2017 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、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 160 学分，其中理论课程 121 学分，实践教学环节 39 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	37.5	600	23.43%
	选修	3	48	1.88%
大类基础课	必修	46	764	28.75%
	选修	1	16	0.63%
专业核心课	必修	17	272	10.63%
专业方向课	必修	6	96	3.75%
	选修	10.5	168	6.56%
独立实践环节	必修	37	764	23.13%
	选修	2	40	1.25%
总计		160	2768	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	1-14 周	15-16 周	17-20 周	4	1-14 周	15-16 周	17-20 周
5	1-16 周	19-20 周	17-18 周	6	1-14 周	15-16 周	17-20 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。

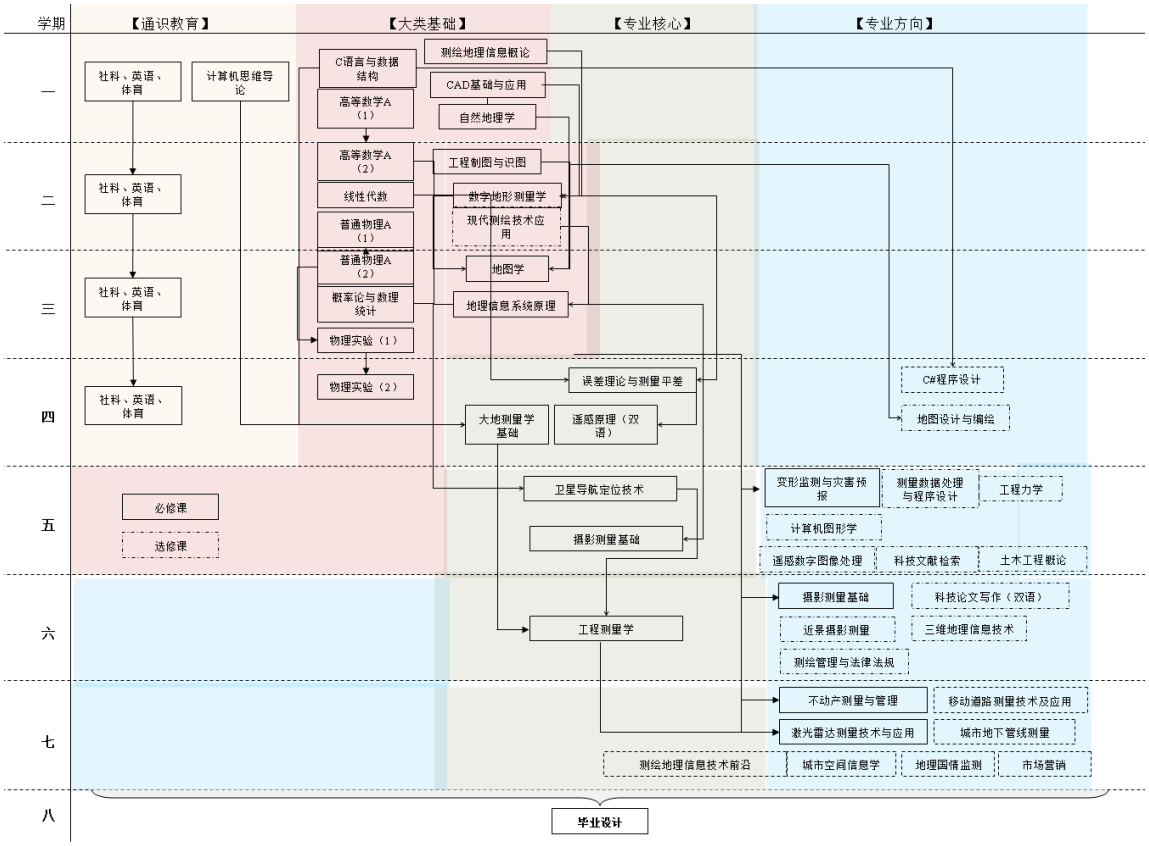
4.研究：能够基于科学原理并采用科学方法对复杂测绘工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	4.1能够运用科学原理对复杂测绘工程问题提出研究方案	地图学、地理信息系统原理（双语）、大地测量学基础、城市地下管线测量、工程测量学、智慧城市导论、地理国情监测、遥感原理实习、地图学实习、卫星导航定位实习等。
	4.2能够基于专业理论知识对研究方案进行设计、论证与预测	计算思维导论、工程制图与识图、遥感原理、摄影测量基础、卫星导航定位技术、工程测量综合实习等。
	4.3能够采用科学方法实施数据采集与分析处理	C#程序设计、C 语言与数据结构、误差理论与测量平差基础、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	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	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

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。	理分析	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	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	地图学实习、控制测量实习、工程测量综合实习、毕业设计等。

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。	程问题与测绘同行及社会公众进行有效沟通和交流	
	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、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
地图设计与编绘
大地测量学基础
遥感原理（双语）
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
摄影测量基础
科技论文写作（双语）
工程测量学
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

2017 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 160, including 121 credits of theoretical courses and 39 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	37.5	600	23.43%
	Optional	3	48	1.88%
Big Academic Subjects	Compulsory	46	764	28.75%
	Optional	1	16	0.63%
Professional Core	Compulsory	17	272	10.63%
Professional Direction	Compulsory	6	96	3.75%
	Optional	10.5	168	6.56%
Practice	Compulsory	37	764	23.13%
	Optional	2	40	1.25%
Total		160	2768	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 of Geodesy、Fundamentals of Error Theory and Surveying Adjustment.
	1.3 use relevant knowledge and mathematical models	Introduction to Computational Thinking、CAD Basic and Application、Engineering Drawing and Interpreting、Linear Algebra、Technology of Satellite navigation and

	to deduce and analyze complex engineering problems in surveying and mapping.	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 City、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	3.1 Master the basic design/development methods and techniques of the whole cycle and whole process of Surveying and	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.

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.	mapping engineering design/development, and understand various factors that affect design 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、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 information technology software to complete data	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、

	acquisition, data processing and accuracy analysis.	Foundation of Geodesy、Technology of Satellite navigation and positioning、Fundamentals of Error Theory and Surveying Adjustment、Engineering Surveying、Deformation Monitoring and Disasters Predicting、Real Estate Surveying and Management、Remote Sensing Digital Image Processing、 Close-range Photogrammetry、Digital Topographic Surveying Practice、Practical Training for Control Surveying、Practical Training for Satellite Navigation and Positioning、GIS Practice、Practical Training for Control Surveying、Practical Training for Engineering Surveying、Practical Training for Real Estate Surveying and Management、Practical Training for Laser Radar Surveying Technology、Comprehensive Practice for Spatial Information、Graduation design、Surveying and Mapping Skills Practice Contest、GIS Software Development Practice。
	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、Practical Training for Photogrammetry Fundamental、Graduation design、Invocation Practice(School of Surveying and Mapping Skills Contest、School of 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	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	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、

solutions on society, health, and safety, law and culture based on engineering-related knowledge background, and understand the responsibilities.	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.	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、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.
8.Occupational norms: Equip with the quality of humanistic social sciences, sense of social responsibility, understand and follow professional ethics and criteria	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	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

in engineering, be conscientious in the performance of one’s duties.	observe them in the practice of Surveying and mapping.	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 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、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 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、Real Estate Surveying and Management、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	Marketing Management、Surveying Management and Laws、Practical Training for Satellite Navigation and Positioning、Graduation design.

	decision-making.	
	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、Practical Training for Real Estate Surveying and Management、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(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	2	32	24			8		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	4	96	48			48		6	马克思主义学院
		形势与政策（1-2） Situation and Policy(1-2)	1	32	32					1、3	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	29.5	640	488			120	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 3 学分										
	通识教育课合计至少修读 40.5 学分 ，其中通识教育必修 29.5 学分，通识教育核心 8 学分，通识教育任选 3 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	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				2	地理信息科学系

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
		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										
专业核心课	必修	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	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）	1.5	24	16	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

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
		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
		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	**33.5**	**544**	**408**	**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		1	32			1	1-3	武装部
	军训 Military Training		1	32	32				
	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	18	遥感工程系
	卫星导航定位实习 Practical Training for Satellite Navigation and Positioning		1	20	20		5	17	测绘工程系
	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		**37**	**764**	**652**	**80**			
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		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 39 学分，课内必修 37 学分，课外（创新实践及科研训练）必修 2 学分									