetry Fundamental、Technology of Satellite navigation and positioning、Practical Training for Engineering Surveying.
	4.3 adopt scientific methods for data acquisition and analysis.	C# Programming、C Programming Language and Data Structure、Fundamentals of Error Theory and Surveying Adjustment、Surveying Data Processing and Programming、The Laser Radar Surveying Technology、Deformation Monitoring and Disasters Predicting、Engineering Surveying、Remote Sensing Digital Image Processing、 Close-range Photogrammetry、Practical Training for Satellite Navigation and Positioning、Surveying Data Processing and

		Program Design Practice Contest、Practical Training for Control Surveying、Practical Training for Photogrammetry Fundamental、Practical Training for Laser Radar Surveying Technology.
	4.4 integrate and judge the results of experiments, and get reasonable conclusions.	Document Retrieval of Science and Technology、Cartography、Scientific Paper writing、Engineering Surveying、Spatial Analysis and Modeling、Practical Training for Real Estate Surveying and Management、Practical Training for Laser Radar Surveying Technology、Comprehensive Practice for Spatial Information、Graduation design.
5. Using modern tools: Have the ability to solve complex engineering problems by developping, selectting and using appropriate technology, resources, modern engineering tools and information technology tools, including the prediction and simulation of complex engineering problems and understanding the limitations.	5.1 choose appropriate modern surveying technology and instruments for complex surveying and mapping engineering problems.	College English(1-2)、Introduction to Computational Thinking、C Programming Language and Data Structure、CAD Basic and Application、C# Programming、Digital Topographic Surveying、The Laser Radar Surveying Technology、Technology of 3D GIS、Computer Graphics、The Detecting and Surveying for underground pipelines in City、GIS base Application Skill、Deformation Monitoring and Disasters Predicting、Engineering Surveying、Real Estate Surveying and Management、Introduction to Smart City、Technology and Application of Mobile Mapping System、Advanced Technology of Surveying,Maping and GIS、Digital Topographic Surveying Practice、Practical Training for Control Surveying、Cartography Practice、Practical Training for Engineering Surveying、Practical Training for Real Estate Surveying and Management、Practical Training for Laser Radar Surveying Technology、Surveying and Mapping Skills Practice Contest、GIS Software Development Practice.
	5.2 use modern surveying and mapping instruments and infor	Engineering Drawing and Interpreting、Advanced Mathematics A(1-2)、Theory of Probability and Statistics (B)、Digital Topographic Sur

	mation technology s oftware to complete data acquisition, data processing and accu racy analysis.	veying、Principles of Remote Sensing、Carto graphy、Photogrammetry Fundamental、Foun dation of Geodesy、Technology of Satellite n avigation and positioning、Fundamentals of E rror Theory and Surveying Adjustment、Engi neering Surveying、Deformation Monitoring a nd Disasters Predicting、Real Estate Surveyin g and Management、Remote Sensing Digital Image Processing、 Close-range Photogramme try、Digital Topographic Surveying Practice、 Practical Training for Control Surveying、Pra ctical Training for Satellite Navigation and P ositioning、GIS Practice、Practical Training f or Control Surveying、Practical Training for Engineering Surveying、Practical Training for Real Estate Surveying and Management、Pra ctical Training for Laser Radar Surveying Te chnology、Comprehensive Practice for Spatial Information、Graduation design、Surveying and Mapping Skills Practice Contest、GIS So ftware Development Practice。
	5.3 use modern tool s to predict and sim ulate complex surve ying and mapping e ngineering problems and understand their limitations.	Theory of Probability and Statistics (B)、Coll ege physics A(1-2)、Linear Algebra、Docum ent Retrieval of Science and Technology、Fu ndamentals of Error Theory and Surveying A djustment、Surveying Data Processing and Pr ogramming、Practical Training for Photogram metry Fundamental、Graduation design、Invo cation Practice(School of Surveying and Map ping Skills Contest、School of Surveying and Mapping Paper Contest).
6. Society and enginee ring: Be able to conduct rational analysis bqsed on related background knowledge and evaluat ion of the effect of prof essional engineering pra	6.1 Familiar with rel evant technical stand ards, laws and regul ations and managem ent regulations of Su rveying and mappin g, and can reasonabl	Thought Morals Accomplishment and Basic Law、Introduction to Civil Engineering、Digi tal Topographic Surveying、Principles of Re mote Sensing、Foundation of Geodesy、Tech nology of Satellite navigation and positionin g、Surveying Management and Laws、Digita l Topographic Surveying Practice、GIS Practi

ctice and complicated engineering problem solutions on society, health, and safety, law and culture based on engineering-related knowledge background, and understand the responsibilities.	y analyze based on engineering related background knowledge.	ce、Practical Training for Engineering Surveying、Engineering practice class、Graduation design.
	6.2 evaluate the impact of Surveying and mapping engineering practice and complex mapping engineering solutions on society, health, safety, law and culture, as well as the impact of these constraints on the implementation of the project, and understanding the responsibilities that should be undertaken.	The Outline of the Modern Chinese History、The Generality of Basic Principle of Marxism、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、Military Theory、Engineering Surveying、Real Estate Surveying and Management、Surveying Management and Laws、Urban Spatial Information Science、Deformation Monitoring and Disasters Predicting、Engineering Surveying、Classical appreciation and cultural inheritance、The philosophical perspective and the dialogue of civilization、Scientific and technological revolution and social development、Architectural art and aesthetic education、Ecological civilization and future cities.
7.Environment and sustainable development : Be able to understand and evaluate the impact of engineering practice on environmental and social sustainable development of complex engineering problems.	7.1 Be aware and understand the concept and connotation of environmental protection and sustainable development.	Physics Experiment(1-2)、Introduction to Geomatics、Physical geography、Remote Sensing Digital Image Processing、Geographic Conditions Monitoring、Situation and Policy(1-2).
	7.2 recognize the sustainability of Surveying and mapping engineering practice from the perspective of environmental protection and sustainable development, and to evaluate the potential damage and hidden danger to environment and society i	Marketing Management、Physical geography、Real Estate Surveying and Management、Introduction to Smart City、Geographic Conditions Monitoring、Deformation Monitoring and Disasters Predicting、Practical Training for Control Surveying、Practical Training for Real Estate Surveying and Management、Compound culture class、Graduation design.

	n the production practice of Surveying and mapping.	
8. Occupational norms: Equip with the quality of humanistic social sciences, sense of social responsibility, understand and follow professional ethics and criteria in engineering, be conscientious in the performance of one's duties.	8.1 Have the humanities and social science literacy; establish the correct world outlook, outlook on life and values.	Thought Morals Accomplishment and Basic Law、The Outline of the Modern Chinese History、The Generality of Basic Principle of Marxism、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、Military Theory、Physical Education(1-4)、Military Training.
	8.2 Understand the professional ethics and norms of the surveying and mapping industry in an honest, fair and honest code, and observe them in the practice of Surveying and mapping.	Thought Morals Accomplishment and Basic Law、The Outline of the Modern Chinese History、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、College Student Occupation Career and Development Planning、Introduction to Geomatics、Surveying Management and Laws、Situation and Policy(1-2)、Digital Topographic Surveying Practice、Practical Training for Real Estate Surveying and Management、Comprehensive Practice for Spatial Information.
	8.3 Understand the social responsibility of Surveying and mapping staff for public safety, health, welfare and environmental protection, and conscientiously fulfill their responsibilities in surveying and mapping engineering practice.	The Generality of Basic Principle of Marxism、College Student Occupation Career and Development Planning、Introduction to Geomatics、Physical geography、Surveying Management and Laws、Graduation design.
9.Individuals and teams: Be able to play an important role of individual, team member and	9.1 Able to effectively communicate with members of architecture, civil engineeri	College Student Occupation Career and Development Planning、Physical Education(1-4)、Introduction to Civil Engineering、Engineering Mechanics、Conspectus of Urban Planning、

person in charge in the team of multi-subject background.	ng and other disciplines.	Surveying Data Processing and Programming、Graduation design.
	9.2 work independently or collaborate work with others in a team.	Military Theory、Military Training、Invocation Practice(School of Surveying and Mapping Skills Contest、School of Surveying and Mapping Paper Contest)、Digital Topographic Surveying Practice、Practical Training for Control Surveying、Practical Training for Satellite Navigation and Positioning、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Practical Training for Laser Radar Surveying Technology、Surveying and Mapping Skills Practice Contest、GIS Software Development Practice.
	9.3 organize, coordinate and command the team to carry out the work.	The Outline of the Modern Chinese History、Military Theory、Cartography Practice、GIS Practice、Comprehensive Practice for Spatial Information、Practical Training for Laser Radar Surveying Technology、Graduation design.
10. Communication: Be able to communicate effectively with industry peers and social public in complex surveying and mapping engineering, including writing reports and design papers, presentations, expressing oneself and responsing instruction clearly. Have international perspective and the ability of communicating between or among interlocutors of different cultural background.	10.1 Able to effectively communicate and communicate with the surveying and mapping colleagues and the public in writing design books, technical reports and presentations.	Cartography Practice、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Graduation design.
	10.2 Have an international perspective and understand the international trend and research hotspots in the field of Surveying and mapping.	College English(1-2)、Principles of Remote Sensing、The Principle of Geographic Information System、Comprehensive Practice for Spatial Information、College English extension series（1-8)、Application of Modern Surveying and Mapping Technology、GIS base Application Skill、Remote Sensing Applicantion Prospect.
	10.3 Have the ability of cross cultural c	College English(1-2)、Scientific Paper writing、College English extension series(1-8).

	ommunicating and p aper work. . Can co mmunicate in cross culture background i n surveying and ma pping issues.	
11. Project manageme nt: Understand and mas ter the method of devel opment and managemen t for economic decision method and application in multi subject enviro nment.	11.1 Master the man agement and econo mic decision-making methods involved i n the project.	Introduction to Civil Engineering、Engineerin g Mechanics、Marketing Management、Real Estate Surveying and Management、Digital T opographic Surveying Practice、Practical Trai ning for Control Surveying、Practical Trainin g for Engineering Surveying、Graduation desi gn.
	11.2 Understand the cost structure of Sur veying and mapping production and und erstand the problems involved in enginee ring management an d economic decision -making.	Marketing Management、Surveying Managem ent and Laws、Practical Training for Satellite Navigation and Positioning、Graduation desig n.
	11.3 apply engineeri ng management and economic decision making in the proce ss of design and de velopment in a multi disciplinary environ ment.	Practical Training for Engineering Surveying、 Practical Training for Real Estate Surveying and Management、Conspectus of Urban Plan ning、Graduation design.
12. Lifelong learning: Have the awareness of autonomous learning an d lifelong learning and the ability to learn, and adapt to the developm ent.	12.1 The consciousn ess of autonomous l earning and lifelong learning.	Thought Morals Accomplishment and Basic Law、College Student Occupation Career and Development Planning、College English(1-2)、Introduction to Geomatics、Fundamentals of Error Theory and Surveying Adjustment、S urveying Management and Laws、Advanced Technology of Surveying, Maping and GIS、 College English extension series(1-8).

	12.2 Have the ability of eternal learning and adapting development.	The Generality of Basic Principle of Marxism、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、Introduction to Geomatics、Scientific Paper writing、Introduction to Smart City、Advanced Technology of Surveying, Maping and GIS、Graduation design、Invocation Practice(School of Surveying and Mapping Skills Contest、School of Surveying and Mapping Paper Contest).

X. Table of Teaching Arrangement (appendix table)

表 1　测绘工程专业指导性教学计划

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
通识教育课	必修	思想道德修养与法律基础 Thought Morals Accomplishment and Basic Law	3	48	32			16		1	马克思主义学院
		中国近现代史纲要 The Outline of the Modern Chinese History	3	48	24			24		2	马克思主义学院
		马克思主义基本原理概论★ The Generality of Basic Principle of Marxism	3	48	32			16		5	马克思主义学院
		毛泽东思想和中国特色社会主义体系理论概论★ Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism	5	80	48			32		6	马克思主义学院
		形势与政策（1-4） Situation and Policy(1-4)	2	32	16			16		1-4	马克思主义学院
		大学生职业生涯与发展规划 College Student Occupation Career and Development Planning	1	16	16					1	学工部
		大学生心理健康 The Mental health of College Students	1	16	16					2	学工部
		大学英语(1-2) ★ College English(1-2)	6	128	96				32	1、2	文法学院
		大学英语拓展系列课程（1-4）	2	32	32					3	文法学院
		大学英语拓展系列课程（5-8）	2	32	32					4	文法学院
		体育(1-4) Physical Education(1-4)	4	120	120					1-4	体育部
		计算思维导论 Introduction to Computational Thinking	1.5	56	24			32		1	电信学院
		小 计	33.5	656	488			136	32		
	核心	经典赏析与文化传承	2	32						1-8	各院部
		哲学视野与文明对话	2	32						1-8	各院部
		科技革命与社会发展	2	32						1-8	各院部
		建筑艺术与审美教育	2	32						1-8	各院部
		生态文明与未来城市	2	32						1-8	各院部
		至少修读 4 类合计 8 学分，每类至少修读 2 学分									
	选修	创新创业类	1-8 学期任选								各院部
		工程实践类	1-8 学期任选								各院部
		复合培养类	1-8 学期任选								各院部
	跨类任选至少 2 学分										
	通识教育课合计至少修读 43.5 学分，其中通识教育必修 33.5 学分，通识教育核心 8 学分，通识教育任选 2 学分										

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
大类基础课	必修	高等数学 A（1）★ Advanced Mathematics A(1)	5	96	80				16	1	理学院
		高等数学 A（2）★ Advanced Mathematics A(2)	5	80	80					2	理学院
		线性代数 Linear Algebra	2	40	32				8	2	理学院
		概率与数理统计 B Theory of Probability and Statistics (B)	3	48	44				4	3	理学院
		普通物理 A（1）★ College physics A(1)	3	56	52			4		2	理学院
		普通物理 A（2）★ College physics A(2)	3	56	52			4		3	理学院
		物理实验（1-2） Physics Experiment(1-2)	2	60		60				3、4	理学院
		工程制图与识图 Engineering Drawing and Interpreting	3	48	44				4	2	理学院
		C 语言与数据结构 ★ C Programming Language and Data Structure	3	48	32	16				1	地理信息科学系
		自然地理学 Physical geography	2	32	32					1	地理信息科学系
		测绘地理信息概论 Introduction to Geomatics	1	16	16					1	测绘学院
		CAD 基础与应用 CAD Basic and Application	2	32	16	16				1	测绘工程系
		数字地形测量学★ Digital Topographic Surveying	4	64	52	12				2	测绘工程系
		地图学 Cartography	3	48	40	8				3	地理信息科学系
		地理信息系统原理(双语)★ The Principle of Geographic Information System	3	48	40	8				3	地理信息科学系
		遥感原理★ Principles of Remote Sensing	2	32	32					3	遥感工程系
		小 计	46	804	644	120		8	32		
	选修	现代测绘技术应用 Application of Modern Surveying and Mapping Technology	1	16	8	8				2	测绘工程系
		GIS 基础应用技能 GIS base Application Skill	1	16	8	8				2	地理信息科学系
		遥感应用前景 Remote Sensing Applicantion Prospect	1	16	8	8				3	遥感工程系
		小 计	3	48	48						
	大类学科基础课合计 47 学分，必修 46 学分，任选 1 学分										
专业	必	误差理论与测量平差基础 ★Fundamentals of Error Theory and Surveying Adjustment	3	48	48					4	测绘工程系

核心课	修	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
		大地测量学基础★ Foundation of Geodesy	4	64	56	8				4	测绘工程系
		卫星导航定位技术★ Technology of Satellite navigation and positioning	3	48	44	4				5	测绘工程系
		摄影测量基础★ Photogrammetry Fundamental	3	48	40	8				5	遥感工程系
		工程测量学★ Engineering Surveying	4	64	52	12				6	测绘工程系
		小计	17	272	240	32					
	专业核心课合计必修 17 学分										
专业方向课	必修	变形监测与灾害预报 Deformation Monitoring and Disasters Predicting	2	32	24	8				5	测绘工程系
		不动产测量与管理 Real Estate Surveying and Management	2	32	28	4				7	测绘工程系
		激光雷达测量技术与应用 The Laser Radar Surveying Technology	2	32	24	8				7	测绘工程系
		小 计	6	96	76	20					
	选修	C#程序设计 C# Programming	2	32	16	16				4	地理信息科学系
		地图设计与编绘 Map Design and Compilation	2	32	16	16				4	地理信息科学系
		计算机图形学 Computer Graphics（限选）	2	32	24	8				5	地理信息科学系
		测量数据处理与程序设计 Surveying Data Processing and Programming	2	32	16	16				5	测绘工程系
		遥感数字图像处理 Remote Sensing Digital Image Processing	2	32	24	8				5	遥感工程系
		科技文献检索 Document Retrieval of Science and Technology	1	24	16			8		5	图书馆
		空间分析与建模 Spatial Analysis and Modeling	2	32	24	8				5	地理信息科学系
		工程力学 Engineering Mechanics（限选）	2	32	32					5	理学院
		土木工程概论 Introduction to Civil Engineering（限选）	2	32	32					5	土木学院
		近景摄影测量 Close-range Photogrammetry	2	32	26	6				6	遥感工程系
		三维地理信息技术 Technology of 3D GIS	2	32	16	16				6	地理信息科学系
		智慧城市导论 Introduction to Smart City	1	16	16					6	地理信息科学系

		课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
		科技论文写作（双语） Scientific Paper writing	1	16	16					6	测绘工程系
		测绘管理与法律法规 Surveying Management and Laws（限选）	1.5	24	24					6	测绘工程系
		城市空间信息学 Urban Spatial Information Science	2	32	24	8				7	地理信息科学系
		城市地下管线测量 The Detecting and Surveying for underground pipelines in City	1	16	10	6				7	测绘工程系
		移动道路测量技术及应用 Technology and Application of Mobile Mapping System	1	16	8	8				7	地理信息科学系
		地理国情监测 Geographic Conditions Monitoring	1.5	24	16	8				7	地理信息科学系
		测绘地理信息技术前沿 Advanced Technology of Surveying, Maping and GIS	1	16	16					7	测绘学院
		城市规划概论 Conspectus of Urban Planning	1.5	24	20	4				7	建筑学院
		市场营销 Marketing Management	1.5	24	24					7	经管学院
		小　计	34	552	416	128		8			
	专业方向课合计 16.5 学分，必修 6 学分，任选至少修读 10.5 学分										

表 2　测绘工程专业指导性教学计划（实践环节）

课程属性	课程名称	学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
课内	军事理论 Military Theory	2	36			1	1-3	武装部
	军训 Military Training	2	40					
	形势与政策（5-7） Situation and Policy(5-7)					5-7	分散	马院、各学院
	数字地形测量实习 Digital Topographic Surveying Practice	3	60	60		2	18-20	测绘工程系
	地图学实习 Cartography Practice	2	40	40		3	17-18	地理信息科学系
	地理信息系统原理实习 GIS Practice	2	40		40	3	19-20	地理信息科学系
	控制测量实习 Practical Training for Control Surveying	3	60	60		4	18-20	测绘工程系
	遥感原理实习 Practical Training for Principles of Remote Sensing	1	20	20		4	17	遥感工程系
	摄影测量基础实习	1	20	20		5	20	遥感工程系
	卫星导航定位实习 Practical Training for Satellite Navigation and Positioning	1	20	20		5	19	测绘工程系
	自然地理地貌及遥感图像解译实习 Natural Geography and Remote Sensing image interpretation Practice	1	20	20		6	16	遥感工程系
	工程测量综合实习 Practical Training for Engineering Surveying	4	80	80		6	17-20	测绘工程系
	空间信息综合实习 Comprehensive Practice for Spatial Information	6	120	120		7	1-6	测绘学院
	不动产测量与管理实习 Practical Training for Real Estate Surveying and Management	2	40	20	20	7	17-18	测绘工程系
	激光雷达测量技术实习 Practical Training for Laser Radar Surveying Technology	2	40	20	20	7	19-20	测绘工程系
	毕业设计与毕业答辩 Graduation design and defense	8	160	160		8	1-16	测绘工程系
	小　计	40	796	640	80			

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
课外	创新实践及科研训练	测绘技能大赛实训 Surveying and Mapping Skills Practice Contest	2	40	40		4	1-14	测绘工程系
		学院测绘技能大赛 School of Surveying and Mapping Skills Contest	1	20	20		4		测绘学院
		测量数据处理与程序设计大赛实训 Surveying Data Processing and Program Design Practice Contest	1	20	20		5		测绘工程系
		全国论文大赛 Mostrule Cup-National Paper Contest	1	20	20				测绘学院
		GIS 软件开发大赛实训 GIS Software Development Practice	1	20	20				地理信息科学系
		科研训练 Scientific research training	1	20	20				测绘工程系
	小 计		7	140	140				
实践环节合计 42 学分，课内必修 40 学分，课外（创新实践及科研训练）必修 2 学分									

2019 级测绘工程(智能导航实验班)专业
本科培养方案

一、专业基本信息

英文名称	Surveying and Mapping Engineering（Intelligent Navigation）		
专业代码	081201	学科门类	工学
学　　制	4 年	授予学位	工学学士

二、培养目标和专业特色

1.培养目标

培养具有德、智、体、美全面发展，具备数理基础和人文社科知识，掌握测绘工程与导航定位基础理论、基本知识和基本技能，接受科学思维和工程实践训练，培养从事自然资源测绘、导航定位、导航软硬件研发与位置服务等应用的专业人才，服务于城市测绘、智能交通、应急管理、互联网、航空航天等领域和部门，具有较强的组织管理能力、创新意识、继续学习能力、国际视野和智能导航特色的应用型工程技术人才。毕业后经过 5 年左右的工作和学习，能够达到如下目标:

（1）掌握数学、自然科学、工程基础、测绘理论与技术及导航定位理论与技术，胜任智慧城市数据采集、高精度导航地图生产、导航产品制造、大数据分析与位置服务以及智能导航硬件研发等专业技术工作；

（2）具有良好专业素养、丰富的产品研发经验和极强工作责任心，成为测绘地理信息及导航企事业单位中的技术负责人或技术骨干；

（3）具有继续学习适应发展的能力，能够独立或协同承担测绘地理信息及导航相关研发工作；

（4）具有良好的团队意识、国际化视野和沟通能力，能够承担团队中的领导角色。

2.专业特色

本专业依托首都建设和学校土木建筑类学科优势，培养服务首都、面向全国，具备解决智慧城市测绘相关问题，能进行导航定位产品研发及集成解决方案设计的测绘人才。适应测绘高新科技发展，融教学、科研和生产为一体，强调测绘理论、生产实践与测绘产品研发制造为一体，突出城市测绘特色，培养测绘新产品研发、新技术、新方法、新工艺的应用能力，服务于城市测绘与管理、智能交通、应急管理、互联网、航空航天等领域。

三、主干学科

测绘科学与技术

四、主干课程

1．主干基础课程

测绘地理信息概论、工程制图与识图、C 语言与数据结构、自然地理学、导航装备基础、数字地形测量学、地图学、CAD 基础与应用、误差理论与测量平差基础、地理信息系统原理（双语）、遥感原理、摄影测量基础。

2．主干专业课程

卫星导航定位技术、大地测量学基础、工程测量学、导航嵌入式系统与程序设计、高精度导航地图与位置服务、组合导航原理、室内定位与智能导航。

五、主要实践教学环节

1．主要实验

数字地形测量学实验 、卫星导航定位技术实验 、摄影测量基础实验、地理信息系统原理实验、大地测量学基础实验、工程测量学实验、导航装备基础实验。

2．主要实践环节

数字地形测量实习、卫星导航定位实习、遥感原理实习、摄影测量实习、地理信息系统实习、地图学实习、控制测量实习、导航装备基础实习、工程测量综合实习、导航定位综合实习、高精度地图采集实习、导航定位嵌入式研发实习。

六、毕业学分要求

参照北京建筑大学本科学生学业修读管理规定及学士学位授予细则，修满本专业最低计划学分应达到 167 学分，其中理论课程 122 学分，实践教学环节 45 学分(含创新实践及科研训练必修 2 学分)。

七、各类课程结构比例

课程类别	课程属性	学分	学时	学分比例
通识教育课	必修	41.5	616	24.85%
	选修	2	32	1.20%
大类基础课	必修	47	784	28.14%
	选修	1	16	0.60%
专业核心课	必修	14	224	8.38%
专业方向课	必修	8	128	4.79%
	选修	8.5	136	5.09%
独立实践环节	必修	39	776	23.35%
	选修	6	120	3.59%
总计		167	2832	100%

八、教学进程表

学期	教学周	考试	实践	学期	教学周	考试	实践
1	4-19 周	20 周	1-3 周	2	1-15 周	16 周	17-20 周
3	1-15 周	16 周	17-20 周	4	1-14 周	15 周	16-20 周
5	1-16 周	17 周	18-20 周	6	1-14 周	15 周	16-20 周
7	8-19 周	20 周	1-7 周	8	1-16 毕业设计/实习 17 周答辩		

九、毕业生应具备的知识能力及实现矩阵

毕业生应具备的知识能力	相关知识领域	实现途径（课程支撑）
1.工程知识:能够将数学、自然科学、工程基础和专业知识用于解决复杂测绘工程问题。	1.1 能够将数学、自然科学、工程科学的语言工具用于测绘工程问题的表述	计算思维导论、C 语言与数据结构、CAD 基础与应用、工程制图与识图、高等数学 A(1-2)、概率与数理统计 B、普通物理 A(1-2)、物理实验（1-2）、线性代数、土木工程概论、地图学、自然地理学、计算机图形学等。
	1.2 能针对具体的测绘对象建立数学模型并求解	高等数学 A(1-2)、线性代数、数字地形测量学、地理信息系统原理（双语）、摄影测量基础、变形监测与灾害预报、大地测量学基础、误差理论与测量平差基础、导航装备基础等。
	1.3 能够将相关知识和数学模型方法用于推演、分析测绘专业复杂工程问题	计算思维导论、CAD 基础与应用、工程制图与识图、线性代数、卫星导航定位技术、激光雷达测量技术与应用、计算机图形学、城市地下管线测量、工程测量学、城市空间信息学等。
	1.4 能够将相关知识和数学模型方法用于测绘专业复杂工程问题解决方案的比较与综合	C 语言与数据结构、概率与数理统计 B、三维地理信息技术、工业智能定位测量、数字地形测量实习、地图学实习、摄影测量基础实习、导航装备基础实习、导航定位综合实习、毕业设计等。
2.问题分析:能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析复杂测绘工程问题，以获得有效结论。	2.1 能够将数学、自然科学与工程科学的基本理论运用到识别、分析与表达	计算思维导论、C 语言与数据结构、高等数学 A(1-2)、概率与数理统计 B、物理实验（1-2）、线性代数、工程力学、土木工程概论、C#程序设计、地图学、地理信息系统原理（双语）、自然地理学、变形监测与灾害预报、空间分析与建模、摄影测量基础实习等。
	2.2 能够基于相关科学原理和数学模型方法正确表达复杂测绘工程问题	CAD 基础与应用、数字地形测量学、误差理论与测量平差基础、测量数据处理与程序设计大赛实训、激光雷达测量技术与应用、三维地理信息技术、城市地下管线测量、室内定位与智能导航、工程测量学、移动道路测量技术及应用等。
	2.3 能够认识到解决问题有多种方案可选择，会通过文献研究寻求可替代的解决方案	C 语言与数据结构、科技文献检索、摄影测量基础、大地测量学基础、工程测量学、地理信息系统原理实习、自然地理地貌及遥感图像解译实习、高精度地图采集实习等。
	2.4 能运用基本原理，借助文献研究，分析过程的影响因素，获得有效结论	普通物理 A(1-2)、科技文献检索、卫星导航定位技术、控制测量实习、工程测量综合实习、毕业设计、科研团队创新训练等。
3.设计/开发解决方案:能够设计针对复杂测绘工程问题的解决方案，设计满足特定需求的系统、生产流程，并能够在设计环节中体现创新意识，考虑社会、健康、安	3.1 掌握测绘工程设计/开发全周期、全流程的基本设计/开发方法和技术，了解影响设计目标和技术方案的各种因素	计算思维导论、CAD 基础与应用、室内定位与智能导航、嵌入式系统与程序设计、智慧城市导论、空间分析与建模、工程测量学、摄影测量基础实习、工程测量综合实习、导航定位综合实习等。
	3.2 能够设计开发满足特定测绘需求的生产流程及系统	C 语言与数据结构、CAD 基础与应用、遥感原理、地理信息系统原理（双语）、摄影测量基础、卫星导航定位技术、激光雷达测量技术与应用、工程测量学、地图设计与编绘、地图学实习、卫星导航定位实习、地理信息系统原理实习、测量数据处理与程序设计大赛实训等。
	3.3 能够在测绘工程解决方案设计中体现创新意识，考虑社会、健康、安全、法律、	测绘地理信息概论、数字地形测量学、工程测量学、移动道路测量技术及应用、地理国情监测、创新实践（测绘技能大赛、测绘科技论文大赛等）、数字地形测量实习、工程

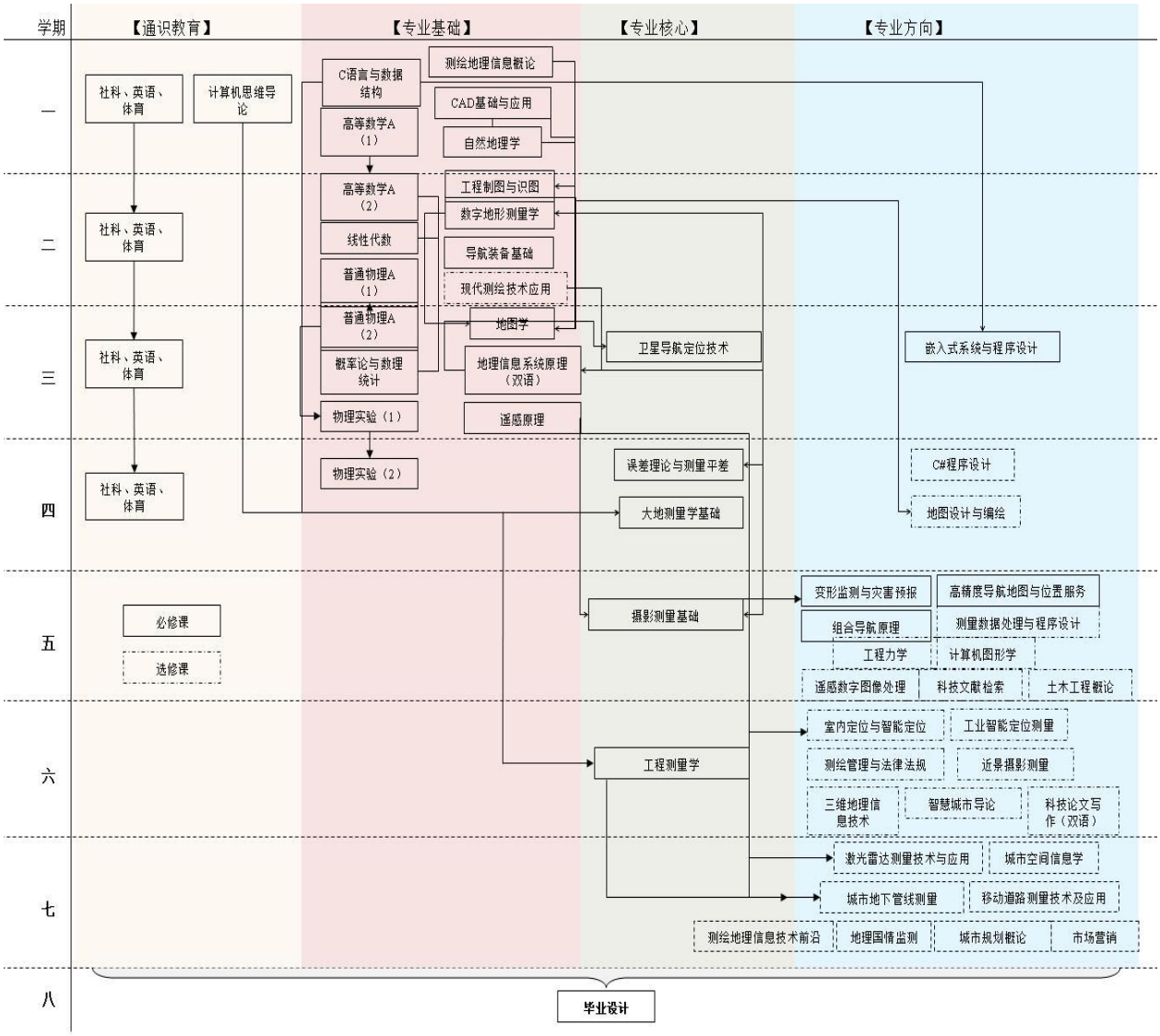
全、法律、文化以及环境等因素。	文化以及环境等因素	测量综合实习、创新创业类、毕业设计等。
4.研究：能够基于科学原理并采用科学方法对复杂测绘工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4.1能够运用科学原理对复杂测绘工程问题提出研究方案	地图学、地理信息系统原理（双语）、大地测量学基础、城市地下管线测量、工程测量学、智慧城市导论、地理国情监测、遥感原理实习、地图学实习、卫星导航定位实习等。
	4.2能够基于专业理论知识对研究方案进行设计、论证与预测	计算思维导论、工程制图与识图、遥感原理、摄影测量基础、卫星导航定位技术、工程测量综合实习等。
	4.3能够采用科学方法实施数据采集与分析处理	C#程序设计、C 语言与数据结构、误差理论与测量平差基础、测量数据处理与程序设计、激光雷达测量技术与应用、变形监测与灾害预报、工程测量学、遥感数字图像处理、工业智能定位测量、卫星导航定位实习、测量数据处理与程序设计大赛实训、控制测量实习、摄影测量基础实习等。
	4.4能够对实验结果进行信息综合与评判，取得合理有效结论	科技文献检索、地图学、科技论文写作（双语）、工程测量学、空间分析与建模、高精度地图采集实习、导航定位综合实习、毕业设计等。
5.使用现代工具：能够针对复杂测绘工程问题，开发、选择与使用恰当的测绘技术、资源、现代测绘仪器和信息技术，包括对复杂测绘工程问题的预测与模拟，并能够理解其局限性。	5.1 能够针对复杂测绘工程问题，选择恰当的现代测绘技术与仪器	大学英语（1-2）、计算思维导论、C 语言与数据结构、CAD 基础与应用、C#程序设计、数字地形测量学、激光雷达测量技术与应用、三维地理信息技术、计算机图形学、城市地下管线测量、室内定位与智能导航、变形监测与灾害预报、工程测量学、组合导航原理、智慧城市导论、移动道路测量技术及应用、测绘地理信息技术前沿、数字地形测量实习、遥感原理实习、地图学实习、工程测量综合实习、高精度地图采集实习、测绘技能大赛实训、导航定位终端嵌入式程序设计大赛等。
	5.2 能够使用现代测绘仪器和信息技术软件完成测绘数据采集、数据处理与精度分析	工程制图与识图、高等数学 A（1-2）、概率与数理统计 B、数字地形测量学、遥感原理、地图学、摄影测量基础、大地测量学基础、卫星导航定位技术、误差理论与测量平差基础、工程测量学、变形监测与灾害预报、组合导航原理、遥感数字图像处理、工业智能定位测量、数字地形测量实习、遥感原理实习、卫星导航定位实习、高精度地图采集实习、控制测量实习、工程测量综合实习、导航定位综合实习、毕业设计、测绘技能大赛实训、导航定位终端嵌入式程序设计大赛等。
	5.3 能够使用现代工具，对复杂测绘工程问题进行预测与模拟，并理解其局限性	概率与数理统计 B、普通物理（1-2）、线性代数、科技文献检索、误差理论与测量平差基础、测量数据处理与程序设计、嵌入式系统与程序设计、摄影测量基础实习、毕业设计、创新实践（测绘技能大赛、测绘科技论文大赛）等。

6.工程与社会：能够基于工程相关背景知识进行合理分析，评价测绘工程实践和复杂测绘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。	6.1 熟悉测绘专业相关技术标准、法律法规及管理规定，能够基于工程相关背景知识进行合理分析	思想道德修养与法律基础、土木工程概论、数字地形测量学、遥感原理、大地测量学基础、卫星导航定位技术、测绘管理与法律法规、数字地形测量实习、地理信息系统原理实习、工程测量综合实习、工程实践类、毕业设计等。
	6.2 能够评价测绘工程实践和复杂测绘工程问题解决方案对社会、健康、安全、法律以及文化的影响，以及这些制约因素对项目实施的影响，并理解应承担的责任	中国近现代史纲要、马克思主义基本原理概论、毛泽东思想和中国特色社会主义体系理论概论、军事理论、工程测量学、工业智能定位测量、测绘管理与法律法规、城市空间信息学、变形监测与灾害预报、工程测量学、经典赏析与文化传承、哲学视野与文明对话、科技革命与社会发展、建筑艺术与审美教育、生态文明与未来城市等。
7.环境和可持续发展：能够理解和评价针对复杂测绘工程问题的测绘工程实践对环境、社会可持续发展的影响。	7.1 知晓和理解环境保护和可持续发展的理念和内涵	物理实验（1-2）、测绘地理信息概论、自然地理学、遥感数字图像处理、地理国情监测、形势与政策（1-2）等。
	7.2 能够从环境保护和可持续发展的角度认知测绘工程实践活动的可持续性，以及评价测绘工程生产实践中可能对环境及社会造成的损害和隐患	市场营销、自然地理学、工业智能定位测量、智慧城市导论、地理国情监测、变形监测与灾害预报、控制测量实习、高精度地图采集实习、复合培养类、毕业设计等。
8.职业规范：具有人文社会科学素养、社会责任感，能够在测绘工程实践中理解并遵守测绘行业职业道德和规范，履行责任。	8.1 具有人文社会科学素养，树立正确的世界观、人生观和价值观	思想道德修养与法律基础、中国近现代史纲要、马克思主义基本原理概论、毛泽东思想和中国特色社会主义体系理论概论、军事理论、体育（1-4）、军训等。
	8.2 理解诚实公正、诚信守则的测绘行业职业道德和规范，并能在测绘工程实践中自觉遵守	思想道德修养与法律基础、中国近现代史纲要、毛泽东思想和中国特色社会主义体系理论概论、大学生职业生涯与发展规划、测绘地理信息概论、测绘管理与法律法规、形势与政策（1-2）、数字地形测量实习、高精度地图采集实习、导航定位综合实习等。
	8.3 理解测绘工作人员对公众的安全、健康、福祉、环境保护的社会责任，能够在测绘工程实践中自觉履行责任	马克思主义基本原理概论、大学生职业生涯与发展规划、测绘地理信息概论、自然地理学、测绘管理与法律法规、毕业设计等。
9.个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及责任人的角色。	9.1 能与建筑、土木等学科的成员有效沟通，合作共事	大学生职业生涯与发展规划、体育（1-4）、土木工程概论、工程力学、城市规划概论、测量数据处理与程序设计、毕业设计等。
	9.2 能够在团队中独立或合作开展工作	军事理论、军训、创新实践（测绘技能大赛、测绘科技论文大赛）、数字地形测量实习、遥感原理实习、卫星导航定位实习、控制测量实习、工程测量综合实习、测绘技能大

		赛实训、导航定位终端嵌入式程序设计大赛等。
	9.3 能够组织、协调和指挥团队开展工作	中国近现代史纲要、军事理论、地图学实习、地理信息系统原理实习、导航定位综合实习、毕业设计等。
10.沟通：能够就复杂测绘工程问题与测绘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。	10.1 能够在撰写设计书、技术报告以及陈述发言中，就复杂测绘工程问题与测绘同行及社会公众进行有效沟通和交流	地图学实习、控制测量实习、工程测量综合实习、毕业设计等。
	10.2 具备一定的国际视野，了解测绘领域的国际前沿发展趋势和研究热点	大学英语（1-2）、遥感原理、地理信息系统原理（双语）、导航定位综合实习、大学英语拓展系列课程（1-8）、现代测绘技术应用、工业智能定位测量、室内定位与智能导航等。
	10.3 具有跨文化交流的语言和书面表达能力，能够就测绘问题在跨文化背景下进行沟通和交流	大学英语（1-2）、科技论文写作（双语）、大学英语拓展系列课程（1-8）等。
11.项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	11.1 掌握工程项目中涉及的管理与经济决策方法	土木工程概论、工程力学、市场营销、工业智能定位测量、数字地形测量实习、控制测量实习、工程测量综合实习、毕业设计等。
	11.2 了解测绘生产的成本构成，理解其中涉及的工程管理与经济决策问题	市场营销、测绘管理与法律法规、卫星导航定位实习、毕业设计等。
	11.3 能在多学科环境下，在设计开发的过程中，运用工程管理与经济决策方法	工程测量综合实习、高精度地图采集实习、导航定位嵌入式研发实习、城市规划概论、毕业设计等。
12.终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	12.1 具有自主学习和终身学习的意识	思想道德修养与法律基础、大学生职业生涯与发展规划、大学英语（1-2）、测绘地理信息概论、误差理论与测量平差基础、测绘管理与法律法规、测绘地理信息技术前沿、大学英语拓展系列课程（1-8）等。
	12.2 具有不断学习和适应发展的能力	马克思主义基本原理概论、毛泽东思想和中国特色社会主义体系理论概论、测绘地理信息概论、科技论文写作（双语）、智慧城市导论、测绘地理信息技术前沿、毕业设计、创新实践（测绘技能大赛、测绘科技论文写作大赛、北斗创新创业大赛、导航定位终端嵌入式程序设计大赛、“北斗杯”全国青少年科技创新大赛）等。

十、指导性教学计划（见附表）

十一、主要课程逻辑关系结构图


学期
【通识教育】
【专业基础】
【专业核心】
【专业方向】
一
二
三
四
五
六
七
八
社科、英语、体育
计算机思维导论
C语言与数据结构
测绘地理信息概论
CAD基础与应用
高等数学A（1）
自然地理学
高等数学A（2）
工程制图与识图
数字地形测量学
线性代数
导航装备基础
普通物理A（1）
现代测绘技术应用
普通物理A（2）
地图学
概率论与数理统计
地理信息系统原理（双语）
物理实验（1）
遥感原理
物理实验（2）
卫星导航定位技术
嵌入式系统与程序设计
误差理论与测量平差
C#程序设计
大地测量学基础
地图设计与编绘
必修课
选修课
摄影测量基础
变形监测与灾害预报
高精度导航地图与位置服务
组合导航原理
测量数据处理与程序设计
工程力学
计算机图形学
遥感数字图像处理
科技文献检索
土木工程概论
室内定位与智能定位
工业智能定位测量
工程测量学
测绘管理与法律法规
近景摄影测量
三维地理信息技术
智慧城市导论
科技论文写作（双语）
激光雷达测量技术与应用
城市空间信息学
城市地下管线测量
移动道路测量技术及应用
测绘地理信息技术前沿
地理国情监测
城市规划概论
市场营销
毕业设计

2019 Undergraduate Program for Specialty in Surveying and Mapping Engineering (Intelligent Navigation)

I. Specialty Name and Code

English Name	Surveying and Mapping Engineering（Intelligent Navigation）		
Code	081201	Disciplines	Engineering
Length of Schooling	Four years	Degree	Bachelor of Engineering

II. Educational Objectives and Features

1.Objectives

This program is to cultivate all-round development of morality, intelligence, physique and beauty, basic knowledge of mathematics and Humanities and social sciences, master basic theory, basic knowledge and basic skills of Surveying and mapping engineering and navigation positioning, accept training of scientific thinking and engineering practice, and train people to engage in natural resources surveying and mapping, navigation positioning, navigation software and hardware development and location services, etc. Applied professionals serve urban surveying and mapping, intelligent transportation, emergency management, Internet, aerospace and other fields and departments. They have strong organizational and management capabilities, innovative consciousness, continuous learning ability, international vision and intelligent navigation characteristics of Applied Engineering and technical personnel. After five years after graduation to work and study, can achieve the following goals:

(1) Master mathematics, natural science, engineering foundation, surveying and mapping theory and technology, navigation and positioning theory and technology, competent for intelligent city data acquisition, high-precision navigation map production, navigation product manufacturing, large data analysis and location services, and intelligent navigation hardware development and other professional and technical work.

(2) With good professional accomplishment, rich product development experience and strong sense of responsibility, the graduate has become a technical leader or backbone in surveying and mapping geographic information and navigation enterprises and institutions.

(3) Ability to continue learning and adapt to development, and be able to independently or collaboratively undertake research and development related to surveying and mapping geographic information and navigation.

(4) Good team awareness, international vision and communication skills, able to assume leadership roles in the team.

2.Features

This program features relying on the advantages of capital construction and university civil architecture, this specialty trains surveying and mapping talents who serve the capital and face the whole country, have the ability to solve the problems related to surveying and mapping in smart cities, and can develop navigation and positioning products and design integrated solutions. To adapt to the development of high and new technology in surveying and mapping, integrate teaching, scientific research and production, emphasize the integration of surveying and mapping theory, production practice and research and manufacture of surveying and mapping products, highlight the characteristics of urban surveying and mapping, cultivate the application ability of new product development, new technology, new method and new technology in surveying and

mapping, and serve urban surveying and mapping management, intelligent transportation, emergency management, internet, aerospace and other fields.

III. Major Disciplines

Science and Technology of Surveying and Mapping

IV. **Major Courses**

1. Basic Courses

Introduction to Geomatics, Engineering Drawing and Read Drawing, C Language and Data Structure, Physical Geography, Foundation of Navigation Equipment, Digital Topographic Surveying, Cartography, CAD Basic and Application, Fundamentals of Error Theory and Surveying Adjustment, The Principle of Geographic Information System (Bilingual), Principles of Remote Sensing, Photogrammetry Fundamental.

2. Specialty Courses

Technology of Satellite navigation and positioning, Foundation of Geodesy, Engineering Surveying, High Precision Navigation Map and Location Service, Principle of Integrated Navigation, Indoor Positioning and Intelligent Navigation.

V. Major Practical Training

1. Major experiment

Experiment of Digital Topographic Surveying, experiment of Satellite Technology of Navigation and Positioning, experiment of Fundamentals of Photogrammetry, experiment of GIS Principles, experiment of Foundation of Geodesy, experiment of Engineering Surveying, and experiment of Foundation of Navigation Equipment.

2. Major Practical Training

Digital Topographic Surveying Practice, Satellite Navigation and Positioning Practice, Principles of Remote Sensing Practice, Fundamentals of Photogrammetry Practice, GIS Practice, Cartography Practice, Control Surveying Practice, Foundation of Navigation Equipment Practice, Comprehensive Training for Engineering Surveying, Comprehensive Training for Navigation and Positioning, High-precision Map Collection Practice, Navigation and Positioning Embedded Research and Development Practice.

VI. Graduation Requirements

In accordance with "Management Regulations for the Undergraduate Students of Beijing University of Civil Engineering and Architecture" and "Bachelor's Degree Awarding Regulations", the minimum credits required by specialty for graduate is 167, including 122 credits of theoretical courses and 45 credits of practice teaching (2 credits of compulsory innovation practice and scientific research training included).

VII. Proportion of Course

Course Category	Course Type	Credits	Class Hour	Proportion
General Education	Compulsory	41.5	616	24.85%
	Optional	2	32	1.20%
Big Academic Subjects	Compulsory	47	784	28.14%
	Optional	1	16	0.60%
Professional Core	Compulsory	14	224	8.38%
Professional Direction	Compulsory	8	128	4.79%
	Optional	8.5	136	5.09%
Practice	Compulsory	39	776	23.35%
	Optional	6	120	3.59%
Total		167	2832	100%

VIII.Table of Teaching Program

Semester	Teaching	Exam	Practice	Semester	Teaching	Exam	Practice
1	4-19	20	1-3	2	1-16	17	18-20
3	1-14	15-16	17-20	4	1-14	15-16	17-20
5	1-16	19-20	17-18	6	1-14	15	16-20
7	8-19	20	1-7	8	1-16 graduation project 17 defence		

IX. Graduate Abilities and Matrices

Graduate Abilities	Related Knowledge	Course Supports
1.Engineering knowledge: have the ability of solving complex Survey and Mapping engineering issues with mathematics, natural science, engineering foundation and professional knowledge.	1.1 Use language tools of mathematics, natural science and engineering science to formulate surveying and mapping engineering issues.	Introduction to Computational Thinking、C Programming Language and Data Structure、CAD Basic and Application、Engineering Drawing and Interpreting、Advanced Mathematics A(1-2)、Theory of Probability and Statistics (B)、College physics A(1-2)、Physics Experiment(1-2)、Linear Algebra、Introduction to Civil Engineering、Cartography、Physical geography、Computer Graphics.
	1.2 set up and solve mathematical models for specific surveying objects	Advanced Mathematics A(1-2)、Linear Algebra、Digital Topographic Surveying、The Principle of Geographic Information System、Photogrammetry Fundamental、Deformation Monitoring and Disasters Predicting、Foundation of Geodesy、Fundamentals of Error Theory and Surveying Adjustment、Foundation of Navigation Equipment.
	1.3 use relevant knowledge and mathematical models to deduce and analyze complex engineering	Introduction to Computational Thinking、CAD Basic and Application、Engineering Drawing and Interpreting、Linear Algebra、Technology of Satellite navigation and positioning、The Laser Radar Surveying Technology、Computer Graphics、The Detecting and Surveying for underground pipelines in City、Engineering Surveying、

	problems in surveying and mapping.	Urban Spatial Information Science.
	1.4 Solution comparison and synthesis of complex surveying and Mapping engineering problems by using relevant knowledge and mathematical modeling methods.	C Programming Language and Data Structure、Theory of Probability and Statistics (B)、Technology of 3D GIS、Industrial Intelligent Positioning Survey、Digital Topographic Surveying Practice、Cartography Practice、Practical Training for Photogrammetry Fundamental、Foundation of Navigation Equipment Pratice、Comprehensive Practice for Navigation and Positioning、Graduation design.
2.Problem analysis: Be able to apply the basic principles of mathematics, natural science and Engineering Science to identify, express, and analyze the complex engineering problems through literature research to obtain the effective conclusion.	2.1 Be able to apply the basic principles of mathematics, natural science and Engineering Science, to identify, analyze and express.	Introduction to Computational Thinking、C Programming Language and Data Structure、Advanced Mathematics A(1-2)、Theory of Probability and Statistics (B)、Physics Experiment(1-2)、Linear Algebra、Engineering Mechanics、Introduction to Civil Engineering、C# Programming、Cartography、The Principle of Geographic Information System、Physical geography、Deformation Monitoring and Disasters Predicting、Spatial Analysis and Modeling、Practical Training for Photogrammetry Fundamental.
	2.2 correctly express complex surveying and mapping engineering problems based on relevant scientific principles and mathematical models.	CAD Basic and Application、Digital Topographic Surveying、Fundamentals of Error Theory and Surveying Adjustment、Surveying Data Processing and Program Design Practice Contest、The Laser Radar Surveying Technology、Technology of 3D GIS、The Detecting and Surveying for underground pipelines in City、Indoor Positioning and Intelligent Navigation、Engineering Surveying、Technology and Application of Mobile Mapping System.
	2.3 recognize alternatives ways to solve problems, and can seek alternative solutions through literature research.	C Programming Language and Data Structure、Document Retrieval of Science and Technology、Photogrammetry Fundamental、Foundation of Geodesy、Engineering Surveying、GIS Practice、Natural Geography and Remote Sensing image interpretation Practice、High-precision Map Collection Practice.
	2.4 use the basic principles and literature research to analyze the influencing factors of the process and get effective conclusions.	College physics A(1-2)、Document Retrieval of Science and Technology、Technology of Satellite navigation and positioning、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Graduation design、Innovation Training Project of Scientific Research Team.
3. Design/Develop solutions: Be able to design solutions for complex engineering problems. The design meets the specific needs of system, the unit	3.1 Master the basic design/development methods and techniques of the whole cycle and whole process of Surveying and mapping engineering design/development, and understand various factors that affect design	Introduction to Computational Thinking、CAD Basic and Application、Indoor Positioning and Intelligent Navigation、Navigation and Positioning Embedded Research and Development Practice、Introduction to Smart City、Spatial Analysis and Modeling、Engineering Surveying、Practical Training for Photogrammetry Fundamental、Practical Training for Engineering Surveying、Comprehensive Practice for Navigation and Positioning.

(components) or process, and can embody the sense of innovation in the design process, considering the society, health, safety, law, culture and environment factors.	objectives and technical solutions.	
	3.2 Able to design and develop workflow and systems that meet specific needs of surveying.	C Programming Language and Data Structure、CAD Basic and Application、Principles of Remote Sensing、The Principle of Geographic Information System、Photogrammetry Fundamental、Technology of Satellite navigation and positioning、The Laser Radar Surveying Technology、Engineering Surveying、Map Design and Compilation、Cartography Practice、Practical Training for Satellite Navigation and Positioning、GIS Practice、Surveying Data Processing and Program Design Practice Contest.
	3.3 Be able to demonstrate innovation awareness in the design of Surveying and mapping projects, taking into account social, health, safety, law, culture and environmental factors.	Introduction to Geomatics、Digital Topographic Surveying、Engineering Surveying、Technology and Application of Mobile Mapping System、Geographic Conditions Monitoring、Invocation Practice(School of Surveying and Mapping Skills Contest、School of Surveying and Mapping Paper Contest)、Digital Topographic Surveying Practice、Practical Training for Engineering Surveying、Innovation and Entrepreneurship、Graduation design.
4.Research: Be able to study complex engineering problems, including the design of experiments, analysis and interpretation of data, and get a reasonable and effective conclusion through using scientific methods and based on scientific theory.	4.1 use scientific principles to propose a research scheme for complex surveying and mapping engineering problems.	Cartography、The Principle of Geographic Information System、Foundation of Geodesy、The Detecting and Surveying for underground pipelines in City、Engineering Surveying、Introduction to Smart City、Geographic Conditions Monitoring、Practical Training for Control Surveying、Cartography Practice、Practical Training for Satellite Navigation and Positioning.
	4.2 design, demonstrate and predict the research plan based on professional theoretical knowledge.	Introduction to Computational Thinking、Engineering Drawing and Interpreting、Principles of Remote Sensing、Photogrammetry Fundamental、Technology of Satellite navigation and positioning、Practical Training for Engineering Surveying.
	4.3 adopt scientific methods for data acquisition and analysis.	C# Programming、C Programming Language and Data Structure、Fundamentals of Error Theory and Surveying Adjustment、Surveying Data Processing and Programming、The Laser Radar Surveying Technology、Deformation Monitoring and Disasters Predicting、Engineering Surveying、Remote Sensing Digital Image

		Processing、Industrial Intelligent Positioning Survey、Practical Training for Satellite Navigation and Positioning、Surveying Data Processing and Program Design Practice Contest、Practical Training for Control Surveying、Practical Training for Photogrammetry Fundamental.
	4.4 integrate and judge the results of experiments, and get reasonable conclusions.	Document Retrieval of Science and Technology、Cartography、Scientific Paper writing、Engineering Surveying、Spatial Analysis and Modeling、High-precision Map Collection Practice、Comprehensive Practice for Navigation and Positioning、Graduation design.
5.Using modern tools: Have the ability to solve complex engineering problems by developping, selectting and using appropriate technology, resources, modern engineering tools and information technology tools, including the prediction and simulation of complex engineering problems and understanding the limitations.	5.1 choose appropriate modern surveying technology and instruments for complex surveying and mapping engineering problems.	College English(1-2)、Introduction to Computational Thinking、C Programming Language and Data Structure、CAD Basic and Application、C# Programming、Digital Topographic Surveying、The Laser Radar Surveying Technology、Technology of 3D GIS、Computer Graphics、The Detecting and Surveying for underground pipelines in City、Indoor Positioning and Intelligent Navigation、Deformation Monitoring and Disasters Predicting、Engineering Surveying、Principle of Integrated Navigation、Introduction to Smart City、Technology and Application of Mobile Mapping System、Advanced Technology of Surveying, Mapping and GIS、Digital Topographic Surveying Practice、Practical Training for Control Surveying、Cartography Practice、Practical Training for Engineering Surveying、High-precision Map Collection Practice、Surveying and Mapping Skills Practice Contest、Navigation and Positioning Embedded Research and Development Practice.
	5.2 use modern surveying and mapping instruments and information technology software to complete data acquisition, data processing and accuracy analysis.	Engineering Drawing and Interpreting、Advanced Mathematics A(1-2)、Theory of Probability and Statistics (B)、Digital Topographic Surveying、Principles of Remote Sensing、Cartography、Photogrammetry Fundamental、Foundation of Geodesy、Technology of Satellite navigation and positioning、Fundamentals of Error Theory and Surveying Adjustment、Engineering Surveying、Principle of Integrated Navigation、Remote Sensing Digital Image Processing、 Industrial Intelligent Positioning Survey、Digital Topographic Surveying Practice、Practical Training

		for Control Surveying、Practical Training for Satellite Navigation and Positioning、High-precision Map Collection Practice、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Comprehensive Practice for Navigation and Positioning、Graduation design、Surveying and Mapping Skills Practice Contest、Navigation and Positioning Terminal Embedded Programming Contest.
	5.3 use modern tools to predict and simulate complex surveying and mapping engineering problems and understand their limitations.	Theory of Probability and Statistics (B)、College physics A(1-2)、Linear Algebra、Document Retrieval of Science and Technology、Fundamentals of Error Theory and Surveying Adjustment、Surveying Data Processing and Programming、Embedded System and Programming、Practical Training for Photogrammetry Fundamental、Graduation design、Invocation Practice(Surveying and Mapping Skills Practice Contest、Surveying and Mapping Paper Contest).
6. Society and engineering: Be able to conduct rational analysis bqsed on related background knowledge and evaluation of the effect of professional engineering practice and complicated engineering problem solutions on society, health, and safety, law and culture based on engineering-related knowledge background, and understand the responsibilities.	6.1 Familiar with relevant technical standards, laws and regulations and management regulations of Surveying and mapping, and can reasonably analyze based on engineering related background knowledge.	Thought Morals Accomplishment and Basic Law、Introduction to Civil Engineering、Digital Topographic Surveying、Principles of Remote Sensing、Foundation of Geodesy、Technology of Satellite navigation and positioning、Surveying Management and Laws、Digital Topographic Surveying Practice、GIS Practice、Practical Training for Engineering Surveying、Engineering practice class、Graduation design.
	6.2 evaluate the impact of Surveying and mapping engineering practice and complex mapping engineering solutions on society, health, safety, law and culture, as well as the impact of these constraints on the implementation of the project, and understanding the responsibilities that should be undertaken.	The Outline of the Modern Chinese History、The Generality of Basic Principle of Marxism、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、Military Theory、Engineering Surveying、Industrial Intelligent Positioning Survey、Surveying Management and Laws、Urban Spatial Information Science、Deformation Monitoring and Disasters Predicting、Engineering Surveying、Classical appreciation and cultural inheritance、The philosophical perspective and the dialogue of civilization、Scientific and technological revolution and social development、Architectural art and aesthetic education、Ecological civilization and future cities.

7.Environment and sustainable development: Be able to understand and evaluate the impact of engineering practice on environmental and social sustainable development of complex engineering problems.	7.1 Be aware and understand the concept and connotation of environmental protection and sustainable development.	Physics Experiment(1-2)、Introduction to Geomatics、Physical geography、Remote Sensing Digital Image Processing、Geographic Conditions Monitoring、Situation and Policy(1-2).
	7.2 recognize the sustainability of Surveying and mapping engineering practice from the perspective of environmental protection and sustainable development, and to evaluate the potential damage and hidden danger to environment and society in the production practice of Surveying and mapping.	Marketing Management、Physical geography、Industrial Intelligent Positioning Survey、Introduction to Smart City、Geographic Conditions Monitoring、Deformation Monitoring and Disasters Predicting、Practical Training for Control Surveying、High-precision Map Collection Practice、Compound culture class、Graduation design.
8.Occupational norms: Equip with the quality of humanistic social sciences, sense of social responsibility, understand and follow professional ethics and criteria in engineering, be conscientious in the performance of one's duties.	8.1 Have the humanities and social science literacy; establish the correct world outlook, outlook on life and values.	Thought Morals Accomplishment and Basic Law、The Outline of the Modern Chinese History、The Generality of Basic Principle of Marxism、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、Military Theory、Physical Education(1-4)、Military Training.
	8.2 Understand the professional ethics and norms of the surveying and mapping industry in an honest, fair and honest code, and observe them in the practice of Surveying and mapping.	Thought Morals Accomplishment and Basic Law、The Outline of the Modern Chinese History、Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism、College Student Occupation Career and Development Planning、Introduction to Geomatics、Surveying Management and Laws、Situation and Policy(1-2)、Digital Topographic Surveying Practice、High-precision Map Collection Practice、Comprehensive Practice for Navigation and Positioning.
	8.3 Understand the social responsibility of Surveying and mapping staff for public safety, health, welfare and environmental	The Generality of Basic Principle of Marxism、College Student Occupation Career and Development Planning、Introduction to Geomatics、Physical geography、Surveying Management and Laws、Graduation design.

	protection, and conscientiously fulfill their responsibilities in surveying and mapping engineering practice.	
9.Individuals and teams: Be able to play an important role of individual, team member and person in charge in the team of multi-subject background.	9.1 Able to effectively communicate with members of architecture, civil engineering and other disciplines.	College Student Occupation Career and Development Planning、Physical Education(1-4)、Introduction to Civil Engineering、Engineering Mechanics、Conspectus of Urban Planning、Surveying Data Processing and Programming、Graduation design.
	9.2 work independently or collaborate work with others in a team.	Military Theory、Military Training、Invocation Practice(School of Surveying and Mapping Skills Contest、School of Surveying and Mapping Paper Contest)、Digital Topographic Surveying Practice、Practical Training for Control Surveying、Practical Training for Satellite Navigation and Positioning、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Surveying and Mapping Skills Practice Contest、Navigation and Positioning Terminal Embedded Programming Contest.
	9.3 organize, coordinate and command the team to carry out the work.	The Outline of the Modern Chinese History、Military Theory、Cartography Practice、GIS Practice、Comprehensive Practice for Navigation and Positioning、Graduation design.
10. Communication: Be able to communicate effectively with industry peers and social public in complex surveying and mapping engineering, including writing reports and design papers, presentations,	10.1 Able to effectively communicate and communicate with the surveying and mapping colleagues and the public in writing design books, technical reports and presentations.	Cartography Practice、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Graduation design.
	10.2 Have an international perspective and understand the international trend and research hotspots in the field of Surveying and mapping.	College English(1-2)、Principles of Remote Sensing、The Principle of Geographic Information System、Comprehensive Practice for Navigation and Positioning、College English extension series（1-8）、Application of Modern Surveying and Mapping Technology、Industrial Intelligent Positioning Survey、Indoor Positioning and Intelligent Navigation.

expressing oneself and responsing instruction clearly. Have international perspective and the ability of communicating between or among interlocutors of different cultural background.	10.3 Have the ability of cross cultural communicating and paper work. . Can communicate in cross culture background in surveying and mapping issues.	College English(1-2)、Scientific Paper writing、College English extension series(1-8).
11.Project management: Understand and master the method of development and management for economic decision method and application in multi subject environment.	11.1 Master the management and economic decision-making methods involved in the project.	Introduction to Civil Engineering、Engineering Mechanics、Marketing Management、Industrial Intelligent Positioning Survey、Digital Topographic Surveying Practice、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Graduation design.
	11.2 Understand the cost structure of Surveying and mapping production and understand the problems involved in engineering management and economic decision-making.	Marketing Management、Surveying Management and Laws、Practical Training for Satellite Navigation and Positioning、Graduation design.
	11.3 apply engineering management and economic decision making in the process of design and development in a multidisciplinary environment.	Practical Training for Engineering Surveying、High-precision Map Collection Practice、Navigation and Positioning Embedded Research and Development Practice、Conspectus of Urban Planning、Graduation design.
12.Lifelong learning: Have the awareness of autonomous learning and lifelong learning and the ability to learn, and adapt to the development.	12.1 The consciousness of autonomous learning and lifelong learning.	Thought Morals Accomplishment and Basic Law、College Student Occupation Career and Development Planning、College English(1-2)、Introduction to Geomatics、Fundamentals of Error Theory and Surveying Adjustment、Surveying Management and Laws、Advanced Technology of Surveying,Maping and GIS、College English extension series(1-8).
	12.2 Have the ability of eternal learning and adapting development.	The Generality of Basic Principle of Marxism、Introduction to Mao Zedong Thoughts and Theoretical System of the

		Chinese characteristic socialism、Introduction to Geomatics、Scientific Paper writing、Introduction to Smart City、Advanced Technology of Surveying,Maping and GIS、Graduation design、Invocation Practice(Surveying and Mapping Skills Contest、Surveying and Mapping Paper Contest、Beidou Innovation and Entrepreneurship Contest、Navigation and Positioning Terminal Embedded Programming Contest、Beidou Cup National Youth Science and Technology Innovation Contest).

X.Table of Teaching Arrangement (appendix table)

表 1　测绘工程（智能导航实验班）专业指导性教学计划

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
通识教育课	必修	思想道德修养与法律基础 Thought Morals Accomplishment and Basic Law	3	48	32			16		1	马克思主义学院
		中国近现代史纲要 The Outline of the Modern Chinese History	3	48	24			24		2	马克思主义学院
		马克思主义基本原理概论★ The Generality of Basic Principle of Marxism	3	48	32			16		5	马克思主义学院
		毛泽东思想和中国特色社会主义体系理论概论★ Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism	5	80	48			32		6	马克思主义学院
		形势与政策（1-4） Situation and Policy(1-4)	2	32	16			16		1-4	马克思主义学院
		大学生职业生涯与发展规划 College Student Occupation Career and Development Planning	1	16	16					1	学工部
		大学生心理健康 The Mental health of College Students	1	16	16					2	学工部
		大学英语(1-2) ★ College English(1-2)	6	128	96				32	1、2	文法学院
		大学英语拓展系列课程（1-4）	2	32	32					3	文法学院
		大学英语拓展系列课程（5-8）	2	32	32					4	文法学院
		体育(1-4) Physical Education(1-4)	4	120	120					1-4	体育部
		计算思维导论 Introduction to Computational Thinking	1.5	56	24			32		1	电信学院
		小 计	33.5	656	488			136	32		
	核心	经典赏析与文化传承	2	32						1-8	各院部
		哲学视野与文明对话	2	32						1-8	各院部
		科技革命与社会发展	2	32						1-8	各院部
		建筑艺术与审美教育	2	32						1-8	各院部
		生态文明与未来城市	2	32						1-8	各院部
		至少修读 4 类合计 8 学分，每类至少修读 2 学分									
	选修	创新创业类	1-8 学期任选								各院部
		工程实践类	1-8 学期任选								各院部
		复合培养类	1-8 学期任选								各院部
	跨类任选至少 2 学分										
	通识教育课合计至少修读 43.5 学分，其中通识教育必修 35.5 学分，通识教育核心 8 学分，通识教育任选 2 学分										

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
大类基础课	必修	高等数学 A（1）★ 或 B、C Advanced Mathematics A(1)	5	80	80				16	1	理学院
		高等数学 A（2）★ 或 B、C Advanced Mathematics A(2)	5	80	80					2	理学院
		线性代数 Linear Algebra	2	32	32				8	2	理学院
		概率与数理统计 B Theory of Probability and Statistics (B)	3	44	44				4	3	理学院
		普通物理 A（1）★ College physics A(1)	3	52	52			4		2	理学院
		普通物理 A（2）★ College physics A(2)	3	52	52			4		3	理学院
		物理实验（1-2） Physics Experiment(1-2)	2	60		60				3、4	理学院
		工程制图与识图 Engineering Drawing and Interpreting	3	48	44				4	2	理学院
		C 语言与数据结构 ★ C Programming Language and Data Structure	3	48	32	16				1	地理信息科学系
		自然地理学 Physical geography	2	32	32					1	地理信息科学系
		测绘地理信息概论 Introduction to Geomatics	1	16	16					1	测绘学院
		CAD 基础与应用 CAD Basic and Application	2	32	16	16				1	测绘工程系
		导航装备基础 Foundation of Navigation Equipment	3	48	44	4				2	测绘工程系
		数字地形测量学★ Digital Topographic Surveying	4	64	52	12				2	测绘工程系
		地图学 Cartography	2	32	24	8				3	地理信息科学系
		地理信息系统原理(双语)★ The Principle of Geographic Information System	2	32	24	8				3	地理信息科学系
		遥感原理★ Principles of Remote Sensing	2	32	32					3	遥感科学与技术系
		小 计	47	784	656	124		8	32		
	选修	现代测绘技术应用 Application of Modern Surveying and Mapping Technology	1	16	8	8				2	测绘工程系
		小 计	1	16	8	8					
	学科基础课合计 48 学分，必修 47 学分，任选 1 学分										
专业核心课	必修	卫星导航定位技术★ Technology of Satellite navigation and positioning	3	48	44	4				3	测绘工程系
		误差理论与测量平差基础★ Fundamentals of Error Theory and Surveying Adjustment	3	48	48					4	测绘工程系
		大地测量学基础★ Foundation of Geodesy	3	48	40	8				4	测绘工程系
		摄影测量基础★ Photogrammetry Fundamental	2	32	32					5	遥感科学与技术系
		工程测量学★ Engineering Surveying	3	48	36	12				6	测绘工程系
		小计	14	224	200	24					
	专业核心课合计必修 17 学分										

		课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
专业方向课	必修	嵌入式系统与程序设计 Embedded System and Programming	2	32	32					3	遥感科学与技术系
		变形监测与灾害预报 Deformation Monitoring and Disasters Predicting	2	32	24	8				5	测绘工程系
		高精度导航地图与位置服务 High Precision Navigation Map and Location Service	2	32	32					5	测绘工程系
		组合导航原理 Principle of Integrated Navigation	2	32	24	8				5	测绘工程系
		小 计	8	128	112	16					
	选修	C#程序设计 C# Programming	2	32	16	16				4	地理信息科学系
		地图设计与编绘 Map Design and Compilation	2	32	16	16				4	地理信息科学系
		计算机图形学 Computer Graphics	2	32	24	8				5	地理信息科学系
		测量数据处理与程序设计 Surveying Data Processing and Programming	2	32	16	16				5	测绘工程系
		遥感数字图像处理 Remote Sensing Digital Image Processing	2	32	24	8				5	遥感科学与技术系
		科技文献检索 Document Retrieval of Science and Technology	1	24	16			8		5	图书馆
		空间分析与建模 Spatial Analysis and Modeling	2	32	24	8				5	地理信息科学系
		工程力学 Engineering Mechanics	2	32	32					5	理学院
		土木工程概论 Introduction to Civil Engineering	2	32	32					5	土木学院
		室内定位与智能导航 Indoor Positioning and Intelligent Navigation	2	32	28	4				6	测绘工程系
		工业智能定位测量 Industrial Intelligent Positioning Survey	2	32	32					6	测绘工程系
		科技论文写作（双语） Scientific Paper writing	1	16	16					6	测绘工程系
		测绘管理与法律法规 Surveying Management and Laws	1.5	24	24					6	测绘工程系
		近景摄影测量 Close-range Photogrammetry	2	32	26	6				6	遥感科学与技术系
		三维地理信息技术 Technology of 3D GIS	2	32	16	16				6	地理信息科学系
		智慧城市导论 Introduction to Smart City	1	16	16					6	地理信息科学系
		激光雷达测量技术与应用 The Laser Radar Surveying Technology	2	32	24	8				7	测绘工程系
		城市空间信息学 Urban Spatial Information Science	2	32	24	8				7	地理信息科学系

		课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
		城市地下管线测量 The Detecting and Surveying for underground pipelines in City	1	16	10	6				7	测绘工程系
		移动道路测量技术及应用 Technology and Application of Mobile Mapping System	1	16	8	8				7	地理信息科学系
		地理国情监测 Geographic Conditions Monitoring	1.5	24	16	8				7	地理信息科学系
		测绘地理信息技术前沿 Advanced Technology of Surveying,Maping and GIS	1	16	16					7	测绘学院
		城市规划概论 Conspectus of Urban Planning	1.5	24	20	4				7	建筑学院
		市场营销 Marketing Management	1.5	24	24					7	经管学院
		小 计	40	648	500	140		8			
	专业方向课合计 16.5 学分，必修 8 学分，任选至少修读 8.5 学分										

表 2　测绘工程（智能导航实验班）专业指导性教学计划

（实践环节）

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
课内	军事理论 Military Theory		2	36			1	1-3	武装部
	军训 Military Training		2	40					
	导航装备基础实习 Foundation of Navigation Equipment Pratice		1	20	20		2	17	测绘工程系
	数字地形测量实习 Digital Topographic Surveying Practice		3	60	60		2	18-20	测绘工程系
	卫星导航定位实习 Practical Training for Satellite Navigation and Positioning		2	40	40		3	17-18	测绘工程系
	地理信息系统原理实习 GIS Practice		2	40		40	3	19-20	地理信息科学系
	导航定位嵌入式研发实习 Navigation and Positioning Embedded Research and Development Practice		1	20		20	4	16	测绘工程系
	遥感原理实习 Practical Training for Principles of Remote Sensing		1	20	20		4	17	遥感科学与技术系
	控制测量实习 Practical Training for Control Surveying		3	60	60		4	18-20	测绘工程系
	高精度地图采集实习 High-precision Map Collection Practice		1	20	20		5	19	测绘工程系
	摄影测量基础实习 Foundation of Photogrammetry Practice		1	20	20		5	20	遥感科学与技术系
	自然地理地貌及遥感图像解译实习 Natural Geography and Remote Sensing image interpretation Practice		1	20	20		6	15	遥感科学与技术系
	工程测量综合实习 Practical Training for Engineering Surveying		4	80	80		6	17-20	测绘工程系
	导航定位综合实习 Comprehensive Practice for Navigation and Positioning		7	140	140		7	1-7	测绘工程系
	毕业设计与毕业答辩 Graduation design and defense		8	160	160		8	1-16	测绘工程系
	小　计		39	776	640	60			
课外									
	创新实践及科研训练	科研团队创新训练-导航基础研发能力实训 Innovation Training Project of Scientific Research Team	1	20	20		1-3		测绘学院
		科研团队创新训练-导航产品/系统研制能力实训 Innovation Training Project of Scientific Research Team	1	20	20		4-5		测绘学院
		科研团队创新训练-团队协作与创新创业能力实训 Innovation Training Project of Scientific Research Team	1	20	20		6-7		测绘学院

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
		测绘技能大赛实训 Surveying and Mapping Skills Practice Contest	2	40	40		4		测绘工程系
		学院测绘技能大赛 School of Surveying and Mapping Skills Contest	1	20	20		4		测绘学院
		测量数据处理与程序设计大赛实训 Surveying Data Processing and Program Design Practice	1	20	20		5		测绘工程系
		测绘科技论文写作大赛 College Students Paper Contest of Surveying and Mapping Science and Technology	1	20	20		5		测绘学院
		北斗创新创业大赛 Beidou Innovation and Entrepreneurship Contest	1	20	20		5		测绘工程系
		导航定位终端嵌入式程序设计大赛 Navigation and Positioning Terminal Embedded Programming Contest	1	20	20		4		测绘工程系
		“北斗杯”全国青少年科技创新大赛 Beidou Cup National Youth Science and Technology Innovation Contest	1	20	20				测绘工程系
	小 计		11	220	220				
实践环节合计 45 学分，课内必修 39 学分，课外（创新实践及科研训练）必修 6 学分									

2019 级地理空间信息工程专业本科培养方案

一、专业基本信息

英文名称	Geospatial Information Engineering		
专业代码	**081205T**	学科门类	工学
学　　制	四年	授予学位	工学学士

二、培养目标及特色

培养目标：

培养具有德、智、体全面发展，具备数理基础和人文社科知识，掌握地理信息基础理论、基本知识和基本技能，接受科学思维和工程实践训练，胜任城市规划、地理国情、资源管理、环境保护等领域地理信息系统的设计、生产、研发及管理工作，具有较强的组织管理能力、创新能力、继续学习能力和国际视野的复合型工程技术人才。

专业特色：

本专业依托首都建设和学校土木建筑类学科优势，培养服务首都、面向全国的城市信息化建设的专业地理信息人才。适应地理信息高新科技发展，融教学、科研和生产为一体，强调理论与实践密切结合，突出城市空间信息特色，培养地理信息系统新技术、新方法的应用及软件设计开发的综合能力，满足城市空间信息化建设的地理信息系统人才需求。

三、主干学科

测绘科学技术、地理学、计算机应用。

四、主干课程

1．主干基础课程（9 门）

测绘地理信息概论、工程制图与识图、C 语言与数据结构、自然地理学、数字地形测量学、地图学、CAD 基础与应用、地理信息系统原理（双语）、遥感原理

2．主干专业课程（6 门）

空间数据库、空间分析与建模、地理信息系统设计与开发、WebGIS 技术与开发、城市空间信息学、误差理论与测量平差基础

五、主要实践教学环节（12 门）

数字地形测量学实习、地图学实习、C#程序实习、空间数据库实习、地理信息系统原理实习、遥感原理与应用实习、地理信息系统设计与开发实习、摄影测量基础实习、空间分析与建模实习、自然地理地貌及遥感图像解译实习、综合实习、毕业设计或论文

六、毕业学分要求

参照北京建筑大学本科学生学业修读管理规定及学士学位授予细则，修满本专业最低计划学分应达到 164 学分，其中理论课程 127 学分，实践教学环节 37 学分。

七、各类课程结构比例

课程类别	课程属性	学分	学时	学分比例
通识教育课	必修	41.5	616	25.30%
	选修	2	32	1.22%
大类基础课	必修	46	804	28.05%
	选修	1	16	0.61%
专业核心课	必修	17	272	10.37%
专业方向课	必修	8	128	4.88%
	选修	11.5	184	7.01%
独立实践环节	必修	35	696	21.34%
	选修	2	40	1.22%
总计		164	2788	100%

八、教学进程表

学期	教学周	考试	实践	学期	教学周	考试	实践
1	4-19 周	20 周	1-3	2	1-16 周	17 周	18-20 周
3	1-15 周	16 周	17-20 周	4	1-15 周	16 周	17-20 周
5	1-15 周	16 周	17-20 周	6	1-15、17-19 周	20 周	16 周
7	7-20 周		1-6 周	8	1-16 毕业设计/实习 17 周答辩		

九、毕业生应具备的知识能力及实现矩阵

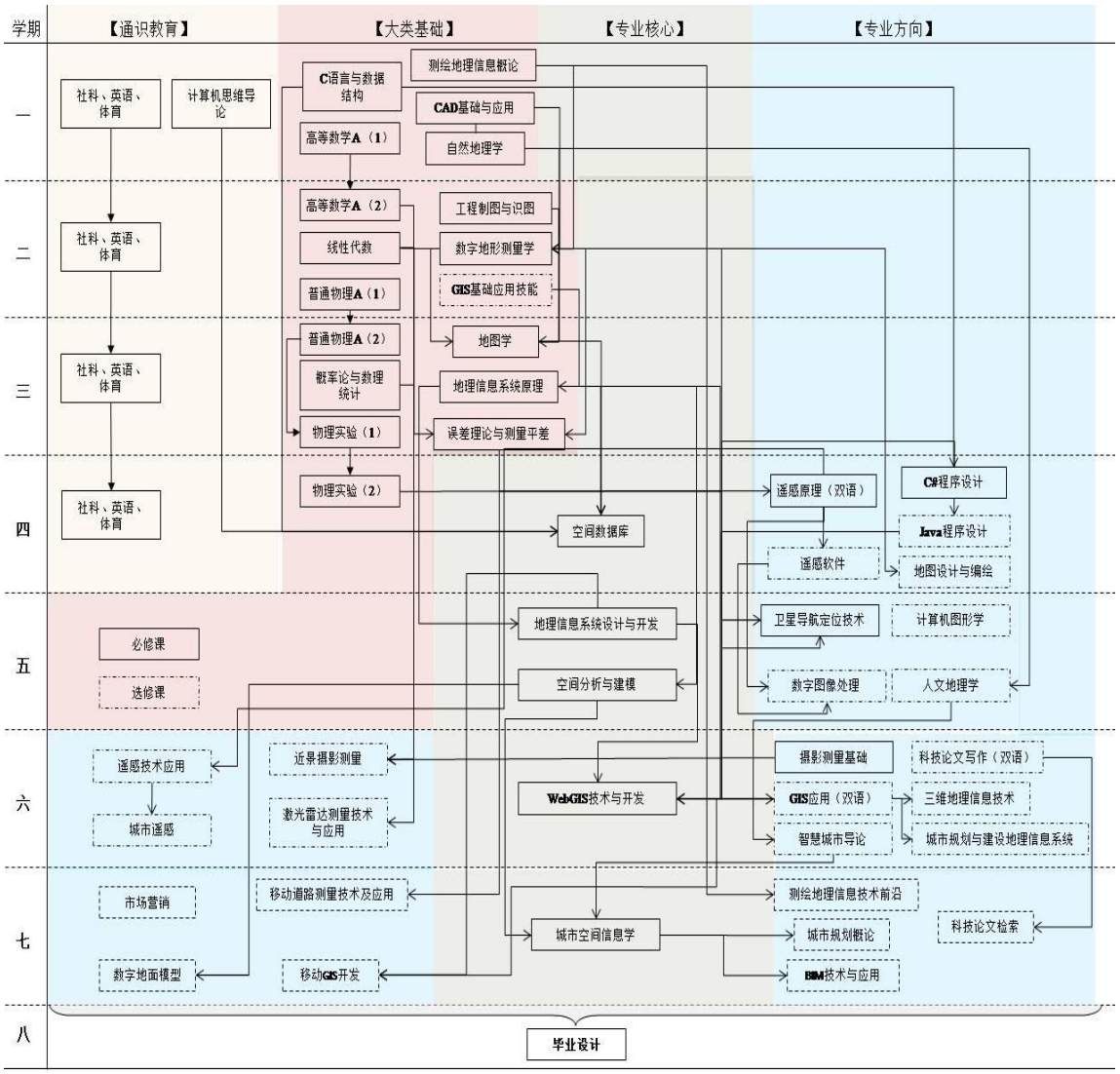
毕业生应具备的知识能力	相关知识领域	实现途径（课程支撑）
具备解决复杂工程问题的数学、地理信息科学、测绘科学、空间信息技术、建筑工程技术等知识；具有应用数学、地理信息系统工程、空间信息技术的等知识进行工程数据获取和处理的能力；应用专业知识进行测绘工程项目的技术设计、组织和实施	工程知识：能够将数学、自然科学、工程基础和专业知识用于解决复杂工程问题	高等数学、测绘地理信息概念、自然地理、地理信息系统原理、地理信息系统开发与设计、WebGIS 技术与开发、移动 GIS 开发、城市空间信息学、数字地形测量学、误差理论与测量平差基础、卫星导航定位技术、数字地形测量实习、地理信息原理实习、空间信息综合实习
能够应用数学、地理信息科学、测绘科学、空间信息科学，识别及表达复杂工程问题；通过文献查阅和研究，能够剖析复杂工程项目，选择合适的数	问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析复杂工程问题，以获得有效结论。	概率论与数理统计、地理信息系统原理、空间分析与建模、地理信息系统开发与设计、WebGIS 技术与开发、移动 GIS 开发、数字地形测

学模型，并进行推理和验证，得到有效结论		量学、误差理论与测量平差基础、卫星导航定位技术
能够根据复杂地理信息系统项目的目标、任务和要求，考虑社会、安全、法律、环境等因素，设计解决方案，编撰项目设计任务书；能够对地理信息系统项目进行技术设计，编撰相关技术文档；能够应用新技术与方法对设计方案进行改进和创新	设计/开发解决方案：能够设计针对复杂工程问题的解决方案，设计满足特定需求的系统、单元（部件）或工艺流程，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。	思想道德修养与法律基础、空间分析与建模、地理信息系统开发与设计、WebGIS 技术与开发、移动 GIS 开发、数字地形测量实习、激光雷达测量技术与应用、移动道路测量技术及应用、卫星导航定位技术、空间信息综合实习、毕业设计
能够利用地理信息科学与技术对复杂地理信息系统问题进行探索和研究；能够利用地理信息系统新技术和计算机技术，进行创新型实验设计，并通过分析解释和改进，得到合理有效的结论	研究：能够基于科学原理并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。	空间分析与建模、地理信息系统开发与设计、WebGIS 技术与开发、移动 GIS 开发、误差理论与测量平差基础、数字地形测量学、毕业设计、激光雷达测量技术与应用
熟练掌握现代空间数据获取仪器设备、计算机、数字绘图、网络等现代工具的应用；能使用现代工具对工程方案进行优化设计、对监测过程进行模拟和灾害预测	使用现代工具：能够针对复杂工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂工程问题的预测与模拟，并能够理解其局限性。	计算思维导论、C 语言与数据结构、C#程序设计、空间分析与建模、CAD 基础与应用、三维地理信息技术、误差理论与测量平差基础、移动 GIS 开发、数字地面模型
理解地理信息系统成果的重要性，并能客观评价其对工程安全和社会等影响；对所实施的工程质量负责，并理解应承担的责任	工程与社会：能够基于工程相关背景知识进行合理分析，评价专业工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。	思想道德修养与法律基础、地理信息系统原理、空间分析与建模、城市规划与建设地理信息系统、遥感原理
理解地理信息学科的实践活动与环境保护和社会可持续发展的关系，具备分析地理信息工程的实践活动对环境保护和社会可持续发展的影响的能力	环境和可持续发展：能够理解和评价针对复杂工程问题的工程实践对环境、社会可持续发展的影响。	遥感原理、概率论与数理统计、自然地理地貌及遥感图像解译实习
理解马克思主义世界观、人生观和价值观的基本意义；了解	职业规范：具有人文社会科学素养、社会责任感，能够在工程实	马克思主义基本原理概论、思想道德修养和法律基础、

国史国情，理解中国特色社会主义道路以及个人的责任；理解职业道德的含义和工程师的职业和责任	践中理解并遵守工程职业道德和规范，履行责任。	中国近现代史纲要、毛泽东思想和中国特色社会主义理论体系概论、测绘地理信息概论、空间信息综合实习、数字地形测量实习
能够理解一个多角色团队中每个角色的含义以及对整个团队环境和目标的意义；能够在团队中做好自己承担的角色，具备综合团队成员的意见并进行合理决策的能力	个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	物理实验、军训、地理信息系统开发与设计、空间信息综合实习、数字地形测量实习
能够就地理信息系统工程问题与同行进行有效沟通和交流，包括撰写项目报告和设计文档，并能够清晰表达；具备一定的国际视野和在跨文化背景下沟通和交流的能力	沟通：能够就复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	地理信息系统开发与设计、毕业设计、毕业答辩、大学英语、大学英语拓展系列课程、科技文献检索、科技论文写作
理解并掌握地理信息系统开发管理与经济决策方法；能在多学科环境中应用地理信息系统管理与经济决策的技术和方法	项目管理：理解并掌握工程管理原理与经济决策方法，并能在多学科环境中应用。	市场营销、人文地理、自然地理学、城市规划概论、遥感图像处理、BIM 技术与应用
能够认识不断进行自我学习的必要性，并采用有效途径，通过不断学习，提升和完善自身能力；通过自我学习能够取得一定的成效	终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	大学英语、误差理论与测量平差基础、C 语言与数据结构、科技论文写作、测绘地理信息概论、科技文献检索

十、指导性教学计划（见附表）

十一、主要课程逻辑关系结构图


学期
【通识教育】
【大类基础】
【专业核心】
【专业方向】
一
二
三
四
五
六
七
八
社科、英语、体育
计算机思维导论
C语言与数据结构
测绘地理信息概论
CAD基础与应用
高等数学A（1）
自然地理学
高等数学A（2）
工程制图与识图
线性代数
数字地形测量学
普通物理A（1）
GIS基础应用技能
普通物理A（2）
地图学
概率论与数理统计
地理信息系统原理
物理实验（1）
误差理论与测量平差
物理实验（2）
遥感原理（双语）
C#程序设计
空间数据库
Java程序设计
遥感软件
地图设计与编绘
必修课
选修课
地理信息系统设计与开发
卫星导航定位技术
计算机图形学
空间分析与建模
数字图像处理
人文地理学
遥感技术应用
近景摄影测量
摄影测量基础
科技论文写作（双语）
城市遥感
激光雷达测量技术与应用
WebGIS技术与开发
GIS应用（双语）
三维地理信息技术
智慧城市导论
城市规划与建设地理信息系统
市场营销
移动道路测量技术及应用
测绘地理信息技术前沿
科技论文检索
城市空间信息学
城市规划概论
数字地面模型
移动GIS开发
BIM技术与应用
毕业设计

2019 Undergraduate Program for Specialty in Geospatial Information Engineering

I. Specialty Name and Code

English Name	Geospatial Information Engineering		
Code	**081205T**	Disciplines	Bachelor of Engineering
Length of Schooling	4 years	Degree	Bachelor of Engineering

II. Educational Objectives and Features

Objectives: This program is to cultivate inter-disciplinary engineering talents, fully developed in morality, intelligence and physique, well equipped with mathematical science and social science, and highly skilled in basic theory, knowledge and profession of geographical information system. The students are required to have the systematic training of scientific thinking and engineering practice, so that they are competent in design, production, R&D and management of geographical information system, including urban planning, geographical conditions and environmental protection. Besides, the graduates have a good ability of organizing, innovation, learning, and international vision as well.

Features: This program features integrating the teaching, research and production together with the development of high-technology, stressing the combination of theory and practice, highlighting the urban spatial information characteristics, and pinpointing the comprehensive ability of application of new GIS technologies and software development. Based on the construction of Beijing and with the advantages of the civil construction disciplines of the University, this program aims to cultivate professional GIS talents for the urban informatization construction of Beijing and the whole country.

III. Major Disciplines

Surveying Science and Technology, Geography, Computer Application

IV. Major Courses

1. Basic Courses

Introduction to Geomatics, Engineering Drawing and Read Drawing, C Language and Data Structure, Physical Geography, Digital Topographic Surveying, CAD Basic and Application, The Principle of Geographic Information System (Bilingual), Principles of Remote Sensing

2. Specialty Courses

Spatial Database, Spatial Analysis and Modeling, Programming and Development for GIS, WebGIS Technology and Development, Urban Spatial Information Science, Fundamentals of Error Theory and Surveying Adjustment

V. Major Practical Training

Digital Topographic Surveying Practice, Cartography Practice, C# Programming Practice, Spatial Analysis and Modeling Practice, The Principle of Geographic Information System Practice,

Principles of Remote Sensing Practice, Programming and Development of GIS Practice, Photogrammetry Fundamental Practice, Spatial Analysis and Modeling Practice, Natural Geography and Remote Sensing Practice, Comprehensive Practice, Graduation Project or Thesis

VI. Graduation Requirements

In accordance with "Management Regulations for the Undergraduate Students of Beijing University of Civil Engineering and Architecture" and "Bachelor's Degree Awarding Regulations", the minimum credits required by specialty for graduate is 164, including 127 credits of theoretical courses and 37 credits of practice teaching.

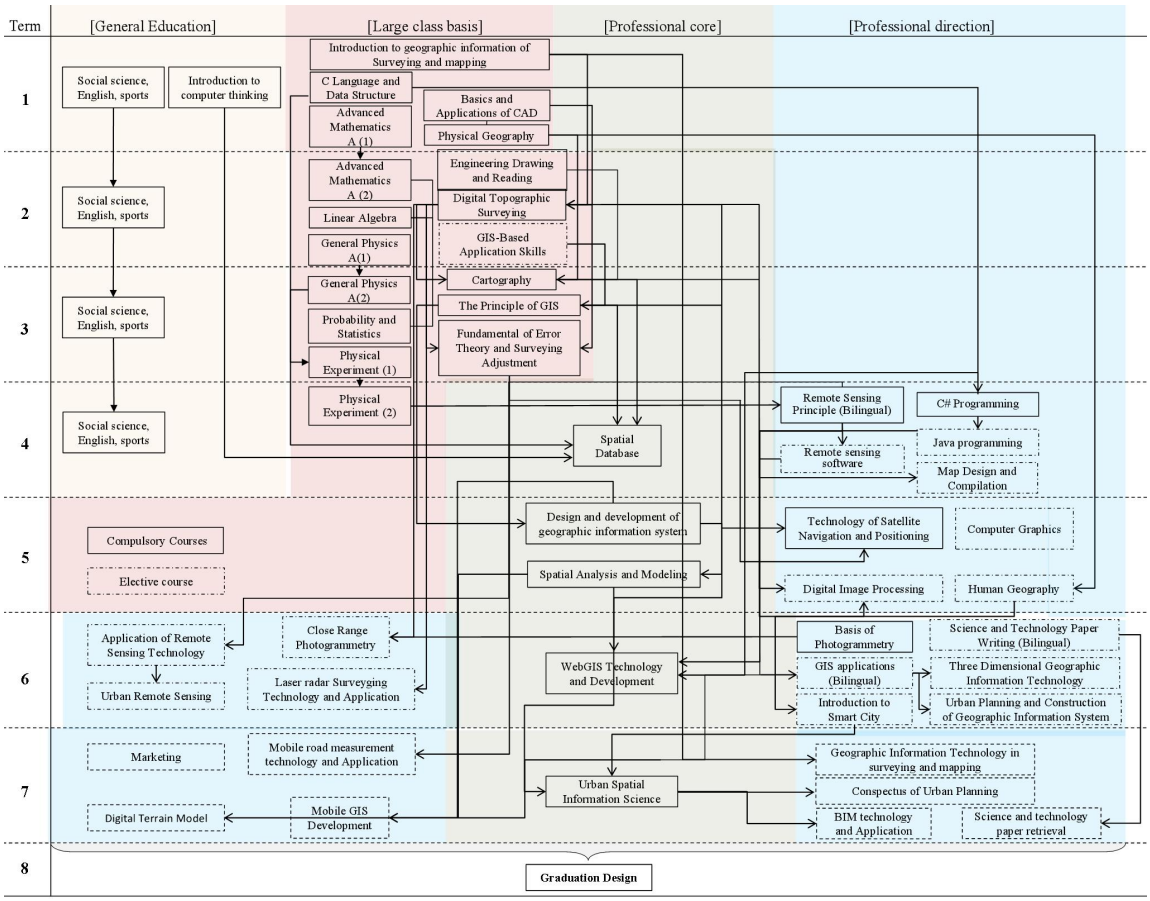
VII. Proportion of Course

Course Category	Course Type	Credits	Class Hour	Proportion
General Education	Compulsory	41.5	616	25.30%
	Optional	2	32	1.22%
Big Academic Subjects	Compulsory	46	804	28.05%
	Optional	1	16	0.61%
Professional Core	Compulsory	17	272	10.37%
Professional Direction	Compulsory	8	128	4.88%
	Optional	11.5	184	7.01%
Practice	Compulsory	35	696	21.34%
	Optional	2	40	1.22%
Total		164	2788	100%

VIII. Table of Teaching Program

Semester	Teaching	Exam	Practice	Semester	Teaching	Exam	Practice
1	4-19	20	1-3	2	1-16	17	18-20
3	1-15	16	17-20	4	1-15	16	17-20
5	1-15	16	17-20	6	1-15、17-19	20	16
7	7-20		1-6	8	1-16 Undergraduate Design or Thesis 17 Graduation reply		

IX. Table of Teaching Arrangement



X. **Graduate Abilities and Matrices**

Graduate Abilities	Related Knowledge	Course Supports
Master mathematics, geographic in formation science, surveying and mapping science, spatial informatio n technology, construction technolo gy and other knowledge to solve t he problems of complex engineeri ng; Ability of engineering data acq uisition and processing with mathe matics, geographic information syst ems engineering, spatial informatio n technology, etc.; Technical desig n, organization and implementation of Surveying and mapping engine ering project with professional kno wledge.	Engineering knowledge: ha ve the ability of solving c omplex engineering proble ms with mathematics, natu ral science, engineering fo undation and professional knowledge.	Advanced Mathematics, Mapping Geographic Information Concept, Physical Geography, Principle of Geographic Information System, G eographic Information System Dev elopment and Design, WebGIS Te chnology and Development, Mobil e GIS Development, Urban Spatial Information Science, Digital Topo graphic Surveying, Fundamentals o f Error Theory and Surveying Adj ustment, Technology of Satellite N avigation and Positioning, Digital Topographic Survey Practice, Princ iple of Geographic Information Pr actice, Space information Compreh

		ensive Practice
Identify and express complex engineering problems by applying mathematics, geography information science, surveying and Mapping Science and spatial information science; be able to analyze complex projects, select the appropriate mathematical model, and conduct reasoning and verification to get an effective conclusion Through literature review and research.	Problem analysis: Be able to apply the basic principles of mathematics, natural science and Engineering Science, identify, express, and analyze the complex engineering problems through literature research to obtain the effective conclusion.	Probability and Statistics, Principle of Geographic Information System, Spatial Analysis and Modeling, GIS Design and Programming, WebGIS Technology and Development, Mobile GIS Development, Digital Topographic Surveying, Fundamentals of Error Theory and Surveying Adjustment, Technology of Satellite Navigation and Positioning
According to the objectives, tasks and requirements of the complex geographic information system project, considering the social, security, legal, environmental and other factors, design solutions, compile the project design task book; be able to design and compile the relevant technical documents, and to apply new technologies and methods to improve and innovate the design scheme.	Design/Develop solutions: Be able to solve complex engineering problems with design solutions. The design meets the specific needs of system, the unit (components) or process, and can embody the sense of innovation in the design process, considering the society, health, and safety, law, culture and environment factors.	Moral Education and Foundation of Law, Spatial Analysis and Modeling, GIS Design and Programming, WebGIS Technology and Development, Mobile GIS Development, Digital Topographic Survey Practice, Laser Radar Surveying Technology and Application, Technology and Application of Mobile Mapping System, Technology of Satellite Navigation and Positioning, Space Information Comprehensive Practice, Graduation Project
Be able to use geographic information science and technology to explore and study the problem of complex geographic information system; be able to use the new technology and computer technology of geographic information system to carry out innovative experimental design, and get a reasonable and effective conclusion through the analysis of the interpretation and improvement.	Study: Be able to study complex engineering problems, including the design of experiments, analysis and interpretation of data, and get a reasonable and effective conclusion through the comprehensive information by using scientific methods based on scientific theory.	Spatial Analysis and Modeling, GIS Design and Programming, Web GIS technology and development, Mobile GIS Development, Fundamentals of Error Theory and Surveying Adjustment, Digital Topographic Surveying, Graduation Project, Laser Radar Surveying Technology and Application

Understand the relationship between the practice of GIS and environmental protection and social sustainable development. Have the ability to analyze the impact of geographic information engineering practices on environmental protection and social sustainable development.	Environment and sustainable development：Be able to understand and evaluate the influence of engineering practice with complex engineering problems for sustainable development of environment and society.	Principles and Applications of Remote Sensing, Probability and Statistics, Natural Geography And Interpretation of Remote Sensing Images
Understand basic meaning of Marxist outlook on life and conception of value, understand the history of national conditions; understand the road of socialism with Chinese characteristics and personal responsibility; understand the meaning of professional ethics and engineer career and responsibility.	Occupational norms: Equip with the quality of humanistic social sciences, sense of social responsibility, understand and follow professional ethics and criteria in engineering, be conscientious in the performance of one's duties	Basic Theory of Marxism, Moral Education and Foundation of Law, The Outline of Modern Chinese History, Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics, Introduction to Geographic Information of Surveying and Mapping, Practical Sessions of Spatial Information Synthesis, Practical Sessions of Digital Topographic Survey
Be able to understand the value of each role in a team and the significance to the environment and objectives. Be able to take responsibility for the team, and have the ability to integrate ideas for making reasonable decisions.	Individuals and teams: Be able to play an important role of individual, team member and person in charge in the team of multi-subject background.	Physics Experiment, Military Training, Programming and Design for GIS, Spatial Information Comprehensive, Practice of Digital Terrain Surveying
Be able to communicate effectively and express clearly with peers on geographic information systems engineering, including project report and design scheme. Have international perspective and the ability of communicating between or among interlocutors of different cultural background	Communication: Be able to communicate effectively with industry peers in complex engineering, including writing reports and design papers, summary statement, express oneself and response instruction clearly. Have international perspective and the ability of communicating between or	Programming and Design for GIS, Graduation Project, Defense of Graduation Project, College English, College English Development, Science and Technology Document Retrieval, Academic Writing

	among interlocutors of different cultural background	
Understand and master the method of development and management for economic decision method; be able to apply the techniques and methods of system management and economic decision making in a multi-disciplinary environment.	Project management: Understand and master the method of development and management for economic decision method and application in multi subject environment.	Marketing Management, Human Geography, Physical Geography, Conspectus of Urban Planning, Remote Sensing Digital Image Processing, BIM Technology and Application
Recognize the necessity of self-study. Enhance and improve their ability by studying continuously and achieve certain effectiveness eventually.	Lifelong learning: Have the awareness of autonomous learning and lifelong learning and the ability to learn, and adapt to the development.	College English, Fundamentals of Error Theory and Surveying Adjustment, C Language and Data Structure, Academic Writing, Advanced Technology of Surveying, Mapping and GIS, Science and Technology Document Retrieval

表 1　地理空间信息工程专业指导性教学计划

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
通识教育课	必修	思想道德修养与法律基础 Thought Morals Accomplishment and Basic Law	3	48	32			16		1	马克思主义学院
		中国近现代史纲要 The Outline of the Modern Chinese History	3	48	24			24		2	马克思主义学院
		马克思主义基本原理概论★ The Generality of Basic Principle of Marxism	3	48	32			16		3	马克思主义学院
		毛泽东思想和中国特色社会主义体系理论概论★ Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism	5	80	48			32		4	马克思主义学院
		形势与政策（1-4） Situation and Policy(1-4)	2	32	16			16		1-4	马克思主义学院
		大学生职业生涯与发展规划 College Student Occupation Career and Development Planning	1	16	16					1/2	学工部
		大学生心理健康 The Mental health of College Students	1	16	16					2	学工部
		大学英语(1-2) ★ College English(1-2)	6	128	96				32	1-2	文法学院
		大学英语拓展系列课程（1-4） College English training（1-4）	2	32	32					3	文法学院
		大学英语拓展系列课程（5-8） College English training（5-8）	2	32	32					4	文法学院
		体育(1-4) Physical Education(1-4)	4	120	120					1-4	体育部
		计算思维导论 Introduction to Computational Thinking	1.5	56	24			32		1	电信学院
		小 计	33.5	656	488			136	32		
	核心	经典赏析与文化传承	2	32						1-8	各院部
		哲学视野与文明对话	2	32						1-8	各院部
		科技革命与社会发展	2	32						1-8	各院部
		建筑艺术与审美教育	2	32						1-8	各院部
		生态文明与未来城市	2	32						1-8	各院部
		至少修读 4 类合计 8 学分，每类至少修读 2 学分									
	选修	创新创业类	1-8 学期任选								各院部
		工程实践类	1-8 学期任选								各院部
		复合培养类	1-8 学期任选								各院部
	跨类任选至少 2 学分										
	通识教育课合计至少修读 43.5 学分，其中通识教育必修 33.5 学分，通识教育核心 8 学分，通识教育任选 2 学分										

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
大类基础课	必修	高等数学 A（1）★ Advanced Mathematics A(1)	5	96	80				16	1	理学院
		高等数学 A（2）★ Advanced Mathematics A(2)	5	80	80					2	理学院
		线性代数 Linear Algebra	2	40	32				8	2	理学院
		概率与数理统计 B Theory of Probability and Statistics (B)	3	48	44				4	3	理学院
		普通物理 A（1）★ College physics A(1)	3	56	52			4		2	理学院
		普通物理 A（2）★ College physics A(2)	3	56	52			4		3	理学院
		物理实验（1-2）Physics Experiment(1-2)	2	60		60				3-4	理学院
		工程制图与识图 Engineering Drawing and Read Drawing	3	48	44				4	2	理学院
		C 语言与数据结构★ C Programming Language and Data Structure	3	48	32	16				1	地理信息科学系
		自然地理学 Physical geography	2	32	32					1	地理信息科学系
		测绘地理信息概论 Introduction to Geomatics	1	16	16					1	测绘学院
		CAD 基础与应用 CAD Basic and Application	2	32	16	16				1	测绘工程系
		数字地形测量学★ Digital Topographic Surveying	4	64	52	12				2	测绘工程系
		地图学 Cartography	3	48	40	8				3	地理信息科学系
		地理信息系统原理(双语) The Principle of Geographic Information System(Bilingual Education)	3	48	40	8				3	地理信息科学系
		遥感原理 Principles of Remote Sensing	2	32	32					3	遥感工程系
		合 计	46	804	644	120		8	32		
	选修	GIS 基础应用技能 GIS-based Application Skills	1	16	8	8				2	地理信息科学系
		现代测绘技术应用 Modern Surveying and Mapping Technology Application	1	16	8	8				2	测绘工程系
		遥感应用前景 Remote Sensing Application Prospect	1	16	8	8				3	遥感工程系
	大类学科基础课合计 47 学分，必修 46 学分，任选 1 学分										

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
专业核心课	必修	空间数据库 Spatial Database	3	48	32	16				4	地理信息科学系
		空间分析与建模 Spatial Analysis and Modeling	3	48	40	8				5	地理信息科学系
		地理信息系统设计与开发 Programming and Development of GIS	3	48	24	24				5	地理信息科学系
		WebGIS 技术与开发 WebGIS Technology and Development	3	48	24	24				6	地理信息科学系
		城市空间信息学 Urban Spatial Information Science	2	32	24	8				7	地理信息科学系
		误差理论与测量平差基础★ Fundamentals of Error Theory and Surveying Adjustment	3	48	48					4	测绘工程系
		小计	17	272	192	80					
		专业核心课合计必修 13 学分									
专业方向课	必修	卫星导航定位技术 Technology of Satellite navigation and positioning	2	32	28	4				5	测绘工程系
		C#程序设计 C# Programming	3	48	32	16				4	地理信息科学系
		摄影测量基础 Photogrammetry Fundamental	3	48	44	4				5	遥感工程系
		小 计	8	128							
	选修	地图设计与编绘 Map Design and Compilation	2	32	16	16				4	地理信息科学系
		Java 程序设计 Java Programming	2	32	24	8				5	地理信息科学系
		人文地理学 Human Geography	1.5	32	16	16				5	地理信息科学系
		遥感软件 Remote Sensing Software	2	32	16	16				4	遥感工程系
		Python 语言 Python language	1	16	8	8				4	地理信息科学系
		计算机图形学 Computer Graphics	2	32	24	8				5	地理信息科学系
		科技论文写作（双语） Academic Writing (Bilingual Education)	1	16	16					6	遥感工程系
		科技文献检索 Document Retrieval of Science and Technology	1	24	16			8		7	图书馆

		城市规划与建设地理信息系统 Geographic Information System for City Planning and Construction	2.5	48	24	24				6	地理信息科学系
		GIS 应用（双语） GIS Applications (Bilingual Education)	1.5	24	16	8				6	地理信息科学系
		三维地理信息技术 Technology of 3D GIS	2	32	16	16				6	地理信息科学系
		遥感技术应用 Applications of Remote Sensing Technology	2	32	16	16				6	遥感工程系
专业方向课	选修	移动 GIS 开发 Mobile GIS Development	2	32	16	16				7	地理信息科学系
		数字地面模型 Digital Terrain Model	2	32	16	16				7	地理信息科学系
		移动道路测量技术及应用 Technology and Application of Mobile Mapping System	1	16	8	8				7	地理信息科学系
		激光雷达测量技术与应用 Laser Radar Surveyging Technology and Application	2	32	24	8				6	测绘工程系
		测绘地理信息技术前沿 Advanced Technology of Surveying,Maping and GIS	1	16	16					7	测绘学院
		智慧城市导论 Introduction to Smart City	1	16	16					6	地理信息科学系
		近景摄影测量 Close Range Photogrammetry	2	32	26	6				6	遥感工程系
		城市遥感(双语)Urban Remote Sensing(Bilingual Education)	2.0	32	24	8				6	遥感工程系
		城市规划概论 Conspectus of Urban Planning	1.5	24	20	4				7	建筑学院
		遥感图像处理 Remote Sensing Image Processing	2	32	24	8				5	遥感工程系
		BIM 技术与应用 BIM Technology and Application	2	32	16	16				7	经管学院
		市场营销 Marketing Management	1.5	24	24					7	经管学院
		小计	40.5	672							
	专业方向课合计 19.5 学分，必修 8 学分，任选 11.5 学分										

表 2　地理空间信息工程专业指导性教学计划（实践环节）

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
课内	军事理论 Military Theory		2	36			1	1-3	武装部
	军训 Military Training		2	40					
	形势与政策（5-7）Situation and Policy(5-7)						5-7	分散	马院、各学院
	数字地形测量实习 Digital Topographic Surveying Practice		3	60	60		2	18-20	测绘工程系
	地图学实习 Cartography Practice		2	40			3	17-18	地理信息科学系
	C#程序实习 C# Programming Practice		2	40			4	18-19	地理信息科学系
	空间数据库实习 Spatial Database Practice		2	40			4	20	地理信息科学系
	地理信息系统原理实习 The Principle of Geographic Information System Practice		2	40			3	19-20	地理信息科学系
	遥感原理实习 Principles of Remote Sensing Practice		1	20			4	17	遥感工程系
	地理信息系统设计与开发实习 Programming and Development of GIS Practice		2	40			5	19-20	地理信息科学系
	摄影测量基础实习 Photogrammetry Fundamental Practice		1	20			5	18	遥感工程系
	空间分析与建模实习 Spatial Analysis and Modeling Practice		1	20			5	17	地理信息科学系
	自然地理地貌及遥感图像解译实习 Natural Geography and Remote Sensing image interpretation Practice		1	20			6	16	遥感工程系
	空间信息综合实习 Comprehensive Practice		6	120	120		7	1-6	测绘学院
	毕业设计或论文 Undergraduate Design or Thesis		8	160	160		8	1-16	地理信息科学系
	合计		35	696					
课外	创新实践及科研训练	GIS 软件开发大赛实训 GIS Software Development Competition Practical Training	1	20	20		4		地理信息科学系
		学院 GIS 选拔比赛 School GIS Selection Competition	1	20	20		5		地理信息科学系

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
		全国大学生 GIS 应用技能大赛 National University GIS Application Skills Contest	1	20	20				地理信息科学系
		超图开发大赛 SuperMap Development Competition	1	20	20				地理信息科学系
		天地图开发大赛 Map World Development Competition	1	20	20				地理信息科学系
		则泰杯全国论文大赛 The Mostrule Cup State Essay Competition	1	20	20				地理信息科学系
		Mapgis 开发大赛 Mapgis Development Competition	1	20	20				地理信息科学系
		测绘技能大赛实训 Surveying and Mapping Skills Practice Contest	2	40	40		4		测绘工程系
		学院测绘技能大赛 School of Surveying and Mapping Skills Contest	1	20	20		4		测绘工程系
		测量数据处理与程序设计大赛实训 Surveying Data Processing and Program Design Practice Contest	1	20	20		5		测绘工程系
		遥感科学与技术创新实践及科研训练	2	40	40		6		遥感工程系
	小 计		13	260					
实践环节合计 37 学分，课内必修 35 学分，创新实践及科研训练选修 2 学分									

2019 级遥感科学与技术专业本科培养方案

一、专业基本信息

英文名称	Remote Sensing Science and Technology		
专业代码	081202	学科门类	工学
学　　制	四年	授予学位	工学学士

二、培养目标及特色

培养目标：面向国家和首都城乡建设的需要，培养具备数理基础和人文社科知识，掌握遥感科学与技术基础理论、基本知识和基本技能，接受科学思维和工程实践训练，胜任国家基础测绘、土地利用与土地覆盖监测、资源调查、城市规划、建设、管理及应急等领域企事业单位工作。具有较强的航空、航天和地面遥感数据获取、处理、分析、应用及遥感影像处理开发能力和国际视野的复合型工程技术人才。毕业后经过 5 年左右的工作和学习，能够达到如下目标：

（1）在遥感与地理信息行业从事测绘数据生产、影像处理等相关生产工作的毕业生，具有良好专业素养、丰富的行业解决经验和极强工作责任心，能独立或负责完成生产任务，成为遥感领域相关企事业单位的技术负责人或技术骨干。

（2）在科研院所、大专院校从事科学研究的毕业生，掌握坚实的遥感科学与技术理论基础，能够独立从事本学科科学研究工作，具有国际化视野和沟通能力，有一定的软件设计开发能力及研究创新性成果。

专业特色：

本专业依托首都建设和学校土木建筑类学科优势，培养服务首都、面向全国、依托建筑行业、服务城乡建设的专业人才。适应摄影测量与遥感高新科技发展，融教学、科研和生产为一体，强调理论与实践密切结合，突出城市遥感特色，培养摄影测量与遥感新技术、新方法、新工艺的应用能力，满足城乡建设、古建筑保护、智慧城市等遥感人才需求。

三、主干学科

测绘科学与技术

四、主干课程

1．主干基础课程

测绘地理信息概论、数字地形测量学、C 语言与数据结构、自然地理学、地图学

2．主干专业课程

遥感原理（双语)、航空航天数据获取、摄影测量基础、遥感数字图像处理、城市遥感、数字摄影测量

五、主要实践教学环节

数字地形测量学实习、摄影测量基础实习、航空数据获取、航空摄影测量外业综合实习、4D 产品综合摄影测量实习、遥感原理实习、遥感数字图像处理、遥感综合实习、自然地理地貌及遥感图像解译实习、（近景与激光雷达、移动测量、微波遥感）新技术综合实习、地理信息系统原理、毕业设计。

六、毕业学分要求

参照北京建筑大学本科学生学业修读管理规定及学士学位授予细则，修满本专业最低计划学分应达到 162 学分，其中理论课程 123 学分，实践教学环节 39 学分。

七、各类课程结构比例

课程类别	课程属性	学分	学时	学分比例
通识教育课	必修	40.5	608	24.5
	选修	3.0	48	2
大类基础课	必修	46	764	28
	选修	1	16	0.4
专业核心课	必修	14	224	8.4
专业方向课	必修	11	176	6.7
	选修	10.5	168	6.4
独立实践环节	必修	39	780	23.6
总计		165	2784	100

八、教学进程表

学期	教学周	考试	实践	学期	教学周	考试	实践
1	4-19 周	20 周	1-3 周	2	1-16 周	17 周	18-20 周
3	1-15 周	16 周	17-20 周	4	1-15 周	16 周	17-20 周
5	1-16 周	17 周	18-20 周	6	1-15、18-19 周	20 周	16-17 周
7	7-14 周	15 周	1-6、16-20 周	8	1-16 毕业设计/实习 17 周答辩		

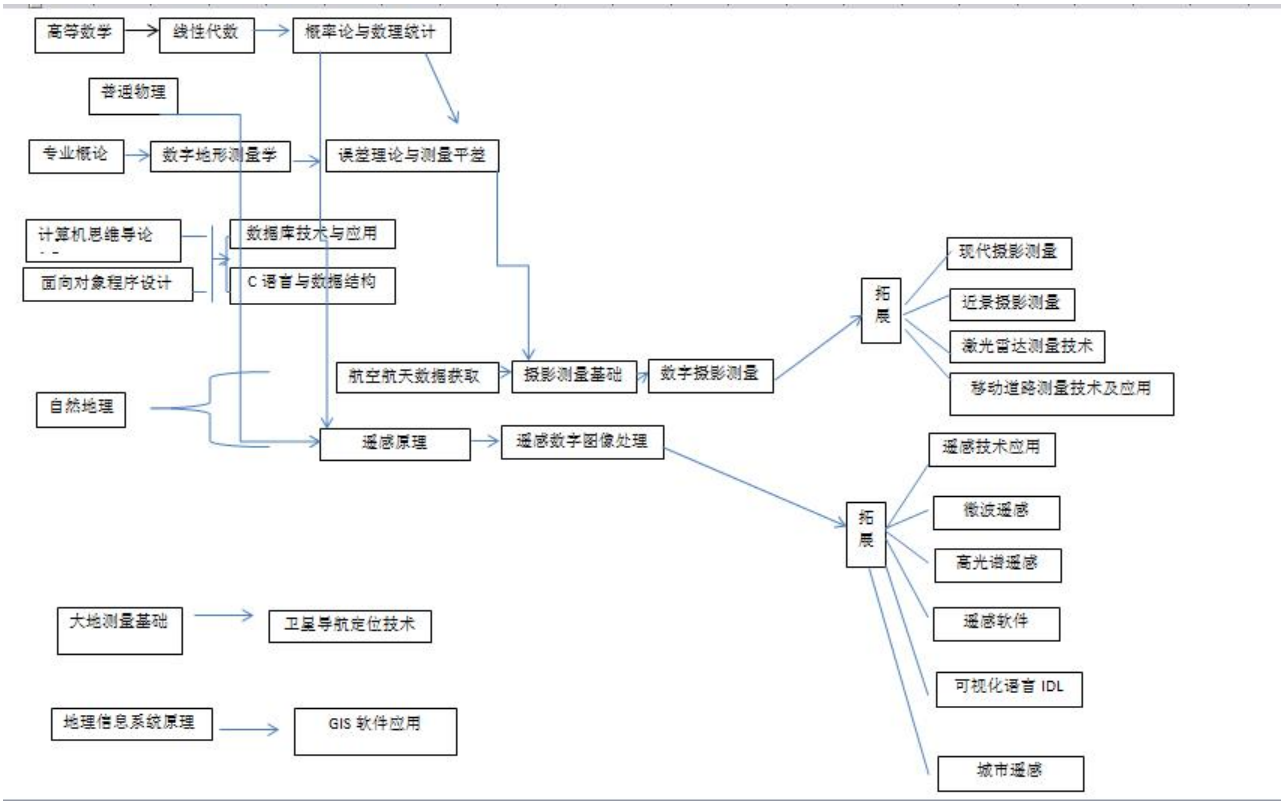
九、毕业生应具备的知识能力及实现矩阵

毕业生应具备的知识能力	相关知识领域	实现途径（课程支撑）
理解马克思主义世界观、人生观和价值观的基本意义；了解国史国情，理解中国特色社会主义道路以及个人的责任；理解职业道德的含义和工程师的职业和责任	职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守工程职业道德和规范，履行责任。	思想道德修养与法律基础、中国近现代史纲要、马克思主义基本原理概述、毛泽东思想和中国特色社会主义理论体系概论、军事理论、形势与政策（1-2）
掌握计算机操作和信息管理的基本知识，具有程序设计和开发能力、了解软件体系架构、软件设计和开发的发展趋势	计算机系统和软件开发等计算机科学与技术基本理论	计算思维导论、C 语言与数据结构、面向对象程序设计、可视化语言 IDL 等
掌握摄影测量的基本知识，具有运用航测相片进行空间信	摄影测量基础等基本理论	航空航天数据获取、摄影测量基础、数字摄影测量、近

息获取能力、了解摄影测量技术的发展趋势		景摄影测量、新型航空遥感数据处理技术等
掌握遥感数据获取、数据处理的基本知识，具有利用遥感数据进行解译、行业应用的能力，了解遥感技术的发展趋势	遥感平台、载荷、数据处理及信息提取等基本理论	航空航天数据获取、遥感原理、遥感数字图像处理、遥感技术应用、微波遥感、高光谱遥感等
能够理解一个多角色团队中每个角色的含义以及对整个团队环境和目标的意义；能够在团队中做好自己承担的角色，具备综合团队成员的意见并进行合理决策的能力。	个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。	思想道德修养与法律基础、军事理论、形势与政策（1-2）、体育（1-4）、军训、空间信息类综合实习
能够通过口头及书面方式表达自己的想法，掌握技术文件写作方法，理解和撰写效果良好的报告和设计文件，基本掌握一门外语，具有外语听说读写能力。	沟通：能够就复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。	大学英语（1-2）、大学英语拓展系列课程（1-8）、科技文献检索、科技论文写作、遥感原理（双语）、地理信息系统原理（双语）
对于遥感技术的发展水平、所面临的挑战有正确认识；对于职业生涯规划和持续学习的必要性有正确认识，能够采用合适的方法通过学习不断发展自身的能力。	终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。	测绘地理信息概论、深度学习与模式识别概论、（近景与激光雷达、移动测量、微波遥感）新技术实习、毕业设计、毕业答辩

十、指导性教学计划（见附表）

十一、主要课程逻辑关系结构图


高等数学
线性代数
概率论与数理统计
普通物理
专业概论
数字地形测量学
误差理论与测量平差
计算机思维导论
面向对象程序设计
数据库技术与应用
C 语言与数据结构
自然地理
航空航天数据获取
摄影测量基础
数字摄影测量
拓展
现代摄影测量
近景摄影测量
激光雷达测量技术
移动道路测量技术及应用
遥感原理
遥感数字图像处理
拓展
遥感技术应用
微波遥感
高光谱遥感
遥感软件
可视化语言 IDL
城市遥感
大地测量基础
卫星导航定位技术
地理信息系统原理
GIS 软件应用

2019 Undergraduate Program for Specialty in Remote Sensing Science and Technology

I. Specialty Name and Code

English Name	Remote Sensing Science and Technology		
Code	081202	Disciplines	Bachelor of Engineering
Length of Schooling	4 years	Degree	Bachelor of Engineering

II. Educational Objectives and Features

Objectives: This program is to meet the needs of urban and rural construction of the country and the city of Beijing, cultivating the knowledge of mathematics, physics, humanities and social sciences, grasp basic theory, basic knowledge and basic skills of Remote Sensing Science and technology, and training of scientific thinking and engineering practice, and be competent for the work of enterprises and institutions in the fields of national basic surveying and mapping, land use and land cover monitoring, resource survey and urban emergency response. Students should have strong ability to acquire, process, analyze, apply and develop remote sensing image processing and have international vision of composite engineering and technical personnel. After about five years of work and study after graduation, the following goals can be achieved:

(1) Graduates engaged in surveying and mapping data production, image processing and other related production work in remote sensing and geographic information industry have good professional literacy, rich industry solving experience and strong sense of responsibility. They can independently or responsibly complete production tasks and become technical leaders or backbone of relevant enterprises and institutions in the field of remote sensing.

(2) Graduates engaged in scientific research in scientific research institutes and colleges and universities have a solid theoretical foundation of Remote Sensing Science and technology, can independently engage in scientific research in their own disciplines, have an international vision and communication skills, and have certain software design and development capabilities and research innovative achievements.

Features: This program features integrating the teaching, research and production together with the development of high-technology, stressing the combination of theory and practice, highlighting the urban remote sensing characteristics, and pinpointing the comprehensive ability of application of new photogrammetry and remote sensing technologies and software development. Based on the construction of Beijing and with the advantages of the civil construction disciplines of the University, this program aims to cultivate professional remote sensing talents for the urban and rural construction, protection of historic buildings and smart city construction of Beijing and the whole country.

III. Major Disciplines

Science and Technology of Surveying and Mapping

IV. **Major Courses**

1. Basic Courses

Introduction to Geomatics, Digital Topographic Surveying, C Language and Data Structure, Physical Geography,, Cartography

2. Specialty Courses

Principles of Remote Sensing (Bilingual), Aerospace Data Acquisition, Photogrammetry Fundamental, Remote Sensing Digital Image Processing, Urban Remote Sensing, Digital Photogrammetry

V. Major Practical Training

Digital Topographic Surveying Practice, Photogrammetry Fundamental Practice, Aviation Data Acquisition, Field Work Practice of Aerial Photogrammetry Control And Annotation, 4D Products Integrated Photogrammetry Practice, Practice of Principles of Remote Sensing, Remote Sensing Digital Image Processing, Remote Sensing Comprehensive Practice, Natural Geography and Remote Sensing Image Interpretation Practice, (Close Range and Laser Radar, Mobile Measurement, Microwave Remote Sensing) New Technology Comprehensive Practice, The Principle of Geographic Information System, Graduation Project.

VI. Graduation Requirements

In accordance with "Management Regulations for the Undergraduate Students of Beijing University of Civil Engineering and Architecture" and "Bachelor's Degree Awarding Regulations", the minimum credits required by specialty for graduate is 162, including 123 credits of theoretical courses and 39 credits of practice teaching.

VII. Proportion of Course

Course Category	Course Type	Credits	Class Hour	Proportion
General Education	Compulsory	40. 5	608	24. 5
	Optional	3. 0	48	2
Big Academic Subjects	Compulsory	46	764	28
	Optional	1	16	0. 4
Professional Core	Compulsory	14	224	8. 4
Professional Direction	Compulsory	11	176	6. 7
	Optional	10. 5	168	6. 4
Practice	Compulsory	39	780	23. 6
total		165	2784	100

VIII. Table of Teaching Program

Semester	Teaching	Exam	Practice	Semester	Teaching	Exam	Practice
1	4-19	20	1-3	2	1-16	17	18-20
3	1-15	16	17-20	4	1-15	16	17-20
5	1-16	17	18-20	6	1-15、18-19	20	16-17
7	7-14	15	1-6、16-20	8	1-16graduation project 17defence		

IX. Table of Teaching Arrangement

X. Graduate Abilities and Matrices

Graduate Abilities	Related Knowledge	Course Supports
Understand the basic meanings of Marxist world outlook, outlook on life and values; understand history conditions, understanding the road of socialism with Chinese characteristics and personal responsibility; understanding ethical meaning and engineer career and responsibility	Professional norms: with the humanities and social science literacy, social responsibility, can be in engineering practice to understand and abide by the engineering ethics and norms, fulfill their responsibilities.	Ideological and moral cultivation and the legal basis, Chinese modern history outline, an overview of the basic principles of Marxism, Mao Zedong Thought and the Chinese characteristic socialism introduction to the theoretical system, military theory, situation and policy (1-2)
To master the basic knowledge of computer operation and information management, with the development of programming and development capabilities, understanding of software architecture, software design and development trends	Basic theory of computer science and technology, such as computer system and software development	Introduction to computational thinking, object oriented programming, data structure, visual language IDL, etc.
Master the basic knowledge of photogrammetry, with aerial photos of space information acquisition ability and understanding of the development trend of photogrammetry technology	Basic theory of Photogrammetry	Aerospace photogrammetry data acquisition, digital photogrammetry, photogrammetry, close range photogrammetry and Modern aerial remote sensing data processing technology
Master the basic knowledge of remote sensing data acquisition, data processing, with the use of	The basic theory of remote sensing platform, sensors, data processing and	Aerospace data acquisition, remote sensing principle, remote sensing digital image processing,

remote sensing data interpretation, the ability of remote sensing application in certain field and the development trend of remote sensing technology	information extraction.	remote sensing technology application, microwave remote sensing, High spectral remote sensing, etc.
Can understand the meaning of a multi role teams for each role and the importance of the team environment and the target; in the team do assume their role, and rational decision-making ability with the opinion of the members of the team.	Individuals and teams: be able to take the role of individuals, team members, and the person in charge in a multidisciplinary context.	ideological and moral cultivation and legal basis, military theory, situation and policy (1-2), sports (1-4), military training, comprehensive practice of spatial information
Through oral and written expression of ideas, to master the writing method of technical documents, understand and write good reports and design documents, basic grasp of a foreign language, with good English listening, speaking, reading and writing ability.	Communication: be able to communicate and communicate effectively with industry colleagues and the public in complex engineering issues, including writing reports and design documents, presentations, clear expression or response instructions. And have a certain international vision, to be able to communicate and exchange in the cross cultural context.	College English (1-2), University English Development Series (1-8), science and technology document retrieval, science and technology paper writing, remote sensing principle (Bilingual), geographic information system (Bilingual)
For the level of development of remote sensing technology and facing challenges have a correct understanding, for career planning and the necessity for continuous learning have correct understanding, to adopt appropriate methods by learning to develop their own capacity.	Lifelong learning: a sense of autonomous learning and lifelong learning, and the ability to continuously learn and adapt to the development of.	Surveying and mapping introduction to geographic information, An introduction to deep learning and pattern recognition, (close range photohrammetry and laser radar, mobile measurement, microwave remote sensing) new technology practice, graduation design, graduation reply

表 1　遥感科学与技术专业指导性教学计划

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续学时	开课学期	教学单位
通识教育课	必修	思想道德修养与法律基础 Thought Morals Accomplishment and Basic Law	3	48	32			16		1	马克思主义学院
		中国近现代史纲要 The Outline of the Modern Chinese History	3	48	32			16		2	马克思主义学院
		马克思主义基本原理概论★ The Generality of Basic Principle of Marxism	3	48	32			16		3	马克思主义学院
		毛泽东思想和中国特色社会主义体系理论概论★ Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese characteristic socialism	5	80	48			32		4	马克思主义学院
		形势与政策（1-4） Situation and Policy(1-4)	2	32	16			16		1-4	马克思主义学院
		大学生职业生涯与发展规划 College Student Occupation Career and Development Planning	1	16	16					1/2	学工部
		大学生心理健康 The Mental health of College Students	1	16	16					2	学工部
		大学英语(1-2) ★ English(1-2)	6	128	96				32	1-2	文法学院
		大学英语拓展系列课程（1-4） College English training（1-4）	2	32	32					3	文法学院
		大学英语拓展系列课程（5-8） College English training（5-8）	2	32	32					4	文法学院
		体育(1-4) Physical Education(1-4)	4	120	120					1-4	体育部
		计算思维导论 introduction to computational thinking	1.5	56	24			32		1	电信学院
		小 计	33.5	656	496			128	32		
	核心	经典赏析与文化传承	2	32						1-8	各院部
		哲学视野与文明对话	2	32						1-8	各院部
		科技革命与社会发展	2	32						1-8	各院部
		建筑艺术与审美教育	2	32						1-8	各院部
		生态文明与未来城市	2	32						1-8	各院部
		至少修读 4 类合计 8 学分，每类至少修读 2 学分									
	选修	创新创业类	1-8 学期任选								各院部
		工程实践类	1-8 学期任选								各院部
		复合培养类	1-8 学期任选								各院部
	跨类任选至少 2 学分										
	通识教育课合计至少修读 43.5 学分 ，其中通识教育必修 33.5 学分，通识教育核心 8 学分，通识教育任选 2 学分										

课程类别	课程属性	课程名称	学分	总学时	讲课学时	实验学时	上机学时	课外学时	延续教学	开课学期	教学单位
大类基础课	必修	高等数学 A（1）★ Advanced Mathematics A(1)	5	80	80				16	1	理学院
		高等数学 A（2）★ Advanced Mathematics A(2)	5	80	80					2	理学院
		线性代数 Linear Algebra	2	32	32				8	2	理学院
		概率与数理统计 B Theory of Probability and Statistics (B)	3	44	44				4	3	理学院
		普通物理 A（1）★ College physics A(1)	3	52	52			4		2	理学院
		普通物理 A（2）★ College physics A(2)	3	52	52			4		3	理学院
		物理实验（1-2） Physics Experiment(1-2)	2	60		60				3-4	理学院
		工程制图与识图 Engineering Drawing and Interpreting	3	44	44				4	2	理学院
		C 语言与数据结构 ★ C Programming Language and Data Structure	3	48	32	16				1	地理信息科学系
		自然地理学 Physical geography	2	32	32					1	地理信息科学系
		测绘地理信息概论 Introduction to Geomatics	1	16	16					1	测绘学院
		CAD 基础与应用 CAD Basic and Application	2	32	16	16				1	测绘工程系
		数字地形测量学★ Digital Topographic Surveying	4	64	52	12				2	测绘工程系
		地图学 Cartography	3	48	40	8				3	地理信息科学系
		地理信息系统原理(双语) The Principle of Geographic Information System	3	48	40	8				3	地理信息科学系
		遥感原理 Principles of Remote Sensing	2	32	32					3	遥感工程系
		小 计	46	764	644	120		8	32		
	选修	现代测绘技术应用 Application of Modern Surveying and Mapping Technology	1	16	8	8				2	测绘工程系
		GIS 基础应用技能 GIS base Application Skill	1	16	8	8					地理信息科学系
		遥感应用前景 Remote Sensing Application Prospect	1	16	8	8				3	遥感工程系
		小 计	3	48	24	24					
	大类学科基础课合计 47 学分，必修 46 学分，选修 1 学分										

专业核心课	必修	航空航天数据获取 Aerospace data acquisition	2	32	28	4				4	遥感工程系
		城市遥感（双语）Urban Remote Sensing	3	48	40	8				6	遥感工程系
		摄影测量基础 Photogrammetry Fundamental	3	48	44	4				5	遥感工程系
		遥感数字图像处理 Digital Image Processing	3	48	40	8				5	遥感工程系
		数字摄影测量 Digital Photogrammetry	3	48	40	8				6	遥感工程系
		小计	14	224	192	32					
	专业核心课合计必修 14 学分										
专业方向课	必修	卫星导航定位技术 Technology of Satellite navigation and positioning	2	32	28	4				5	测绘工程系
		面向对象程序设计 object oriented programming	2	32	32					4	遥感工程系
		误差理论与测量平差基础 Fundamentals of Error Theory and Surveying Adjustment	3	48	48					4	测绘工程系
		激光雷达测量技术与应用 Laser radar Surveying Technology	2	32	24	8				6	遥感工程系
		遥感技术应用(研讨式教学)Applications of Remote Sensing（seminar）	2	32	16	16				6	遥感工程系
		小 计	11	176	148	28					
	选修	近景摄影测量 Close Range Photogrammetry	2	32	26	6				6	遥感工程系
		微波遥感 Microwave Remote Sensing	2	32	32					5	遥感工程系
		移动道路测量技术及应用 Technology and Application of Mobile Mapping System	1	16	8	8				7	地理信息科学系
		新型航空遥感数据处理技术 Modern aerial remote sensing data processing technology	2	32	32					7	遥感工程系
		大地测量基础 Geodesy Fundamental	2	32	24	8				4	测绘工程系
		高光谱遥感 Hyperspectral remote sensing	2	32	24	8				6	遥感工程系
		科技论文写作（双语）Academic Writing (Billinguish)	1	16	16					6	遥感工程系
		科技文献检索 document retrieval of science and technology	1	16	16			8		5	图书馆
		深度学习与模式识别概论 An introduction to deep learning and pattern recognition	1	16	16					7	遥感工程系
		智慧城市导论 Introduction to smart city	1	16	16					6	地理信息科学系
		遥感软件 Remote Sensing Software	2	32	16	16				4	遥感工程系
		GIS 软件使用 GIS Software	2	32	16	16				4	地理信息科学系
		可视化语言 IDL The Language IDL	2	32	16	16				5	遥感工程系
		小 计	21	336	258	78					
	专业方向合计 21.5 学分，必修 11 学分，选修 10.5 学分										

表 2　遥感科学与技术专业指导性教学计划（实践环节）

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
课内	军事理论 Military Theory		2	36	36		1	1-3	武装部
	军训 Military Training		2	40	40				
	数字地形测量实习 Digital Topographic Surveying Practice		3	60	60		2	18-20	测绘工程系
	地图学实习 Cartography Practice		2	40	40		3	17-18	地理信息科学系
	摄影测量基础实习 Photogrammetry Fundamental Practice		1	20	20		5	19	遥感工程系
	地理信息系统原理实习 The Principle of Geographic Information System Practice		2	40	40		3	19-20	地理信息科学系
	遥感数字图像处理实习 Digital Image Processing Practice		2	40	40		5	19-20	遥感工程系
	航空航天数据获取 Aerospace data Acquisition Practice		1	20	20		4	18	遥感工程系
	空间信息综合实习 Spatial Information Practice		6	120	120		7	1-6	测绘学院
	遥感综合实习 Remote Sensing Comprehensive Practice		3	60	60		7	18-20	遥感工程系
	遥感原理实习 Principles and Applications of Remote Sensing Practice		1	20	20		4	17	遥感工程系
	自然地理地貌及遥感图像解译实习 Natural geography and remote sensing image interpretation Practice		2	40	40		6	16-17	遥感工程系
	（近景与激光雷达、移动测量、微波遥感）新技术实习 New technology Practice		2	40	40		7	16-17	遥感工程系、地理信息科学系
	面向对象程序设计实习 Object oriented programming Practice		2	40	40		4	19-20	地理信息科学系
	毕业设计 Undergraduate Design or Thesis		8	320	320		8	1-16	遥感工程系
	小　计		39	936	936				
课外									
	创新实践及科研训练	遥感科学与技术创新实践及科研训练	2	40	40		6		遥感工程系
		测绘技能大赛实训 Surveying and Mapping Skills Practice Contest	2	40	40		4		测绘工程系

课程属性	课程名称		学分	折合学时	实验实践	上机	开课学期	开设周次	教学单位
		测量数据处理与程序设计大赛实训 Surveying Data Processing and Program Design Practice Contest	1	20	20		5		测绘工程系
		则泰杯全国论文大赛 Mostrule Cup-National Paper Contest	1	20	20				遥感工程系
		GIS 软件开发大赛实训 GIS Software Development Competition Practical Training	1	20	20		4		地理信息科学系
		学院测绘技能大赛 School of Surveying and Mapping Skills Contest	1	20	20		4		测绘工程系
		Esri 杯、航天宏图杯等遥感应用开发竞赛 学院遥感应用选拔比赛 学院 GIS 选拔比赛 全国 GIS 选拔比赛 则泰杯全国论文大赛	获奖可得 1 分						遥感工程系
	小 计		9	160	160				
实践环节合计 41 学分，其中课内 39 学分，课外 2 学分（创新实践及科研训练必修 2 学分）									