地下水科学与工程专业培养方案

一、专业简介

地下水科学与工程专业是以地球科学基本理论为基础，以地下水为主要研究对象，系统学习地下水的形成、分布、运动和变化等方面的专业知识和技能，并将其应用于地下水资源的开发、管理与保护，地下水环境和地质环境的调查、监测、评价、治理与修复。本专业学生既具备较扎实的基础理论知识又具有较宽的专业知识和技能，从业的适应面广，可在国土资源、水利、城建、环保、交通等部门相关领域从事与地下水科学与工程相关的科研、教学、管理、设计和生产等方面的工作。

二、培养目标

本专业主要培养学生具有良好的思想品德、社会公德和职业道德，具有良好的体魄和健康的身心，达到国家规定的大学生体育和军事训练合格标准，具有扎实的数理基础和地球科学基本理论，较好的人文科学知识，较强的计算机、外语、管理等方面应用能力，受到应用基础研究和技术开发方面的科学思维和科学实验训练，具有良好的科学素养，掌握地下水形成和演化机理、地下水资源及其环境调查、监测、评价、开发、治理等基本知识和技能，具有独立获取知识、综合分析与解决问题的能力和开拓创新的精神。毕业生可在国土资源、水利、城建、环保、交通等部门从事与地下水科学与工程相关的科研、教学、管理、设计和生产等方面的工作。学生毕业五年左右，基本具备胜任工程师或相应职称的专业技术能力和条件，能成长为水文地质、环境地质领域的高级专门人才。

三、培养要求

经过四年学习，毕业生应获得以下的知识和能力：

（1）工程知识：具有分析与解决地下水问题的数学、物理、化学、计算机、地质、水文地质等基础知识。

（2）问题分析：能够应用地下水科学与工程基本理论，识别、表达、并通过中外文文献资料了解具体地下水问题的研究现状，解决方法；具有一定的实验设计能力，能够针对特定地下水问题，设计合理实验，并能够归纳、整理、分析实验结果，根据所得结果分析地下水问题，以获得有效结论。

（3）设计 / 开发解决方案：掌握地下水科学基本原理和知识，掌握地下水的形成、分布、运动、变化规律；掌握地下水化学成分形成、主要作用和影响因素；掌握地下水运动的基本理论、数学模型及计算方法；掌握地下水勘查、监测、评价、管理及保护的基本知识和野外调查方法；掌握地下水污染的调查、评价、控制及治理方法；掌握地质灾害识别、勘察、评价、监测方法；能够设计不同地下水科学与工程问题的解决方案，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。

（4）研究：能够基于地下水科学与工程的基本原理并采用科学方法对地下水问题进行研究，包括设计实验、分析与解释数据、并通过综合分析得到合理有效的结论；初步具备撰写论文，参与学术交流的能力。

（5）使用现代工具：掌握运用专业设备和仪器进行野外地下水调查、监测、取样及分析测试；熟悉并掌握一定专业软件，进行水化学数据分析、水文地质图件编制、水文地质概念模型建立、地下水数值模拟等，定量分析与研究地下水科学与工程问题。

（6）工程与社会：能够基于工程相关背景知识进行合理分析，评价专业工程实践和工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

（7）环境和可持续发展：了解国家的可持续发展战略，及环境保护的相关法律法规；在具体工程设计中，具有环境保护意识，并考虑工程设计及开发利用可能对社会可持续发展产生影响的因素。

（8）职业规范：具备正确的人生观、价值观和良好的人文素养；熟悉法律法规，了解地下水科学与工程相关的国家和行业标准； 在实践中，理解并遵守职业道德和规范，具有工程安全意识，能够认真履行职责，具有社会责任感。

（9）个人和团队：具备良好的个人素养，具有良好的团队合作意识和协作精神；能够在多学科背景下的团队中根据需要承担相应的责任。

（10）沟通：能够就地下水科学与工程问题撰写设计报告、并能与同行进行沟通交流；具有外语交流能力和一定的国际视野。

（11）项目管理：理解并掌握工程管理原理；能在多学科环境中应用。

（12）终身学习：具有自主学习和终身学习的意识；能够采用合适的方法，提高自主学习能力，适应地下水科学与工程及社会发展需要的能力。

四、学制与学位

学制四年。学生修满所规定的最低毕业学分，达到培养目标规定的各项要求后，授予工学学士学位。

五、核心课程

专业核心课程：地下水资源评价、地下水勘查、地下水监测、污染水文地质学、地下水动力学、地下水水化学、地下水科学专论、地质灾害与防治、工程土质土力学、地下水科学与工程专业英语、工程岩体力学。

实践课程：测量实习、北戴河地质认识实习、周口店地质教学实习、专业实习、地下水污染调查评价实践、AutoCAD 与水工环制图、GIS 及其在水文中的应用实践、水文地质调查方法设计、毕业设计（论文）。

Undergraduate Program in Groundwater Science and Engineering

1. Major Introduction

Groundwater Science and Engineering studies the genesis, distribution, movement and change of groundwater based on the principles of geosciences. It covers the development, management and protection of groundwater resources, and the investigation, monitoring, assessment, treatment and remediation of groundwater environments. Graduates are normally engaged in scientific research, teaching, management and designing in departments/institutes of land resources, water conservancy, urban construction, environmental protection and communication.

2. Academic Objectives

Students should love our country, support the leadership of the Communist Party of China, love work and labor, obey the law, and have good moral, and social morality and professional ethics. They should be both physically and mentally healthy, have the necessary military training, and meet the requirements of the national college sports and military training standards.

Students are expected to be knowledgeable in mathematics and social sciences and familiar with the principles of geosciences. They are able to use computers and one foreign language. They also have to grasp mechanisms of groundwater genesis and evolution, investigation, monitoring, assessment, development and treatment of groundwater resources and environment. Most of all, they will learn to do independent thinking and research and will put their creativity into play. With sufficient specialized knowledge and skills they are expected to work as researchers, teachers, managers and designers in governmental agencies, academic institutes or industries related to land resources, water conservancy, urban construction, environmental protection and communication. They will be qualified engineers with the corresponding titles in five years after graduation, and will become senior specialists in hydrogeology, environmental geology and relevant areas.

3. Academic Requirements

After the four-year courses, the students should acquire the following knowledge and abilities：

(1) Engineering knowledge

Students will master the basic knowledge and basic principles in mathematics, physics, chemistry, computer, and geosciences. They will also master the basic methods of field work, and will possess the knowledge reserves for resolving groundwater problems.

(2) Problem analysis

Students will be able to identify and describe scientific problems by applying the basic principles of engineering science. They will know about the development trends of the specialty by inquiring about and doing research on Chinese and foreign literature. Students will possess the ability to design experiments, to carry on experiments and to analyze the results of experiments. They will learn how to analyze complex engineering problems and draw valid conclusions.

(3) Designing and Developing Solutions

Students will grasp the formation, distribution, movement and changes of groundwater resources; master the principles, major functions, factors of the formation of groundwater chemical components, the classification, zoning of groundwater chemical components, and research methods of groundwater chemistry. Besides, students will grasp the basic theories, mathematical models and computing methods, learn the basic knowledge and field investigation methods for groundwater exploration, monitoring, assessment, management and protection. They will learn the methods for groundwater pollution investigation, assessment, control and remediation and grasp the methods of geological hazards identification, investigation, assessment and monitoring. They will understand the basic principles of designing of geological hazard prevention and management. With these, students are expected to have the ability to design solutions for groundwater science and engineering problems under different hydrogeological conditions with the sense of innovation and with considerations of society, health, safety, law, culture and the environment.

(4) Research

They will do research on complex engineering problems based on scientific principles by designing experiments, analyzing and interpreting data, and drawing reasonable and effective conclusions through information integration. They will gain the initial ability of writing papers and participating in academic meetings.

(5) Using modern tools

They will be able to develop, select and use appropriate technology, resources, modern engineering tools and informational technology to solve complex engineering problems. They will grasp the methods to use professional equipment and instruments in groundwater investigation, monitoring, sampling and analytical tests. They will be learnt to use some professional software for water chemical analysis, hydrogeological mapping, hydrogeological concept model building, groundwater simulation, etc. Students will be able to make quantitative analysis of groundwater science and engineering issues.

(6) Engineering and society

Students will make reasonable analysis based on engineering related background knowledge, and evaluate the effects of engineering practice and pollution prevention schemes on society, health, safety, law, and culture, and they will understand relevant responsibilities.

(7) Environment and sustainable development

Students will be able to understand and evaluate the effects of groundwater engineering practice upon the environment and social sustainable development. They will understand the national sustainable development strategy, and relevant laws and regulations. They will develop the sense of environment protection in engineering designs, and will take sustainable development of society into account when designing engineering projects and carrying on the designs.

(8) Career Development

Students will have a sound understanding of social sciences, a strong sense of social responsibilities, and a healthy body. They should abide by professional ethics and norms, and fulfill professional duties in the engineering practice. They will develop correct outlooks of life and values and positive personal attributes. They will be familiar with laws and regulations, and the related national and industry standards of environmental engineering. In engineering practice, they will understand and comply with engineering ethics and norms, possess engineering safety consciousness, be able to earnestly perform their duties, and have sense of social responsibilities.

(9) Individuals and teams

Students will get to know the importance of teamwork as well as responsibilities and obligations of various roles through participating in practices, National College Students' innovation experiment projects, graduation projects, and thesis writing, etc. Teachers will train students' awareness of team cooperation and coordination, and each student should be able to work in inter-disciplinary settings. Students will develop some good personal qualities and teamwork spirit. They will be able to assume corresponding responsibilities as required in a team with multi-disciplinary backgrounds.

(10) Communication

Students will be able to communicate effectively with their counterparts and the public about complex engineering problems through writing papers and reports, delivering speeches at conferences or talking personally. Students will master a foreign language up to the national level Four. They will acquire communication skills of the foreign language, will develop certain international visions, and will be able to communicate with professionals of different cultural backgrounds.

(11) Project management

Students will understand and master principles of engineering management and will be able to apply the principles in multi-disciplinary fields.

(12) Lifelong learning

Students will have the awareness of autonomous, lifelong learning and will have the ability to learn continuously to adapt to new developments of environment engineering and society.

4. Length of Schooling and Degree

The length of schooling is four years of full-time study. Students will be awarded the Bachelor Degree of Engineering when they have completed the required minimum credits and have met all other requirements.

5. Core Courses

Specialized Core Courses: Assessment of Groundwater, Investigation and Exploration of Groundwater, Groundwater Monitoring, Contamination Hydrogeology, Groundwater Hydraulics, Groundwater Chemistry, Special Topics on Groundwater Sciences, Geological Hazard and Control, Engineering and Soil Mechanics, Specialty English for Groundwater Science and Engineering, Mechanics of Engineering Rock Mass.

Practice courses: Surveying Practice, Geological Survey Field Trip in Beidaihe, Geological Survey Field Trip in Zhoukoudian, Professional Practice, Practice for Groundwater Contamination Investigation and Evaluation, AutoCAD and Mapping for Hydrogeology, Application of GIS to Hydrology, Design for Groundwater Survey, Graduation Design (Thesis).

六、最低毕业总学分要求及学分分配（Minimum Required Credits and Distribution）

课程类别 Course Classification		学时 Hours	学分 Credits	学 期 Semester										
				1	2	2 夏	3	4	4 夏	5	6	6 夏	7	8
必修课 Required Courses	通识教育必修课程 Required Courses of General Education	680	39	13	12		3	4			5			2
	学科基础课程 Disciplinary Fundamental Courses	936	58.5	9	11		19	13		6. 5				
	专业核心课程 Specialized Core Courses	464	29							6	16.5		6. 5	
	实践教学 Practice Courses	36 周 +96 学时	34		3	4	1	1	5	4	3	7		6
选修课 Selective Courses	通识教育选修课程 Selective Courses of General Education	256	16	----										
	创新创业实践 Innovation and Entrepreneurship	----	6	----										
最低毕业总学分 Total Credits				182. 5										

七、课程设置 (Curriculum)

1、通识教育必修课程 (Required Courses of General Education)：680 学时 (680 Hours)，39 分 (39 Credits)

课程代码 Course Code	课程名称 Course Name	学时 Hours	学分 Credits	讲课学时 Lecture	实验学时 Experiment	考核方式 Assessment	开课学期 Semester	备注 Notes
GR181001	思想道德修养与法律基础 Ethics and Fundamentals of Law	48	3	48		考试 Exam	1	
GR182002	中国近现代史纲要 Essentials of Modern Chinese History	32	2	32		考试 Exam	3	
GR182003	马克思主义基本原理 Principles of Marxism	48	3	48		考试 Exam	4	
GR183004	毛泽东思想和中国特色社会主义理论体系概论 Introduction to Mao Zedong Thoughts and Theoretical System of the Chinese Characteristic Socialism	64	4	64		考试 Exam	6	
GR180005	形势与政策 Situation and Policies	32	2	32		考查 Term Paper	1-8	
GR301001	大学生心理素质教育 Mental Health	16	1	16		考查 Term Paper	1	
GR081001	大学英语（1-2） College English (1-2)	96	6	96		考试 Exam	1	
GR081002	大学英语（3-4） College English (3-4)	96	6	96		考试 Exam	2	

课程代码 Course Code	课程名称 Course Name	学时 Hours	学分 Credits	讲课学时 Lecture	实验学时 Experiment	考核方式 Assessment	开课学期 Semester	备注 Notes
GR141001	体育（1） Physical Education (1)	30	1		30	考试 Exam	1	
GR141002	体育（2） Physical Education (2)	30	1		30	考试 Exam	2	
GR142003	体育（3） Physical Education (3)	30	1		30	考试 Exam	3	
GR142004	体育（4） Physical Education (4)	30	1		30	考试 Exam	4	
GR041001	大学计算机技术 College Computer	32	2	16	16	考试 Exam	1	
GR041002	计算机语言程序设计 Computer Language Programming	64	4	32	32	考试 Exam	2	
GR301002	大学生职业生涯规划与就业指导（1） Career Planning and Employment Guidance for University Students (1)	16	1	16		考试 Exam	2	
GR303003	大学生职业生涯规划与就业指导（2） Career Planning and Employment Guidance for University Students (2)	16	1	16		考试 Exam	6	

2、**学科基础课程** (Disciplinary Fundamental Courses)：936 **学时** (936 Hours)，58.5 **学分** (58.5 Credits)

课程代码 Course Code	课程名称 Course Name	学时 Hours	学分 Credits	讲课学时 Lecture	实验学时 Experiment	考核方式 Assessment	开课学期 Semester	备注 Notes
DR191003	高等数学 B（1） Advanced Mathematics B (1)	96	6	96		考试 Exam	1	
DR191004	高等数学 B（2） Advanced Mathematics B (2)	64	4	64		考试 Exam	2	
DR192006	概率论与数理统计 Probability and Mathematics Statistic	48	3	48		考试 Exam	3	
DR192018	复变函数与积分变换 Complex Variable Functions and Integral Transformations	48	3	48		考试 Exam	4	
DR192005	线性代数 Linear Algebra	32	2	32		考试 Exam	3	
DR191008	大学物理（1） College Physics (1)	48	3	48		考试 Exam	2	
DR192009	大学物理（2） College Physics (2)	48	3	48		考试 Exam	3	
DR191010	大学化学 College Chemistry	48	3	48		考试 Exam	1	
DR192017	物理化学 B Physical Chemistry B	48	3	48		考试 Exam	3	

课程代码 Course Code	课程名称 Course Name	学时 Hours	学分 Credits	讲课学时 Lecture	实验学时 Experiment	考核方式 Assessment	开课学期 Semester	备注 Notes
DR011036	地球科学概论 Geosciences	64	4	32	32	考试 Exam	2	
DR122001	测量学 A Surveying A	40	2.5	24	16	考试 Exam	4	
SR013025	第四纪地质学与地貌学 Quaternary Geology and Geomorphology	48	3	24	24	考试 Exam	4	
DR012066	矿物学与岩石学 Mineralogy and Petrology	48	3	32	16	考试 Exam	3	
DR012002	古生物学与地史学 Paleontology and Historical Geology	32	2	32		考试 Exam	3	
DR012038	构造地质学 Structural Geology	48	3	30	18	考试 Exam	3	
DR053012	地下水科学概论 Introduction to Groundwater Sciences	56	3. 5	48	8	考试 Exam	5	
DR052013	水力学 Hydraulics	32	2	28	4	考试 Exam	4	
DR052010	水文学原理 Principles of Hydrology	40	2.5	36	4	考查 Term paper	4	
DR053009	地下水运动方程 Equations of Subsurface Hydraulics	48	3	48		考试 Exam	5	

3、**专业核心课程** (Specialized Core Courses)：464 **学时** (464 Hours)，29 **学分** (29 Credits)

课程代码 Course Code	课程名称 Course Name	学时 Hours	学分 Credits	讲课学时 Lecture	实验学时 Experiment	考核方式 Assessment	开课学期 Semester	备注 Notes
SR053042	地下水资源评价 Assessment of Groundwater	40	2.5	32	8	考试 Exam	6	
SR053043	地下水勘查 Investigation and Exploration of Groundwater	32	2	32		考查 Term Paper	6	
SR054044	地下水监测 Groundwater Monitoring	32	2	24	8	考试 Exam	7	
SR053045	污染水文地质学 Contamination Hydrogeology	48	3	48		考查 Term Paper	6	
SR053046	地下水动力学 Groundwater Hydraulics	48	3	44	4	考试 Exam	6	
SR053047	地下水水化学 Groundwater Chemistry	48	3	40	8	考试 Exam	5	
SR054048	地下水科学专论 Special Topics on Groundwater Sciences	40	2.5	38	2	考试 Exam	7	
SR053037	地质灾害与防治 Geological Hazard and Control	40	2.5	36	4	考试 Exam	6	
SR053049	工程土质土力学 Engineering and Soil Mechanics	48	3	38	10	考试 Exam	5	
SR054050	地下水科学与工程专业英语 Specialty English for Groundwater Science and Engineering	32	2	32		考试 Exam	7	
SR053033	工程岩体力学 Mechanics of Engineering Rock Mass	40	2.5	36	4	考试 Exam	6	
	学科前沿课 Discipline Frontiers	16	1	16		考查 Term Paper	6	全院任选 Optional

4、实践教学 (Practice Courses)：36 周 +96 学时 (36 Weeks and 96 Hours)，34 学分 (34 Credits)

课程代码 Course Code	课程名称 Course Name	周（学时） Weeks（Hours）	学分 Credits	考核方式 Assessment	开课学期 Semester	备注 Notes
PR311001	军事理论及训练 Military Theory and Training	2	2	考查 Term Paper	2 夏	
PR183006	思想政治社会实践 Political Social Practice	2	2	考试 Exam	6	
PR191045	实验物理（1） Physics Experiments (1)	24	1	考试 Exam	2	
PR192046	实验物理（2） Physics Experiments (2)	24	1	考试 Exam	3	
PR191047	实验化学 Chemistry Experiments	48	2	考试 Exam	2	
PR122059	测量实习 Surveying Practice	1	1	考查 Term Paper	4	
PR011044	北戴河地质认识实习 Geological Survey Field Trip in Beidaihe	2	2	考查 Term paper	4 夏	
PR012046	周口店地质教学实习 Geological Survey Field Trip in Zhoukoudian	5	5	考查 Term paper	4 夏	
PR053073	专业实习 Professional Practice	5	5	考查 Term paper	6 夏	
PR053074	地下水污染调查评价实践 Practice for Groundwater Contamination Investigation and Evaluation	2	2	考查 Term paper	6 夏	
PR053067	AutoCAD 与水工环制图 AutoCAD and Mapping for Hydrogeology	2	2	考查 Term paper	5	
PR053068	GIS 及其在水文中的应用实践 Application of GIS to Hydrology	2	2	考查 Term paper	5	
PR053076	水文地质调查方法设计 Design for Groundwater Survey	1	1	考查 Term paper	6	
PR054075	毕业设计（论文） Graduation Design (Thesis)	12	6	考查 Term paper	8	

5、通识教育选修课程（Selective Courses of General Education）：16 学分 (16 Credits)

序号 No.	课程名称 Course Name		学分 Credits	备注 Notes
1	人文社科类（含在线课程） Humanities and Social Sciences Courses (Inc. Online Courses)		6	附件 1
2	自然科学类（含在线课程） Natural Science Courses (Inc. Online Courses)		6	附件 2
3	创新创业类 Innovation and Entrepreneurship Courses	专业导论课 Professional Introduction Courses	1	附件 3
		新生研讨课 Freshman Seminar	1	附件 4
		系列创业课（含在线课程） Entrepreneurial Courses (Inc. Online Courses)	2	附件 5

6、创新创业实践 (Innovation and Entrepreneurship)：6 学分 (6 Credits)

包括社会实践、科研训练和创新创业活动 3 大类。每位学生在校期间须完成 6 学分方可毕业。其中，社会实践 2 学分，包括志愿者、勤工俭学、暑期社会实践等；科研训练 2 学分；创新创业活动 2 学分。

创新创业活动学分的认定按照教务处相关规定执行。

Innovation and Entrepreneurship includes three categories: social practice, scientific research training, and innovation and entrepreneurship activities. Each student is required to complete 6 credits in the university before graduation. There are two credits for social practice, including working as a volunteer, having the work-study program and social practice in summer vacation, etc. There are two credits for scientific research innouation and two for innovation and entrepreneurship activities.

The recognition of the credits for innovation and entrepreneurship shall be implemented according to the regulations of Academic Affairs Office.